Application for

# Resource Consent

Section 88 of the Resource Management Act 1991

Te Kaunihera o Te Tairāwhiti
GISBORNE
DISTRICT COUNCIL

## About this form

Please answer all the questions and provide the relevant details of your proposal. We recommend you talk your proposal through with Council planning staff before you fill in this form.

## 1. Activity type and location

This application is for:

☐ Change of consent notice (s.221) ☑ Land Use Consent ☑ Subdivision Consent ☐ Land Use (Regional)

☐ Other

Site(s) to which this application relates is described as:

Street/ Rapid No.: 99a

Street/Road Name: Stanley Road

Property valuation No.:

(see rates invoice)

Legal Description: Lot 1 DP 5799

Fully describe the location:

**OFFICE USE ONLY:** Map Reference NZTM:

## 2. Applicant's details (all correspondence will be sent to the applicant unless agent's details are completed)

Name in full: NZ Housing Group Gisborne

Surname: First Name(s)

Postal address:

Phone: Day: Mobile:

Email: mitch@twproperty.co.nz

Email is Council's preferred method of contact.

Do you agree to receive your correspondence and consent by email? ☑ Yes ☐ No

## Office use only

Application No:

Received GDC: Received SO: Received ADM: EDRMS No:

Deposit paid: Date paid: Category: Officer:

The applicant is the:

☑ Owner ☐ Occupier ☐ Prospective Purchaser ☐ The Crown ☐ Network Utility Operator

☐ Agent / Consultant (provide details over page)

## 3. Property owner's details (if different from applicant)

Name in full:

Surname: First Name(s)

Postal address:

Phone:

Day Mobile:

Email:

## 4. Agent/consultant's details (all correspondence will be sent to your agent)

Company: Stradegy Planning Ltd

Contact Person: Matthew Morley

Postal address:

Phone: 021 990 531

Day Mobile:

Email: matt@stradegy.co.nz

Email is Council's preferred method of contact.

Do you agree to receive your correspondence and consent by email? ☑ Yes ☐ No

## 5. Address for invoices

Send all invoices and annual charges to: ☑ Applicant ☑ Agent/Consultant ☐ Other

If other, name

Surname: First Name(s)

Postal address:

## 6. Detailed description of proposed activity

1. Land use consent to construct eight dwellings as a Restricted Discretionary Activity pursuant to Rule 1.6.1 (17).
2. Land use consent as a Discretionary Activity pursuant to Rule 6.2.3(13) for point source water discharge.
3. Subdivision consent to create an eight-lot fee simple subdivision as a Discretionary Activity pursuant to Rule 10.1.6 (9).
4. Resource Consent is also required pursuant to Regulation 10 of the NES-CS (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) as a Restricted Discretionary Activity.

## 7. Additional resource consents required for this proposal

Are any other resource consent(s) required for your proposal, but are not being applied for under this application? ☐ Yes ☑ No

☐ Land Use Consent ☐ Subdivision Consent ☐ Discharge Permit

☐ Coastal permit ☐ Water Permit ☐ Land Disturbance

☐ Other (give details):

Please list any previous consents relevant to this current application:

## 8. Consultation

Have you consulted with iwi? ☐ Yes ☐ No

If yes, which iwi groups have you consulted with?

Who else have you consulted with?

Please attach any relevant correspondence.

## 9. Approval of potentially affected parties

Have you obtained written approval from all parties potentially affected by the proposal? ☐ Yes ☑ No

Please attach the completed approval forms with a copy of your plans also signed by the affected people.

**Please Note:** Council planning staff will determine whether any people or groups are potentially affected by your proposal. Please discuss with our planning staff prior to lodging your application.

## 10. Notification of the application

Are you requesting the application to be publicly notified? ☐ Yes ☑ No

Please discuss the implications of notification with our planning staff if necessary.

## 11. Assessment of Environmental Effects (AEE)

Further information about preparing an AEE is on our website.

Please note: An AEE generally requires a separate sheet/report. Please attach any additional information.

## 12. Council contact

Have you discussed your proposal with any Council planning staff? ☑ Yes ☐ No

If yes, who have you spoken with:

(name of Council staff member)

## 13. Draft conditions

Do you wish to see the draft conditions prior to the release of the resource consent decision? ☐ Yes ☐ No

If yes, the Council may extend the processing timeframe pursuant to Section 37A of the Resource Management Act 1991 to give you time to consider and respond to Council.

## 14. Contributions

When granting consent to certain activities, Council may levy a monetary contribution. Development contributions are levies under the Local Government Act 2002 in accordance with the Council's Development Contribution Policy. Financial or reserve contributions are levies under the RMA and Council's Combined Regional Land and District Plan.

## 15. Deposit and signature

The required deposit must be paid before we process your application.

Please refer to the Fees and Charges Schedule as per the website.

☐ I enclose a deposit of $ 1800 paid for processing this application.

☐ I have paid a deposit by electronic banking of $ ______ on ______ (date)

Council's bank account details: **Account No. 03 0638 0502288 00**

Particulars: RC DEPOSIT CODE: ______ (surname) PARTICULARS: ______ (road name)

**Declaration**

I understand that Council may invoice me for the actual and reasonable costs incurred in processing this application.

I Kate Taylor (print your name),

Agree that:

☐ I am liable for all fees and charges relating to this application

☐ The deposit is to be paid at the time of lodging the application

☐ That payment is due within 30 days of the issue date of any additional charges

☐ The information provided in this application and the attachments are accurate.

Signature of Applicant: (or person authorised to sign on behalf of applicant)

Date: 24.11.23

KTaylor.

Admin check ☐

## 16. Privacy information

The information you have provided on this form is required so that your application can be processed under the RMA and statistics can be collected by Council. The information will be stored on a public register held by Council. The details may also be made available to the public on Council's website. These details are collected to inform the general public and community groups about all consents which have been issued through Council. If you would like to request access to, or correct your details, please contact Council.

## 17. Checklist for completing your application

To ensure your application will be accepted by Council for processing, this checklist sets out the information required to be lodged with your application for a resource consent. This is a generic list of information required to be lodged with all resource consent applications. For some activities, specific information requirements are detailed in activity specific information requirement checklists.

If any of the required information is not supplied Council will not accept the application and will return the documentation and deposit fee.

### Lodging

Two methods for consent applications to be lodged are:

1. Digital applications – to be emailed to rclodgement@gdc.govt.nz
   Please note if the combined file size of your documents exceeds 30MB you will need to contact Consent Coordinators on the above email address. Staff responding will send out a secure link to upload your files.

2. Physical applications, lodged in person over the front counter. These will need to be lodged with the Duty Planner at Council Offices. Two paper copies (including one unbound) of all the information is required.

### Information required

| Along with a completed application form, the following information is required: | Council use | | |
|---|---|---|---|
| ✓ Applicant to check | Y | N | n/a |
| ☐ Proof of deposit fee payment. | ☐ | ☐ | ☐ |
| ☐ Record(s) of Title less than three months old for the site to which this application relates. Please attach the title and any consent notices, covenants, easements attached to the title if relevant or affected by the proposed activity. | ☐ | ☐ | ☐ |
| ☐ A detailed description of the proposed activity. | ☐ | ☐ | ☐ |

| | | | | |
|---|---|---|---|---|
| ☐ | Locality plan or aerial photo. Indicate the location of the site in relation to the street and other landmarks. Show the location of the subject site and those of adjoining sites. | ☐ | ☐ | ☐ |
| | A scaled site plan showing: | ☐ | ☐ | ☐ |
| ☐ | The boundaries; | ☐ | ☐ | ☐ |
| ☐ | The location of the proposed activity or building; | ☐ | ☐ | ☐ |
| ☐ | North point; | ☐ | ☐ | ☐ |
| ☐ | Title/reference number(s); | ☐ | ☐ | ☐ |
| ☐ | Date the plans were drawn and individual plan numbers; | ☐ | ☐ | ☐ |
| ☐ | Location of existing and proposed accessways and points of entry; | ☐ | ☐ | ☐ |
| ☐ | Topographic features; | ☐ | ☐ | ☐ |
| ☐ | Contours; | ☐ | ☐ | ☐ |
| ☐ | Location of any mapped natural or cultural heritage features; | ☐ | ☐ | ☐ |
| ☐ | Location of any mapped natural hazards; | ☐ | ☐ | ☐ |
| ☐ | Location of any rivers, streams, watercourses. | ☐ | ☐ | ☐ |
| ☐ | Also refer to the checklist specific to the consent type to see any additional features that need to be added to the site plan. | ☐ | ☐ | ☐ |
| ☐ | An assessment of the activity the relevant provisions of the Tairawhiti Resource Management Plan (TRMP) - A list of the rules from the TRMP that require resource approval and status of the proposed activity in the TRMP. | ☐ | ☐ | ☐ |
| ☐ | An assessment against any relevant National Environmental Standards. | ☐ | ☐ | ☐ |
| ☐ | An assessment against any relevant National Policy Statements (i.e NPS for highly productive land) | ☐ | ☐ | ☐ |
| ☐ | An assessment of effects on the environment (AEE) in accordance with Schedule 4 of the RMA at a level of detail that corresponds with the scale and significance of the effects that the proposed activity may have on the environment. In addition, this may require one or more technical specialist reports. The AEE must include a full description of the proposed activity, the effects that may be generated and how these will be managed. For more information refer the AEE guidance available for each consent activity type. | ☐ | ☐ | ☐ |
| ☐ | An assessment against the relevant matters in Part 2 of the RMA will be required. Part 2 matters may be included in your AEE or in a separate document. | ☐ | ☐ | ☐ |
| ☐ | An assessment against any relevant provisions (i.e. policies and objectives) of a statutory document (e.g. the Tairawhiti Resource Management Plan, Regional and/or National Policy Statement). The assessment may be included in your AEE or in a separate document.<br>Note: This is only required for discretionary and non-complying activities. | ☐ | ☐ | ☐ |
| ☐ | Include details (name, postal and site address) of any consultation undertaken (including iwi) and any responses from those consulted with. | ☐ | ☐ | ☐ |
| ☐ | Written approval from all affected persons which includes a completed Affected Party Approval form(s) and signed and dated copies of the site plan, elevations. | ☐ | ☐ | ☐ |
| ☐ | A completed checklist relevant to your application – Refer to the separate checklists relating to the consent you are applying for, i.e. the activity type. | ☐ | ☐ | ☐ |

## Pre-lodgement meeting

Have you had a pre-lodgement meeting with a Council Consents Planner? ☐ Yes ☐ No

Whom did you have the pre-lodgement meeting with?

To ensure a smoother lodgement process and to increase the chance of the application being accepted (as any outstanding information would have been identified at the pre-lodgement meeting) we encourage you to arrange a pre-lodgement meeting with a planner prior to lodging your application.

## Office use only

Signed by Acceptance Officer:

Officer:

Date:

# View Payment

**Payment Details:**

**Payment Date:** 24/11/2023

**From Account:** NZHG Gisborne - 00 -- 03-0698-0184904-000

**Other Party Name:** GISBORNE DISTRICT CO

**Particulars:** NZHGGISBORNE

**Analysis Code:** RC DEPOSIT

**Reference:** 50233027

**Amount:** $1,800.00

**Original Hash Value:** 682929

**Current Hash Value:** 682929

**Transaction Note:**

**Create Many Single Payments:** No

**Status:** Processed

**Payee Details:**

| Payee Name | Account Number | Particulars | Analysis Code | Reference | Amount |
|---|---|---|---|---|---|
| GISBORNE DISTRICT CO | 03-0638-0502288-000 | NZHGGISBORNE | RC DEPOSIT | 99ASTANLEYRD | $1,800.00 |
| | | | | | **Total: $1,800.00** |

**Authorisation History:**

| Action | User Name | Date/Time |
|---|---|---|
| Create | Samantha Webby | 24/11/2023 14:05 |
| Approve | Tracey Roussety | 24/11/2023 15:22 |
| Approve | Sally Watts | 24/11/2023 15:25 |

◁ Back

Note: Business Online Helpdesk 0800 337 522

STRADEGY
Urban, Environmental & Strategic Planning

# Resource Consent Application for Land Use and Subdivision

99A Stanley Road, Gisborne

NZHG Gisborne Limited

23128 AP1
24th November 2023

# APPLICATION DETAILS

**Consent Authority**: Gisborne District Council (GDC)

**The Applicant:** NZHG Gisborne Limited

**Address for Service:** Stradegy Planning Limited, PO Box 239, Napier 4140
Matt Morley – matthew@stradegy.co.nz

**Address for Invoice:** Mitch Jackson
mitch.jackson@twproperty.co.nz

**Site Details:**

*Street Address:* ....................................99A Stanley Road, Gisborne
*Legal Description:*...............................Lot 1 DP 5799
*Certificate of Title:* .............................GS3D/818
*Area:* ....................................................1,590m$^2$
*Zoning:* .................................................General Residential Zone

**Activity for which Consent is sought:**

1. Land use consent to construct eight dwellings as a Restricted Discretionary Activity pursuant to Rule 1.6.1 (17).
2. Land use consent as a Discretionary Activity pursuant to Rule 6.2.3(13) for point source water discharge.
3. Subdivision consent to create an eight-lot fee simple subdivision as a Discretionary Activity pursuant to Rule 10.1.6 (9).
4. Resource Consent is also required pursuant to Regulation 10 of the NES-CS (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) as a **Restricted Discretionary Activity**.

**Prepared by:**

Matt Morley BEP
Intermediate Planner

**Reviewed and Approved for Release by:**

Pip Beachen
Senior Planner

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**Appendices –**

1. Record of Title
2. Development Plans
3. Subdivision Scheme Plan
4. Servicing Report
5. Detailed Site Investigation
6. Geotechnical Reports
7. District Plan Compliance Analysis
8. Design Process Overview

# 1. INTRODUCTION

The purpose of this application is to obtain resource consent approval on behalf of NZHG Gisborne Limited to construct eight residential dwellings at 99A Stanley Road which will constitute a multi-unit development within the General Residential Zone of the Tairāwhiti Resource Management Plan (TRMP). Additionally, a concurrent subdivision is proposed to obtain eight separate records of title for each of the eight dwelling units and one jointly owned access leg (JOAL) which will be subsequently amalgamated with some of the residential lots.

As the development cannot comply fully with all Plan conditions, the proposal overall falls to be assessed as a **Discretionary Activity** pursuant to Rule C10.1.6 (9).

The proposed dwellings and lots have been designed and arranged in a manner that is considered to constitute an appropriate form of medium density residential development which is anticipated by the Plan and compatible with the pattern of development within the receiving environment. **Figures 1** and **2** provide two perspectives of the site and development.

**Figure 1:** Stanley Streetscape Perspective

**Figure 2:** Streetscape Perspective

The application seeks dual land use and subdivision approval, and it is proposed that the construction of the dwellings will occur prior to the issue of Section 224C certification and titles.

Specialist inputs have been prepared to inform the assessment of this application. These are detailed in **Table 1** and are included as appendices to this application.

**Table 1:** Expert Reports

| Expert Report | Author | Purpose |
|---|---|---|
| **Development Plans** | Atkinson Hardwood Architecture | Provide plans showing the bulk, location and design of the development. |
| **Subdivision Scheme Plan** | Definition Surveying Limited | Inform the layout of the proposed subdivision. |
| **Geotechnical Report** | LDE Development & Engineering | Assessment of site suitability from a geotechnical perspective. |
| **Detailed Site Investigation** | EAM Consultants | To confirm any soil contamination under the NES-CS. |
| **Servicing Report** | Infir | To determine wastewater, water supply and stormwater servicing solutions and to develop the necessary earthworks plan. |

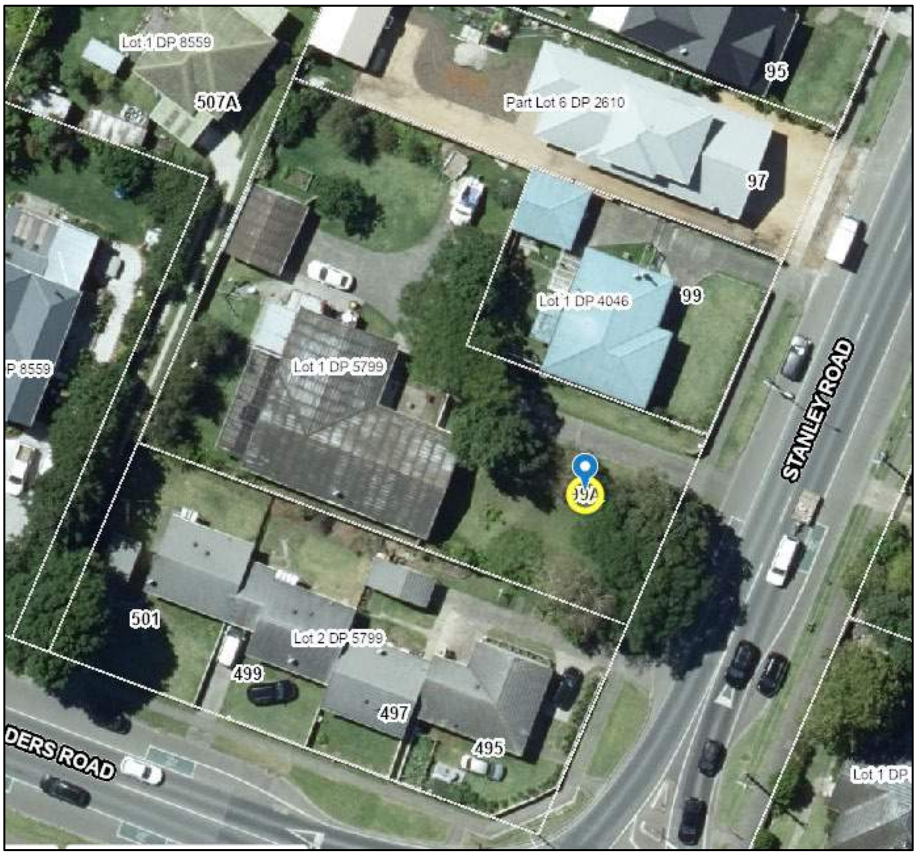
The following report has been prepared in accordance with Schedule 4 of the Resource Management Act (**the RMA**) and meets the requirements of Form 9. The level of detail provided is commensurate to the scale and significance of the effects that the activity may have on the environment.

# 2. BACKGROUND AND SITE DESCRIPTION

The site is situated at 99A Stanley Road, Gisborne and is legally described as Part Lot 1 DP 5799. It covers an area of 1,590m$^2$.

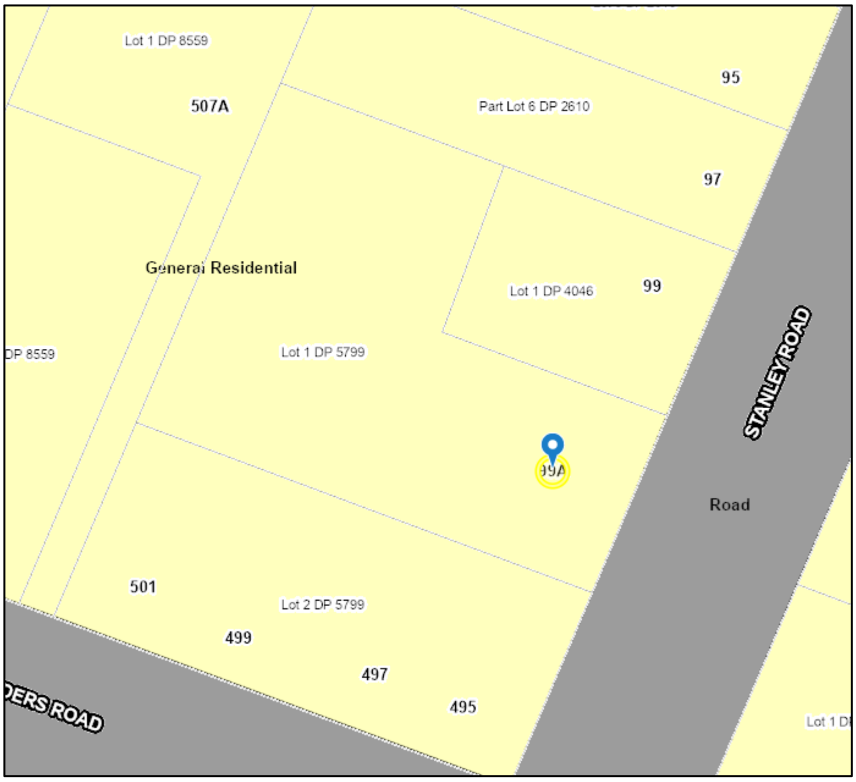
The site is irregularly shaped and has a total frontage toward Stanley Road of 20.8m. As shown in **Figure 1** below, the site is currently occupied by one dwelling with an ancillary building. Vehicle access to the site is via the existing crossing and accessway off Stanley Road.

**Figure 3:** Locality Plan



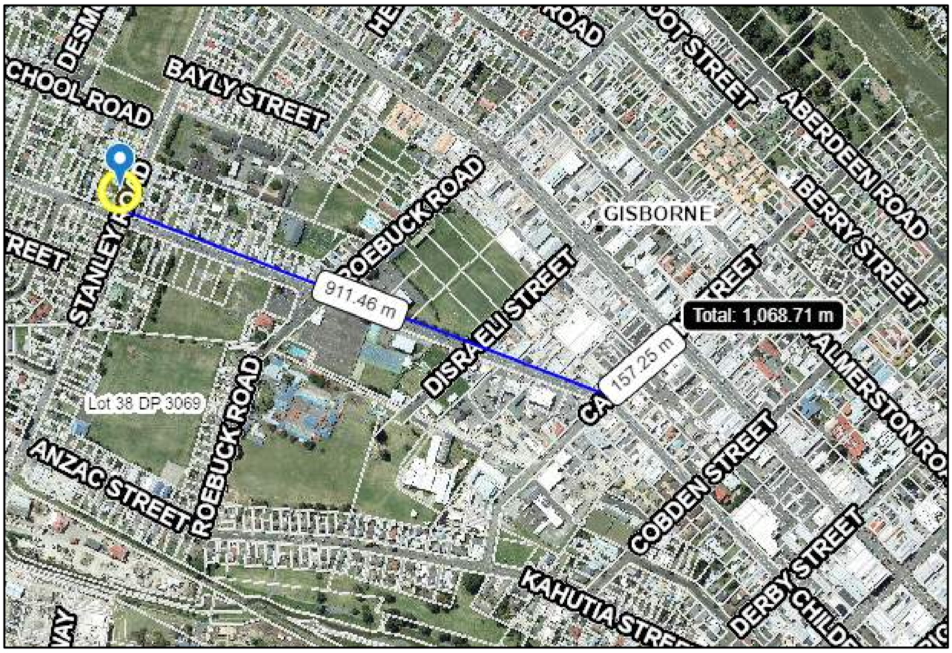
As shown in **Figure 4** below, the site, and all sites surrounding it, are within the General Residential Zone of the District Plan.

**Figure 4:** District Plan Zoning



The site is located within 1km of the Gisborne CBD as shown in **Figure 5 below.**

**Figure 5:** Distance to CBD



The portion of Stanley Road adjacent the subject site is characterised by a 20m wide road reserve which is occupied by two 2m wide grass berms, two 1.2m wide footpaths.

**Figure 6:** Google Street View Images of Subject Site and Streetscape

***Statutory Acknowledgment Areas***

We understand that the subject site is located within the following Areas of Interest:

- Rongowhakaata (Rongowhakaata Claims Settlement Act 2012)
- Te Aitanga-a-Māhaki Area of Interest

Research into the Nga Whakaaetanga a Ture mo Te Tairāwhiti (Statutory Acknowledgements of the Gisborne District June 2022) indicates that the site is not within a formal Statutory Acknowledgement Area.

***Geotechnical Considerations***

A geotechnical assessment has been undertaken by LDE Consultants and is attached as **Appendix 6,** which has the purpose of determining whether the site is suitable for subdivision and subsequent residential development as proposed. Its findings/recommendations are discussed further in Section 7 of this application in respect to the above hazards.

***Legal Instruments***

A copy of the relevant Record of Title is provided in **Appendix 1**. Here it is noted that there are no legal instruments or interests registered against the title that would compromise or restrict the exercise of the proposed activities.

***Potential Soil Contamination***

The NES-CS applies to the following activities where they are undertaken on land on which an activity or industry on the 'Hazardous Activities or Industries List' (HAIL) has been, is or is more likely than not to have been undertaken:

- The removal of underground fuel storage systems and associated soil.
- Soil sampling.
- Soil disturbance Subdivision of land.
- Change in land use.

In accordance with Appendix C: Hazardous Activities and Industries List (HAIL), the site is considered HAIL under:

> *Section H: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.*

Section H is considered to apply based on the age of the dwelling being present since at least 1942 and the potential for building materials such as lead-based paints and construction materials to contaminate the site, through weathering and renovation.

A Detailed Site Investigation (DSI) has been completed by EAM and is attached as **Appendix 5**. The purpose of the DSI was to determine:

- *The type, extent, and level of contamination, if any, within the proposed subdivision sites.*
- *Whether contaminants of concern identified present an unacceptable risk to human health or identified environmental receptors.*
- *Whether the soils remaining on-site are suitable for the proposed end use*.

The DSI included a desk top analysis which entailed a search of GDC property records, assessing historical Aerial Photographs, a HAIL review, and a site visit. Subsequent soil sampling was carried out in twelve locations depicted in **Figure 7.**

**Figure 7:** Soil Sample Locations (Red Denotes Exceedances of NES Residential Thresholds)

Laboratory results from soil sampling indicate the following:

- Lead and zinc concentrations were reported well above regional background concentrations for the Gisborne area, when compared with a control sample.
- Sample locations #2 and #3, #4, #7 and #8 reported exceedance of the NES residential standards of 210 mg/kg for lead, reporting concentrations of 300mg/kg, 300mg/kg, 290mg/kg, 500mg/kg, and 250 mg/kg, respectively.
- Sample location #7 exceeds the Landcare Updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco-SGVs) for Zinc (300mg/kg), reporting a concentration of 480 mg/kg.
- The RPD results were reported within the data quality objective.

As lead and arsenic levels exceed NES residential standards, there is potential risk to human health associated with the proposed activity unless it is otherwise mitigated by remedial works.

### *Natural Hazards*

The site is located in the yellow zone for tsunami risk which indicated that it may be subject to tsunami in the case of a severe (i.e., M8.9) local earthquake. However, this is not uncommon for the Gisborne District, with a large percentage of the city also being subject to the tsunami risk. The site is not within a known Flood Hazard Area.

### *Servicing*

The subject site and surrounding area are fully reticulated with water supply, wastewater, and stormwater disposal infrastructure **(Figure 8)** located in the adjoining road reserve as follows:

- Wastewater-DN225 main located in Stanley Road,
- Stormwater-DN450 main within Stanley Road,
- Water Supply-DN150 main located in Stanley Road.

The existing dwelling appears to have a connection to each three waters service. A servicing report is attached as **Appendix 4** and outlines earthworks, drainage, and services concept design for the activity.

**Figure 8:** GDC Three Waters Infrastructure

*Stormwater*

*Wastewater*

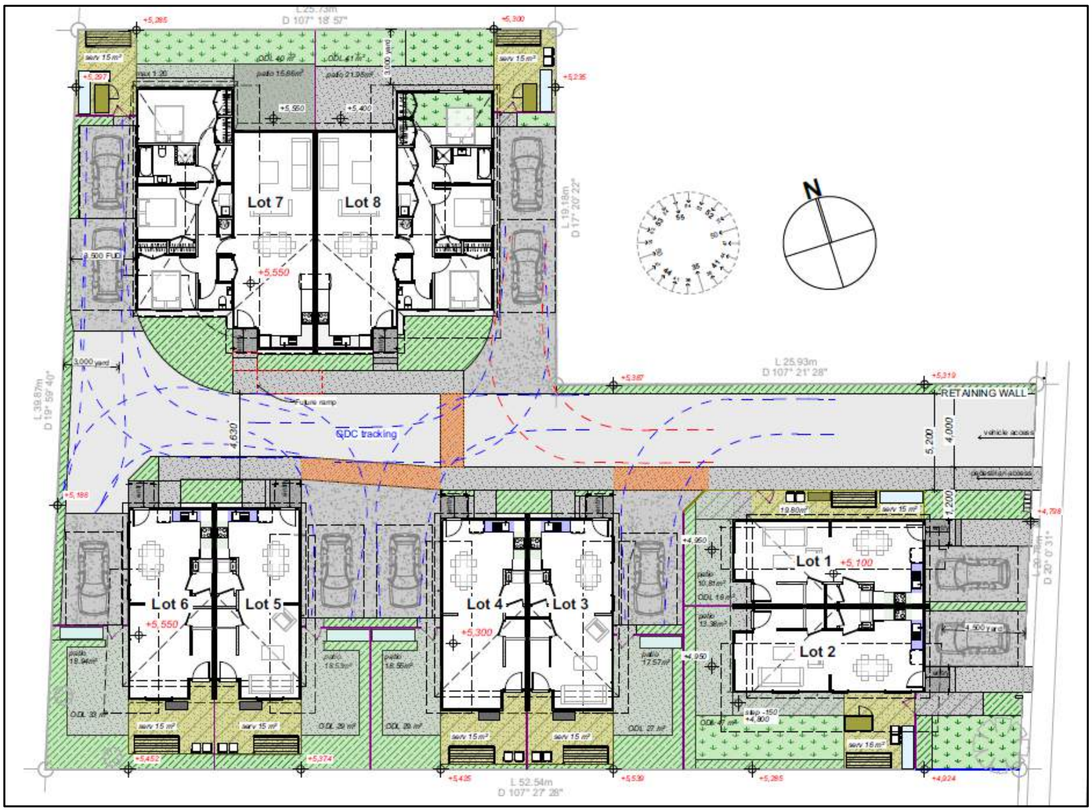
*Water Supply*

# 3. DESCRIPTION OF PROPSAL

The proposal entails the clearance of the site and the subsequent construction of eight dwellings resulting in a multi-unit development as depicted on the Development Plans provided in **Appendix 2** and reproduced in **Figure 9** below.

The proposal also involves a fee simple subdivision to subdivide the site into eight residential lots and one JOAL which will provide access to Stanley Road. The proposed Scheme Plan is provided in **Appendix 3** and is shown in **Figure 14.**

**Figure 9:** Proposed Multi-Unit Site Plan



The following description of the proposal has been divided into two sections being the multi-unit development and subdivision components.

***Multi-Unit Development***

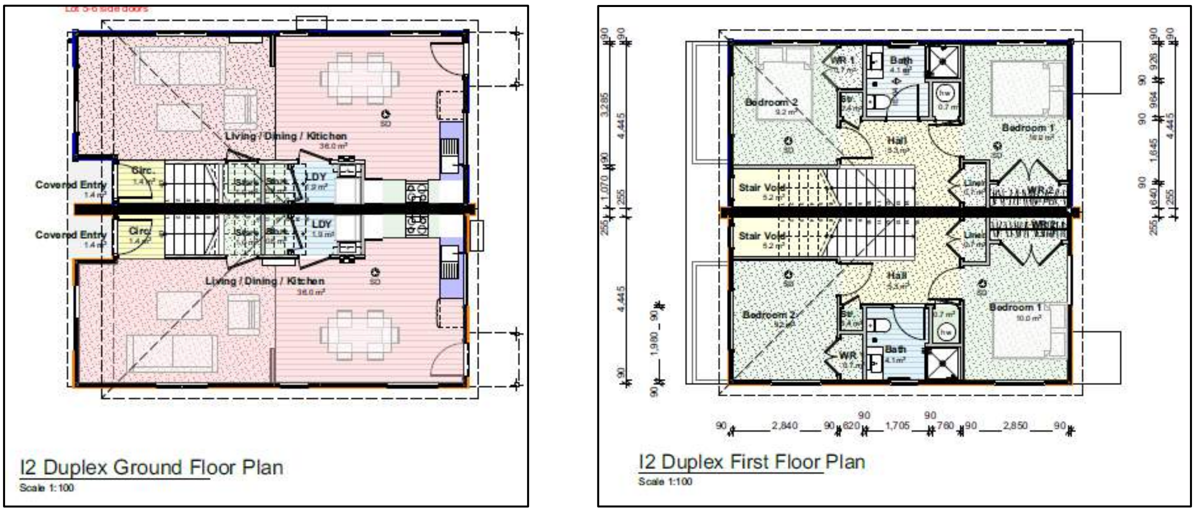
Proposed Units 1-8 have the following characteristics:

Design, Layout, Materiality, Bulk and Location

- Units 1-6 are located adjacent the southern side boundary of the site, whilst Units 7 and 8 are adjacent the northern side boundary.
- Units 1-6 are arranged in a two-story duplex typology with 2-bedrooms, one bathroom and an open plan, ground floor living, dining and kitchen space.

- Units 7 and 8 will be single story duplex units with 3-bedrooms, 2-bathrooms and an open plan living, kitchen and dining space,
- Units 1 – 6 will have a gross floor area (GFA) of 90.2m², whilst Units 7 and 8 will have a GFA of 113.7m$^2$ and 112.8m$^2$,
- Floor plan layouts are depicted in **Figures 10-11.**
- All dwellings are located a minimum of 3m from external site boundaries and 4.5m from the front boundary.
- Dwelling heights will not exceed 8m.
- Unit materiality will include corrugated iron roofing, aluminium joinery, and a mix of weatherboard, fibre cement sheet cladding and board and batten exterior walls.
- A colour palette for all units is included in the plan set in **Appendix 3.**

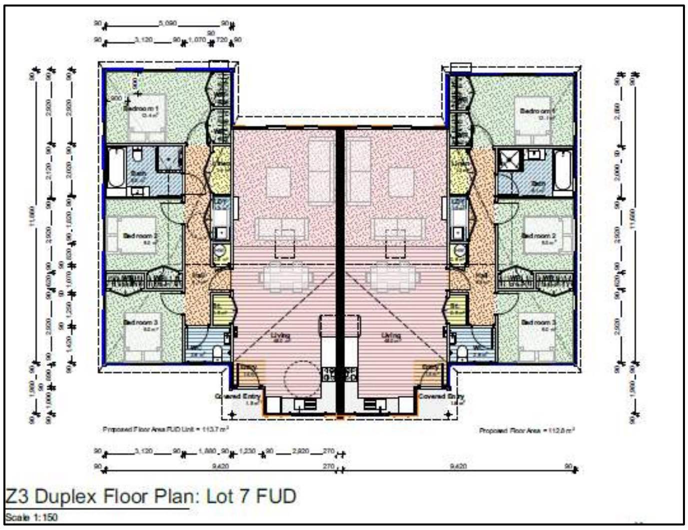
**Figure 10:** Unit 1 and 6 Floor Plans



I2 Duplex Ground Floor Plan
Scale 1:100

I2 Duplex First Floor Plan
Scale 1:100

**Figure 11:** Units 7 and 8 Floor Plan



Z3 Duplex Floor Plan: Lot 7 FUD
Scale 1:150

Access and Parking

- Vehicle and pedestrian access to Lots 3-8 will be via a centrally located JOAL.
- Units 1 and 2 will gain access via a new double vehicle crossing directly off Stanley Road.
- Pedestrian access is provided to Units 3-8 by a 1.2m wide footpath which traverses the southern side of the JOAL. Pedestrian access to Units 1 and 2 will be directly off Stanley Road via individual pedestrian paths. A pedestrian gate will also be provided to Lot 1 from the footpath within the JOAL.
- All units will each have the use of one uncovered vehicle parking pad.
- On site manoeuvring for Units 3-8 can be achieved within the accessway, whilst Units 1 and 2 will reverse directly onto Stanley Road.

Landscaping and Fencing

- The Development Plans **(Appendix 2)** include detail on landscaping and fencing elements which have the following characteristics:
    - Each dwelling unit will accommodate one specimen tree (lemon, orange feijoa, kowhai or puka) with maximum mature heights of 2-4m, screen planting with a height of 1.8-2m which will provide inter-unit privacy and road front screening.
    - The southern side boundary and western rear boundary will be traversed by screen planting of between 1.8m-2m in height.
    - A fencing plan is included on Sheet 06 of the plans attached at **Appendix 2**. Here it is demonstrated that a combination of 1.2m and 1.8m high fencing is proposed throughout the site. Specifically, it is noted:
        - Fencing along the front boundary will comprise 1.55m high solid vertical timber paling with a 300mm high visually permeable portion above resulting in a total height of 1.85m,
        - Fencing along the JOAL will be reduced to 1.2m, and
        - Intertenancy fencing is proposed as solid 1.85m vertical timber fencing.
        - The existing external boundary fence is proposed to be retained.

Service Areas and Open Space

- All units are provided with individual service areas ranging in size from 14.79m²-15.35m².
- Each of these service areas accommodate rubbish and recycling facilities, a washing line and a small storage shed.
- All service areas are screened from adjacent land.
- Each unit has independent OLS areas in the order of 15.47m²-41.02m².
- All OLS has a northern orientation, is directly accessible from internal living space and is screened from other units and adjacent land by the proposed fencing and landscaping.

Servicing (water, sewer, stormwater, access, and earthworks)

The application includes a servicing assessment prepared by Infir and attached as **Appendix 4.** A plan showing overall service provision is included in **Figure 12.** The following is a summary of service provision:

Stormwater

- Stormwater will be discharged to the existing DN450 RC stormwater main. A connection to the stormwater main is required to drain the below-ground attenuation storage.
- Post development 1 in 10-year discharge rates will be limited to the predevelopment discharge rates.
- It is proposed to provide attenuation in a combination of above-ground roof attenuation tanks and in-ground attenuation storage within accessway.
- A total of 10m$^3$ of rainwater tank storage is required. Units 1-6 need 1m$^3$ storage tank each discharging water at 0.29L/s. Units 7-8 need a 2m$^3$ tank each discharging water at 0.58L/s to control stormwater runoff for 10% AEP events,
- During 1% AEP events the tanks will overflow and discharge through a combination of primary and secondary overland flow.
- When stormwater is attenuated, the effective discharge coefficients for a 10% AEP event and a 1% AEP event are obtained as 0.41 and 0.52, respectively. These values are lower than the predevelopment values. Post-development peak discharge rates will therefore be lower than current peak discharge rates.
- A Silt pit will be provided within the design for treatment (if necessary) with a DN900 Hynds First Defence High-Capacity treatment unit in the silt pit.
- The connection to the stormwater main is proposed to be vested to Council – with the discharge consent for stormwater also being transferred to Council as part of s224c approval. The following condition (or similar) is proposed to be included in the subdivision decision in this regard:
  - That prior to approval under s224 of the RMA:
    - The ownership of the outlet structure is vested to Council, and
    - The discharge consent is transferred to Council.

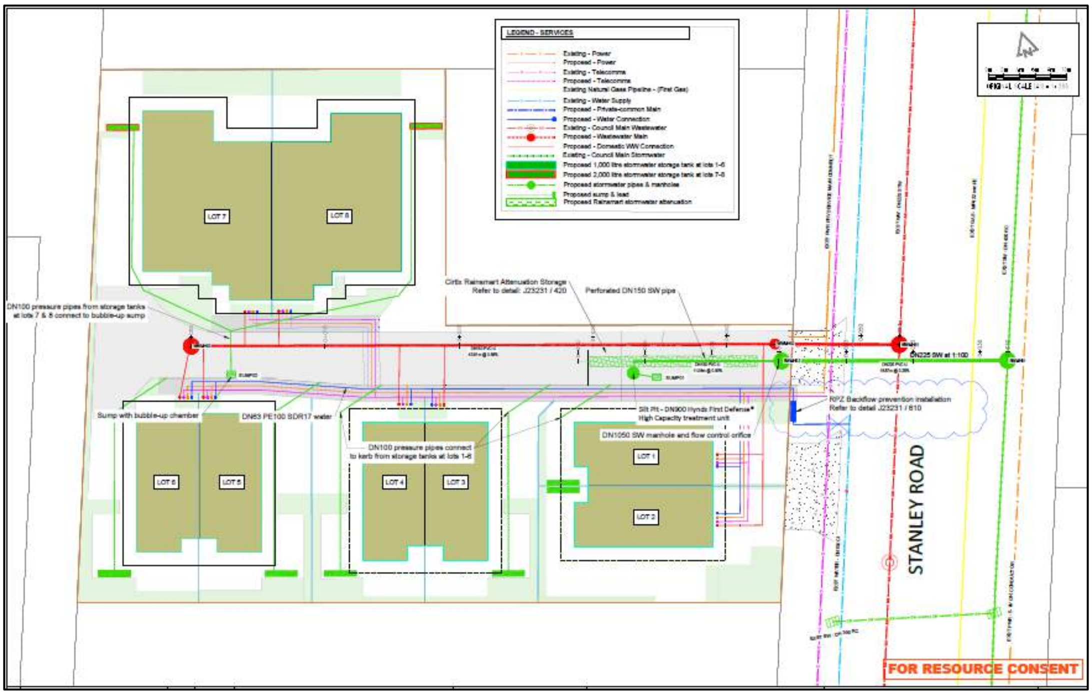
Water Supply/Fire Fighting

- DN20 connections will be taken from the DN63 within the carriageway and 550mm in front of the face of the northern kerb.
- The DN63 main will be connected to the DN150 water main within Stanley Road,
- Peak water demand will be 8,400 litres per day, based on 8 households, 3.2 people per household and 330 litres peak demand per person per day.
- The instantaneous peak flow rate, based on a peak factor of 10, will be 0.98L/s, which will generate a flow velocity of 0.5m/s in a 50mm internal diameter DN63 pipe.
- In regard to Fire Fighting, the existing fire hydrants opposite 91 Stanley Road and 497 Childers Road satisfies firefighting distance requirements (135m for the closer fire hydrant and 270m maximum for the furthest one). It is not necessary to install additional fire hydrants for this development.

Wastewater

- It is proposed to install a DN150 gravity main discharging to the existing DN225 sewer main in Stanley Road.
- A new manhole will be required at the connection point.

**Figure 12:** Three Waters Servicing Plan



Earthworks

- The net earthworks volume consists of 99 m³ of fill and 273 m³ of cut, measured solid in place.
- Along the parts of the northern and southern boundaries where the level difference between the proposed development and neighbouring lots will exceed 300mm, it is proposed to install retaining walls.
- Where the level difference between the proposed development and neighbouring lots will be less than 300mm, the height difference can be accommodated by fence nibs.
- Level changes at the property boundary will be less than 600mm along the site perimeter.
- The proposed earthworks will ensure that stormwater flows are directed away from new buildings and ensure that minimum grades are achieved to prevent ponding over paved areas. The works will also ensure that stormwater flows are directed away from new buildings and ensure that minimum grades are achieved to prevent ponding over paved areas.

***Subdivision***

The subdivision of the site involves:

- Fee simple subdivision to create a total of eight residential lots and one JOAL as outlined in **Table 2**:

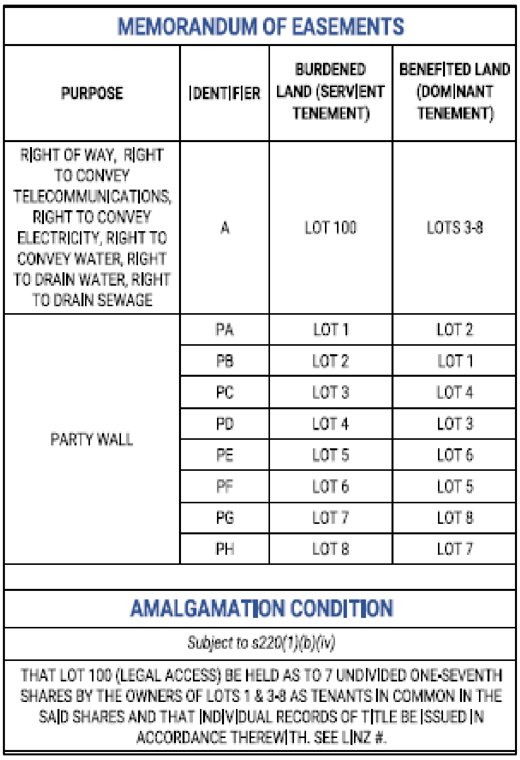
**Table 2:** Proposed Lots Sizes and Site Coverage

| Lot Number | Gross Lot Area (m²) | Net site Area (m²) | Site Coverage (%) |
|---|---|---|---|
| 1 | 168.3 | 168.4 | 29.3 |
| 2 | 159.6 | 159.6 | 30.9 |
| 3 | 156.2 | 129.79 | 30.8 |
| 4 | 150.3 | 129.23 | 32 |
| 5 | 151.5 | 131.61 | 31.7 |
| 6 | 156.1 | 130.05 | 30.8 |
| 7 | 290.3 | 239.07 | 39.6 |
| 8 | 286.3 | 254.69 | 40 |
| 100-JOAL | 295.7 | 295.7 | N/A |

- Lots 3-8 will gain access via the JOAL (Lot 100) from Stanley Road, whilst Lots 1 and 2 will obtain independent access from Stanley Road via two proposed vehicle crossings,
- The JOAL will have a total width of 5.35m (including a 1.2m footpath) where it serves Lots 1, 3-8,
- Formed carriageway width will be 3m-6.3m (estimate) depending on the level of service required.
- The legal use of this JOAL will be protected via easements registered on the respective titles as shown in **Figure 14** and the JOAL will be amalgamated with the Lots 3-8.
- After subdivision, the proposed development will result in site coverages detailed in **Table 2**.
- Servicing of the sites can be achieved as referred to above in the multi-unit development description and as outlined in **Appendix 4.**
- The proposed scheme plan is provided in **Appendix 3** and reproduced in **Figure 13** below.

**Figure 13:** Proposed Subdivision Scheme Plan

**Figure 14:** Proposed Easement Schedule and Amalgamation Conditions



**MEMORANDUM OF EASEMENTS**

| PURPOSE | IDENTIFIER | BURDENED LAND (SERVIENT TENEMENT) | BENEFITED LAND (DOMINANT TENEMENT) |
|---|---|---|---|
| RIGHT OF WAY, RIGHT TO CONVEY TELECOMMUNICATIONS, RIGHT TO CONVEY ELECTRICITY, RIGHT TO CONVEY WATER, RIGHT TO DRAIN WATER, RIGHT TO DRAIN SEWAGE | A | LOT 100 | LOTS 3-8 |
| PARTY WALL | PA | LOT 1 | LOT 2 |
| | PB | LOT 2 | LOT 1 |
| | PC | LOT 3 | LOT 4 |
| | PD | LOT 4 | LOT 3 |
| | PE | LOT 5 | LOT 6 |
| | PF | LOT 6 | LOT 5 |
| | PG | LOT 7 | LOT 8 |
| | PH | LOT 8 | LOT 7 |

**AMALGAMATION CONDITION**

*Subject to s220(1)(b)(iv)*

THAT LOT 100 (LEGAL ACCESS) BE HELD AS TO 7 UNDIVIDED ONE-SEVENTH SHARES BY THE OWNERS OF LOTS 1 & 3-8 AS TENANTS IN COMMON IN THE SAID SHARES AND THAT INDIVIDUAL RECORDS OF TITLE BE ISSUED IN ACCORDANCE THEREWITH. SEE LINZ #.

***Sequencing of Development***

In terms of the sequencing of development, the applicant intends to undertake the consenting and development process as follows:

- Obtain resource consent,
- Obtain engineering approval to allow external service connections to public infrastructure,
- Obtain two separate building consents:
    1. Stage 1: Building Consent for the infrastructure and JOAL, and
    2. Stage 2: Building Consent for the vertical build.
- Undertake the construction of the development beginning with Stage 1 then following with Stage 2 of the building process.

Through following this process, an application for 223 and 224c can be lodged once the code compliance certificates have been approved for Stage 1. This generally provides for title and code compliance certificates for the buildings (Stage 2) being issued at the same time. As such, while the process of obtaining the new titles will be undertaken concurrently with the build, all dwellings will initially be constructed on the parent site as a whole. The following will therefore consider a ‘pre-subdivision’ (land use) and ‘post-subdivision’ (subdivision) scenario in terms of determining reasons for consent and activity status.

# 4. STATUTORY CONSIDERATIONS

Section 88 of the RMA allows any person to make a resource consent application, provided it is in the prescribed form and includes, in accordance with Schedule 4, an assessment of environmental effects in such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

Schedule 4 of the Act lists those matters that should and must be included in an assessment of environmental effects, as well those matters that should be considered. These matters are referenced throughout the body of this report confirming that the application meets all the requirements of Section 88.

In accordance with section 104(1), and when considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2 of the Act, have regard to:

a) Any actual and potential effects on the environment of allowing the activity; and
ab) any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result for allowing the activity; and
b) Any relevant provisions of:
  i) a national environmental standard:
  ii) other regulations:
  iii) a national policy statement:

    - iv) a New Zealand coastal policy statement:
    - v) a regional policy statement or proposed regional policy statement:
    - vi) a plan or proposed plan; and
- c) Any other matter the consent authority considers relevant and reasonably necessary to determine the application.

When considering an application for subdivision however, Section 106 must be satisfied first. Section 106 relates to circumstances where an application for subdivision may be refused and is considered in Section 7 of this report.

An assessment of the activities actual or potential effects in terms of section 104(1)(a) is undertaken in Section 8 of this report, the conclusions of which are considered in relation to notification in Section 9 prior to continuing with the more substantive considerations of section 104.

The relevant provisions of the TRMP in terms of section 104(1)(b) are considered in Section 10. Here we note that it is only the provisions of the TRMP that are relevant in terms of the various documents listed in s104(1)(b).

Part 2 of the Act contains sections 5, 6, 7 and 8. Section 5 outlines the purpose of the Act, which is to "*promote the sustainable management of natural and physical resources*", and the meaning of the "sustainable management". Sections 6 and 7 contain "matters of national importance" and "other matters", while Section 8 provides for the principles of the Treaty of Waitangi. Part 2 of the Act is considered in Section 11 of this report where an overall assessment is arrived upon.

*National Environmental Standards for Sources of Human Drinking Water 2007*

In terms of National Environmental Standards, the NES for Sources of Human Drinking Water is relevant for discharge permits.

Given that the subject site is within an urban area, there are no known bores within close proximity to the subject site.

Due to the level of treatment proposed, it is considered the proposed discharge is unlikely to increase the concentration of any of the determinants at any registered drinking water abstraction points, nor is it likely to introduce, or increase, the concentration of any aesthetic determinants in the drinking water to levels exceeding the drinking water guideline values.

Therefore, the provisions of the NES need not apply as the effects of the proposed activity will not be significantly adverse (Regulations 11 and 12).

*National Policy Statement for Freshwater Management 2020*

The National Policy Statement for Freshwater Management (Freshwater NPS 2020) came into force on 3 September 2020, and was subsequently amended in February 2023. It generally relates to freshwater quantity and quality matters, but also contains a suite of further provisions relating to other matters such as tangata whenua involvement, integrated management, setting objectives/ outcomes/ actions and monitoring. These are generally high level and designed to inform plan development processes, with a limited number of provisions applicable to the consideration of resource consent applications of this nature and scale.

*Regional Policy Statement*

The RPS is contained within Part B of the TRMP. Section B6 Freshwater is considered relevant to this application.

# 5. PLANNING DOCUMENTS

The proposal is subject to the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) and the Tairawhiti Resource Management Plan (TRMP).

## 5.1 National Environmental Standard for Assessing and Managing Contaminants in Soil

The "National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (**NESCS**)" applies to the following activities where they are undertaken on land on which an activity or industry included on the "Hazardous Activities or Industries List" (**HAIL**) has been, is or is more likely than not to have been undertaken:

- The removal of underground fuel storage system and associated soil.
- Soil sampling.
- Soil disturbance.
- Subdivision of land.
- Change in land use.

Regulation 6(1) Methods, prescribes the only two methods that may be used for establishing whether or not an area is 'a piece of land' that is subject to the National Environmental Standard (**NES**):

6(2) By using the most up to date information about the area where the piece of land is located that the territorial authority holds on its dangerous goods files, property files or resource consent database or relevant registers or which it has available from the regional council.

6(3) By relying on the report of a Preliminary Site Investigation (**PSI**) stating that an activity on the HAIL is or is not/has or has not/been or is being undertaken on the piece of land or stating the likelihood of a HAIL being or been undertaken on the piece of land.

A DSI was carried out by EAM **(Appendix 5)** which concluded the following:

- *Lead and zinc concentrations were reported well above regional background concentrations for the Gisborne area, when compared with a control sample.*

- *Sample locations #2 and #3, #4, #7 and #8 reported exceedance of the NES residential standards of 210 mg/kg for lead, reporting concentrations of 300mg/kg, 300mg/kg, 290mg/kg, 500mg/kg, and 250 mg/kg, respectively.*
- *Sample location #7 exceeds the Landcare Updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco-SGVs) for Zinc (300mg/kg), reporting a concentration of 480 mg/kg.*
- *The RPD results were reported within the data quality objective.*

Considering the above, the site is a HAIL and poses a potential risk to human health without appropriate remediation. Given that a DSI has been provided to Council, and the DSI confirms that the soil contamination exceeds the applicable standards, the proposal may remain to be assessed as a **Restricted Discretionary Activity** pursuant to Regulation 10 (2) of the NES-CS.

## 5.2 The Tairāwhiti Resource Management Plan (TRMP)

The proposal involves the construction of eight dwelling units (multi-unit development) and a concurrent fee simple subdivision to eight records of title to accommodate the proposed dwellings. The proposal is subject to the provisions of the TRMP and the reasons for resource consent are identified as follows.

The TRMP is a Unitary Plan, comprising both Regional Plan and District Plan matters. A detailed assessment of the proposal against the various provisions of the TRMP has been undertaken and is provided as **Appendix 7** to this application. This assessment has found that the activity complies with the Permitted Activity rules and associated general standards of the following Sections of the TRMP that are applicable to the proposal with Part C relating to 'Region Wide Provisions' (Parts 1-11):

- C1-Air Quality
- C3-Coastal Management
- C4-Cultural and Historic Heritage
- C5-Environmental Risks
- C6-Freshwater
- C7-Land Management
- C8-Natural Hazards
- C9-Natural Heritage
- C11-General Standards

The analysis does however determine that resource consent is required under the following rules for the following reasons:

**Regional Activities**
<u>C6 – Freshwater</u>

The discharge of stormwater from land, roofs, paved areas and roads, or diversion of the same to a public network is provided for as a Permitted Activity under Rule 6.2.3(2), however as the development includes an impervious area of greater than 1000m$^2$, the proposal falls to be assessed as a **Discretionary Activity** pursuant to **Rule 6.2.3(13)**.

***DD1-Land Use Consent (Multi-Unit Development)***

Part D (Area Based Provisions)-DD1 Residential Zones

The land use component of the proposal involves the construction of eight dwellings within the General Residential Zone which cannot comply with the following rules:

- **Rule 1.6.1 (2)-Minimum Site Area**
  The rule which requires a minimum site area of 320m² per unit attached on one side to another dwelling unit (duplex) cannot be met with minimum site areas being between 150.3m² and 290.3m² (average 198.75m²). **Table 2** above outlines specific lot areas.
- **Rule DD.1.6.1(2) Yard Distances (a) Front Sites:**
  The proposed 1.2m² storage sheds on Lots 2, 3 and 4 infringe the external 'other yard setback' of 2m being setback instead 1m, 1.37m and 1.74m respectively.
- **Part C2 Built Environment and Infrastructure**

  The proposed development is unable to comply with the following rules in relation to transportation matters specified in Rule C2.1.7 (Rules for Provision of Infrastructure for Development-Works and Services):

  - C2.1.7.1 (I6)-Minimum Distance Between Vehicle Crossings
    The proposal includes two vehicles crossings which do not comply with the required 15m separation.
  - C2.1.7.1 (I7)-Single Site Access
    The subject site has a road frontage width of 20m and will be served by three vehicle crossings which does not comply with the above rule which requires a site frontage to be greater than 60m for three crossings to be installed.

The above General Residential Zone infringement falls to assessed as a **Restricted Discretionary Activity** pursuant to Rule 1.6.1 (17).

***C10-Subdivision Consent***

Sections C2 relates to the Built Environment, Infrastructure and Energy pertaining to Subdivision and C10 pertains to subdivision are relevant. The proposal raises issues in terms of both of these sections and are considered below.

C10-Subdivision

The proposal includes a concurrent subdivision within the General Residential Zone which is regulated by Rules C10.1.6.

Subdivision in each case is classified as a Controlled Activity subject to compliance with the general standards in chapter C10.

The proposed subdivision is unable to comply with the following rules:

- C10.1.6.1 (B) - Allotment Sizes

The proposal cannot comply with the 320m² minimum lot size for duplex dwellings with proposed lot sizes of between 158m² and 241m², with an average of 200m².

In addition to the above, as a result of the subdivision the proposal fails to comply with the following performance standards:

- Rule 1.6.1 (2)-Yard Distances (Other Yards (2m))
  - All Units will incur an infringement along the common boundary due to being duplex dwellings, as well the setback form the boundary of the JOAL,
- Rule1.6.1.1 (2)-Recession Planes
  - Due to their duplex layout, all lots infringe the height control along their common party wall boundary.
- Rule 1.6.1(2)-Site Coverage
  - Total coverage for Lots 7 and 8 is 39.6% and 40%, respectively and thus exceeding the 35% maximum site coverage control.

The above infringements fall to be assessed as a **Discretionary Activity** pursuant to Rule 10.1.6 (9).

***Overall Activity Status***

Overall, the proposal is to be assessed under the TRMP as a **Discretionary Activity** being the most restrictive activity status.

## 5.3 Planning Context

The applicable planning context is established by the provisions of the Operative District Plan and National Policy Statement for Urban Development, with the provisions of the Proposed District Plan also having influence.

***The Tairawhiti Resource Management Plan***

As detailed in Section 5.1 above, the following policy context is relevant to the assessment of the application:

***Part C – Region Wide Provisions***

- *C2 – Built Environment, Infrastructure and Energy*
- *C10 – Subdivision*

***Part D – Area Based Provisions***

- *DD1 – Residential Zone*

Each is summarised as follows.

***C2 – Built Environment, Infrastructure and Energy***

The subject application does not include any Network Utility Operations but does include the provision of works and services associated with servicing of the subdivision. To this end, the general controls related to infrastructure are applicable to the application. The six objectives for infrastructure are included within Section C2.1.3, and seek to:

- *Provide infrastructure that is designed, located, constructed, operated, and maintained in a manner that ensures a safe and healthy environment, achieves efficient use of energy and resources, and avoids, remedies, or mitigates adverse effects.*
- *Ensures that infrastructure associated with subdivision is provided in an integrated and co-ordinated manner.*
- *Enable and promote subdivision and development of infrastructure that allows implementation of good urban design practices, low impact design principles and reflects the environmental and social context of the location.*

The relevant policies related to funding and provision of infrastructure, the design and reticulation of infrastructure, and in particular works and services (being road reserve, landscaping, stormwater, water, and wastewater), are detailed in Sections C2.1.4.2, C2.1.4.3 and C2.1.4.5 respectively. A detailed assessment of the activity against these provisions is undertaken in Section 10 of this report below.

### ***C10 – Subdivision***

The two objectives for subdivision are detailed in Part C10.1.3 and seek to:

- *Enable subdivision, provided that any consequent adverse environmental effects can be avoided remedied or mitigated.*
- *Subdivision that is consistent with high quality urban environment, in particular promoting a high level of amenity values and establishing a safe and healthy urban environment; and*
- *Encourage resource and energy efficiency.*
- *Avoid, remedy, or mitigate adverse effects on the environment.*

The associated policies detailed in C10.1.4 seek to ensure that a building platform can be established within each allotment, without causing or contributing to land instability; and that the proposed subdivision does not result in adverse effects with regard to network utility infrastructure. Further assessment of the application in terms of these considerations is provided in Section 7 and 8 of this report below.

### ***DD1 – Residential Zone***

The subject site is included within the General Residential Zone. Chapter DD1.1 details that:

> *The rules within the residential chapter endeavour to maximise the freedom of individuals to determine and provide for their physical and social needs whilst ensuring that the residential environment, which is potentially affected by each individual's decision s to meet his or her needs, is preserved, and enhanced for the benefit of present and future generations.*

The zone identifies 5 Objectives (Section DD1.3) of which the following three are considered relevant to the current application:

**DD1.3.1-Residential Styles**
To enable a diversity of residential styles to provide for the varied housing needs of the community.

**DD1.3.2-Amenity Values**
To maintain or enhance residential amenity; and

**DD1.3.4-Location and Density**
To enable the community to locate anywhere that does not compromise the capacity of the infrastructure systems to function, the amenity of the residential environment or the highly productive and fertile soils within the region.

### *National Policy Statement for Urban Development*

The National Policy Statement for Urban Development (NPS-UD 2020) replaced the NPS-UDC 2016 and came into force on 20 August 2020, and is particularly reflected in Objective 4 of the NPS which states:

> New Zealand's urban environments, including their amenity values, develop and change over time in response to the diverse and changing needs of people, communities, and future generations.

The NPS-UDC 2016 required councils to improve planning processes to enable more development. The NPS-UD gives further direction in certain areas, such as where development capacity should be provided and how councils can be more responsive to development opportunities.

The NPS-UD is designed to improve the responsiveness and competitiveness of land and development markets. In particular, it requires local authorities to open up more development capacity, so more homes can be built in response to demand. This NPS is considered relevant to this application, insofar as it seeks to promote and encourage additional capacity for housing within existing urban environments.

It sets out different requirements for tier 1, 2 and 3 urban environments and local authorities, but in Section 1.5, '*strongly encourages*' tier 3 local authorities, such as Tairawhiti District Council, to '*do the things that tier 1 or 2 local authorities are obliged to do under Parts 2 and 3 of the NPS.'*

To this end, it is noted that there is a clear intention from the NPS that every local authority should give particular regard to the Objectives and Policies contained in Part 2 of the NPS when assessing an application for resource consent.

The Objectives include:

> *Objective 1: New Zealand has well-functioning urban environments that enable all people and communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future.*
>
> *Objective 2: Planning decisions improve housing affordability by supporting competitive land and development markets.*

*Objective 3: 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.*

*Objective 4: New Zealand's urban environments, including their amenity values, develop and change over time in response to the diverse and changing needs of people, communities, and future generations.*

The most relevant policies of the NPS-UD to this application are:

*Policy 1: Planning decisions contribute to well-functioning urban environments, which are urban environments that, as a minimum:*

- *(a) have or enable a variety of homes that:*
  - *(i) meet the needs, in terms of type, price, and location, of different households; and*
  - *(ii) enable Māori to express their cultural traditions and norms; and National Policy Statement on Urban Development 2020 – updated May 2022 11*
- *(b) have or enable a variety of sites that are suitable for different business sectors in terms of location and site size; and*
- *(c) have good accessibility for all people between housing, jobs, community services, natural spaces, and open spaces, including by way of public or active transport.*

*Policy 5: Regional policy statements and district plans applying to tier 2 and 3 urban environments enable heights and density of urban form commensurate with the greater of:*

- *a. the level of accessibility by existing or planned active or public transport to a range of commercial activities and community services; or*
- *b. relative demand for housing and business use in that location.*

*Policy 6: When making planning decisions that affect urban environments, decision-makers have particular regard to the following matters:*

- *c. the planned urban built form anticipated by those RMA planning documents that have given effect to this National Policy Statement*
- *d. that the planned urban built form in those RMA planning documents may involve significant changes to an area, and those changes:*
  - *i. may detract from amenity values appreciated by some people but improve amenity values appreciated by other people, communities, and future generations, including by providing increased and varied housing densities and types; and*
  - *ii. are not, of themselves, an adverse effect.*
- *e. the benefits of urban development that are consistent with well-functioning urban environments (as described in Policy 1)*
- *f. any relevant contribution that will be made to meeting the requirements of this National Policy Statement to provide or realise development capacity.*

*g. the likely current and future effects of climate change.*

It is considered relevant that:

- Policy 5 contemplates District Plans applying to tier 3 urban environments allowing a change in density,
- Policy 6 recognises that changes in amenity values need not, of themselves, be considered an adverse effect - this is relevant in considering Policies 8 and 10 of Objectives 5.3.1(a) and (b).

As such, the consideration of this resource consent application for increased density need not be considered at odds with what is expected of practitioners, and an example of the type of step change encouraged by the NPS for how development initiatives can maximise opportunity.

Additional consideration of these provisions in relation to Section 104(1)(b)(vi) will occur in Section 10 of this report.

# 6. CONSULTATION

In accordance with Schedule 4 of the RMA, an application for resource consent should:

1. Identify the persons affected by the proposal,
2. The consultation undertaken,
3. Any response to the views of any person consulted.

To avoid doubt, while the applicant is not obliged to undertake consultation, nor is there any grounds for expecting the applicant to consult with any person, the applicant is obliged to report on who may be affected by the proposal. This is expanded upon in Section 9 of this report.

The development of the site has been introduced to the Council's Resource Consents Principal Planner (Awhina White) and Engineers (Barry Sanders and Phillip Dodds). Detail in relation to this consultation with Council has been attached at Appendix 8. In summary, feedback in relation to planning was largely oriented around confirming activity status with later feedback around the proposed density and how to address this in the application report.

In terms of servicing, correspondence between Joahn Ehlers of Infir and Barry Sanders confirmed appropriate stormwater design for the site including the level of detail and design required. This has been addressed in the engineering report attached at **Appendix 6**.

In terms of (2) and (3) however, the site is located within the General Residential Zone, the proposal is considered to constitute an anticipated and appropriate form of infill development with the effects of the activity considered to be less than minor. No other consultation was therefore considered necessary. This is expanded upon in Sections 8 and 9 of this report.

Further, while there is no obligation under Schedule 4 of the RMA for consultation with Mana Whenua, the applicant has begun this consultation process with:

- Te Aitanga a Mahaki, and
- Rongowhakaata.

This consultation process is proposed to occur in parallel with the processing of the resource consent.

# 7. SECTION 106 ASSESSMENT

Section 106 relates to circumstances when the consent authority may refuse an application to subdivide and states:

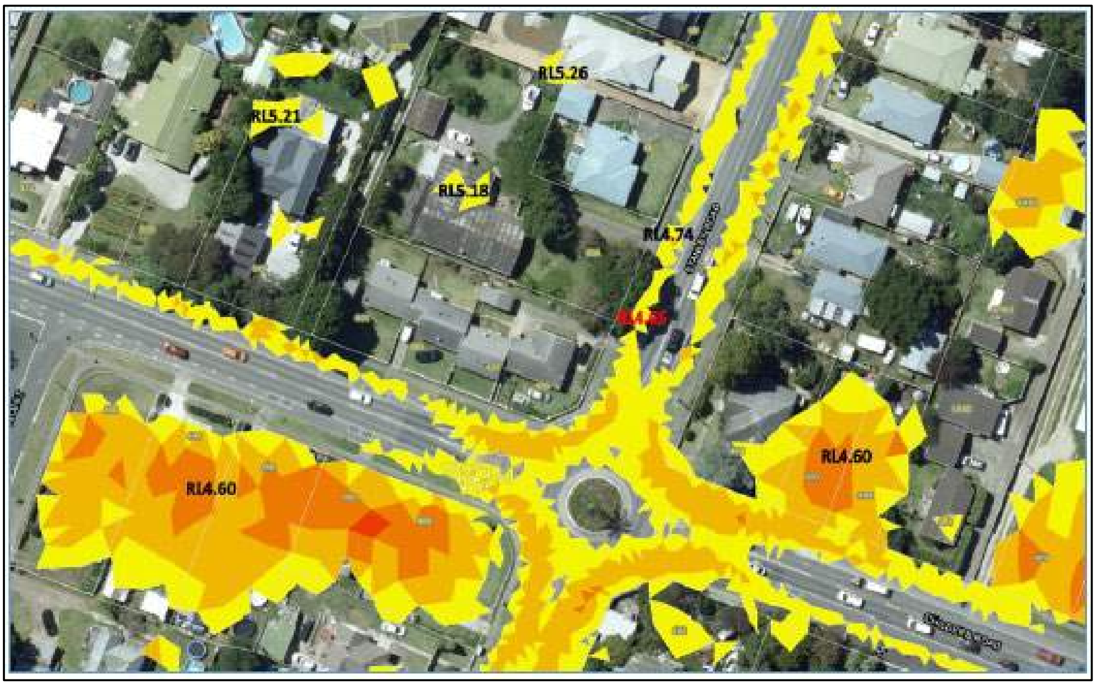
> *(1) A consent authority may refuse to grant a subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that:*
> *(a) there is a significant risk from natural hazards; or*
> *(b) [Repealed]*
> *(c) sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.*
> *(1A) For the purpose of subsection (1)(a), an assessment of the risk from natural hazards requires a combined assessment of:*
> *(a) the likelihood of natural hazards occurring (whether individually or in combination); and*
> *(b) the material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and*
> *(c) any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).*
> *(2) Conditions under subsection (1) must be:*
> *(a) for the purposes of avoiding, remedying, or mitigating the effects referred to in subsection (1); and*
> *(b) of a type that could be imposed under Section 108.*

In terms of Section 106(1)(a) and taking 106(1A) into account, the following considered the potential for flooding/ponding and geotechnical hazards.

***Flooding and Ponding***

The site is not located within a known flood hazard area, but the rain on grid model (2090 1% AEP) do show isolated ponding areas on the site and some ponding on Stanley Road's berms as shown in **Figure 16.** The overland flow path drains to a ponding area south of Childers Road with a flood level of RL4.60.

**Figure 15:** 2090 1% AEP Wider Area Flood Extent



Notwithstanding that the site is not within a known flood hazard area, consideration is still required in relation to stormwater management and final ground and floor levels.

Section C2.1.7.1 of the TRMP requires primary stormwater systems to convey a 10% AEP rain event without relying on secondary flow paths, and secondary stormwater systems to have sufficient capacity to convey a 1% AEP event while protecting buildings and household gully traps from inundation. Where stormwater runoff is greater than the capacity of the system, which is to receive it, runoff shall be managed to the relevant pre-development rates, or the capacity of the system shall be upgraded.

To limit stormwater discharge rates from the site to pre-development discharge rates, 10m³ of rainwater tank storage is required. Lots 1-6 need 1m³ storage tank each discharging water at 0.29L/s. Lots 7-8 need a 2m³ tank each discharging water at 0.58L/s to control stormwater runoff for 10% AEP events. Further detail as to how these work are provided in the Infir report.

Earthworks are also necessary to direct stormwater away from new buildings and ensure that minimum grades are achieved to prevent ponding over paved areas. Works are also required to ensure overland flows from the new lots are directed to the new access road and then to Stanley Road, and away from neighbouring private properties. Level changes at the property boundary will be less than 600mm along the site perimeter.

The water level in the berm in Stanley Road at the proposed access point is at RL4.74 (NZVD2016), flowing to a ponding area south of Childers Road where the flood level is at RL4.60. This is considered to be the controlling water body in the area, setting a minimum floor level of RL5.10 to provide 500mm freeboard. Building Code requirements, such as a minimum of 150mm clearance above surrounding sealed ground, may require floor levels to be higher.

***Geotechnical Hazards***

With reference to the geotechnical suitability of the site/the ability to provide for stable building platforms within each of the proposed lots, it is noted that the submitted LDE Geotechnical Reports for Lots 1-8 **(Appendix 6)** conclude the following:

- *Following development of the site in accordance with our recommendations, we consider that:*
  - *a) The land in respect of which a consent is sought, or any structure on the land built in accordance with our recommendations, is unlikely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and*
  - *b) Any subsequent use that is likely to be made of the land is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; and*
  - *c) Sufficient provision has been made for physical access to each allotment to be created by the subdivision.*

***Summary***

The conclusions in these expert reports are relied on in coming to the view that while the potential for hazards does exist, the proposal is not considered to carry significant risk, or a degree of risk beyond that already anticipated under the TRMP.

In terms of Section 106(1)(c), legal and physical access onto each lot can be provided from Stanley Road via the JOAL and two vehicle crossings.

On this basis, it is not considered necessary to refuse the application on any grounds expressed in Section 106 of the RMA.

# 8. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The TRMP provides for subdivision as a Controlled Activity where compliance with the general standards can be met, however based on the analysis above, the proposal is to be assessed overall as a Discretionary Activity.

Notwithstanding that Council's ability to assess the adverse effects of a Discretionary Activity is unrestricted, it is considered that the general standards specified for both subdivisions and land use activities, combined with the matters of control and assessment criteria pertaining to the different aspects of the proposal provide a useful framework to guide the assessment of the proposed development in terms of its effects.

In adopting these general standards, matters of control and assessment criteria to guide the assessment of environmental effects, the following section of this report is structured as follows:

- Section 8.1 – Land Use – Section DD1 (Rules for Residential zones)
- Section 8.2 – Subdivision
  - Section 8.2.1 – C10.1.6.1 – General Standards for all Subdivisions
  - Section 8.2.2 – C10.1.6(1) – Matters of Control for Subdivision

- Section 8.3 – Contaminated Soils
- Section 8.4 – Freshwater
- Section 8.5 – Construction Effects
- Section 8.6 – Summary

## 8.1 Land Use (Multi Unit Development)

Due to the sequencing of development, the proposal includes the construction of 8 dwellings on the site prior to the issue of Section 224 certification and issue of titles. This aspect has been assessed under the rules contained in DD1.6 (Rules for Residential zones). The activity does not achieve compliance with rules in relation to minimum site area, the separation distance for vehicle crossings and the number of vehicle crossings based on road frontage as it relates to the overall site. It is noted that infringements to yards, recession planes and site coverage are generated following the subdivision of the site.

The matters of discretion are set out in DD1.6.1(17) and C2.1.7.2(c) of relevance to the proposal are noted as:

*d)* *Minimum site area,*
*e)* *Service Area;*
*f)* *Recession Planes;*
*g)* *Site coverage;*
*h)* *Yard distances;*
*i)* *Infrastructure, works and services.*

There is no further guidance provided beyond the listed matters above. Thus, this assessment will address each matter as follows:

*Minimum Site Area*

All proposed dwellings do not comply with the required 320m² minimum site area required for duplex units.

The following comments are made:

- The proposed dwellings are fully compliant to external boundaries with regards to yard distances and height recession planes and comply with the building coverage control on a site wide basis. Further, all dwellings are provided with an outdoor living space which is either east, west or north of the dwellings and will achieve sunlight from the north and a separate a service court of at least 15m$^2$. This careful design and high level of compliance across the site, ensures the outcomes of the residential zone sought by the minimum net site area rule are achieved.
- Further to the above, through the provision of relatively compliant service spaces and high-quality outdoor living areas, the onsite amenity for each dwelling will not be compromised as a result of the reduced lot sizes.
- The utilisation of two storey, duplex dwellings additionally enable smaller lot sizes to be employed provided the amenity outcomes discussed above are met.
- The proposal has included a high level of landscaping (including specimen trees and lower growing ground cover plants) to ensure that the presence of buildings

does not predominate the site. Notwithstanding this, all lots except two (Lots 7 and 8) comply with building coverage and the proposal complies with building coverage on a site wide basis (32.7%), as such, the extent of buildings across the site is within that anticipated by the plan.
- It is noted that minimum net site areas prescribed by Council generally provide for the ability for compliant vehicle access, parking and manoeuvring on the site. As the proposal includes a communal access for Units 3-8 which includes space for manoeuvring, it removes the need for this area to be located on the site. Therefore, reducing the site area required per dwelling.
- In terms of an anticipated development scenario, with the overall site area of 1590m², the TRMP would allow for up to three lots each with a detached dwellings (at 400m² each) and four lots each with a duplex dwelling (at 320m² each) as an anticipated activity. However, it is noted that each of these lots could also contain a minor dwelling, therefore providing for 6 – 8 buildings across the site provided external boundary and site coverage controls are met. As such, the level of built form across the site will not be dissimilar to an anticipated activity of this scenario. It is noted however that the central access point, provides for greater openness and results in less built domination when viewed from adjacent sites than what could occur in a potential alternative development scenario.

Noting the above, through careful design, the site results in onsite amenity not being compromised as a result of minimum lot sizes not being met and any effects on the surrounding environment being mitigated or avoided and less than minor.

*Recession Planes*

The proposal is fully compliant with recession planes as it relates to the external boundaries and therefore any effects on the surrounding environment are within those anticipated by the plan.

In terms of the infringements arising as a result of the proposed subdivision:

- A number of the infringements arising are along the internal wall of the duplex dwellings which is an effect anticipated by Rule 1.6.1(2)(b) which allows for multiple dwellings to be connected to each other.
- Given that the infringements are internal to the site and compliance can be achieved with the external site boundaries, adverse shading, privacy and dominance effects on adjacent sites will be avoided.
- The streetscape will not be dominated noting the compliant setbacks form side boundaries, open space area provided within the lots and landscaping/fencing solutions. It should also be noted that Units on Lots 3-8 are screened from view from Stanley Road via proposed development between them and the road frontage.
- In terms of onsite amenity, adverse effects from the recession plane infringements are considered to be less than minor noting that internal and external living spaces will not be compromised as a result of the locations of the dwellings on the site. Specifically, all dwellings comply with the recession planes adjacent to outdoor living

areas.

*Site Coverage*

The proposal is fully compliant with site coverage requirements as it relates to the overall site area. However, infringements are generated as a result of the subdivision as it relates to Lots 7-8.

The following comments are made in relation to this matter:

- Given that the total building coverage across the site equates to 32.7%, the proposed infringements will be indiscernible to that of a compliant scheme when viewed from the surrounding locality as sufficient proportions of open space will be provided throughout the site.
- Despite the above, mitigation measures employed to reduce the dominance of buildings includes varied fencing throughout the site and landscaping which includes various species (including specimen trees) and a combination of both single storey and two storey dwellings. Each of these aspects assists to reduce the overall perceived built dominance of the site.
- Further mitigation is afforded to adjacent sites via compliance with external yard, height and height in relation to boundary controls.
- In terms of stormwater runoff, this has been mitigated via on-site attenuation and controlled discharge as outlined in the servicing report prepared by Infir,
- The infringements to site coverage are essentially created through smaller lot sizes being utilised than what is anticipated by the District Plan. However, as has been established above, the lot sizes are considered to be adequate to provide for outcomes on the site which do not compromise residential amenity.

*Yard Distances*

The following comments are made in relation to the yard infringements which arise as a result of the subdivision:

- It is noted that these are all internal to the site as such, any associated adverse effects generated are also internalised therefore avoiding privacy, shading of impacts upon amenity on surrounding sites.
- As has been established above, while infringements are generated, the onsite amenity achieved will not be compromised.
- Through the compliance achieved with external boundaries by the dwellings and also the open space provided within the centre of the site afforded by the JOAL, parking and manoeuvring areas, the development will retain a sense of spaciousness when viewed from the surrounding area.
- It is relevant to consider the baseline set by the Plan which allows for several conjoined dwellings with no internal separation through the provision of minimum net site areas for dwellings that can be attached on two sides in Rule 1.6.1(2)(b). Comparatively, the proposal offers mitigation to the bulk of buildings on the site through providing separation and a combination of both one and two storey dwellings.

*Infrastructure, Works and Services*

The proposal fails to meet the following standards as it relates to access:

- I6 Minimum distance between vehicle crossings: Prior to subdivision, there will be two vehicle crossings serving one site which achieve a separation distance of 3m, therefore not meeting the 15m required. Following the subdivision, this will become compliant.
- I7(b) Single-site vehicle access: The development is served by more than one crossing and thus exceeds the maximum of one crossing per site.

The assessment criteria for Roading and Access is contained within Section C2.1.7.2(c) of the TRMP. Taking these into consideration, the following comments are made in relation to the proposed access:

- In regard adverse effects of the infringements, we note that these will be temporary until such time as the subdivision is complete. Regardless, the crossings are located on a straight stretch of Stanley Road and will be provided with unobstructed sightlines so as to ensure safe and effective movements onto and off Stanley Road,
- All crossings will comply with the design requirements under the TRMP,
- It is considered that the 3m separation distance will still provide sufficient refuge for pedestrians between each to the site should there be two vehicles using the crossings at the same time.
- With regard to waste collection, there is sufficient space left on the berm to provide for rubbish and recycling removal,
- Having crossings which are located closer that the permitted 15m is not uncommon along Staney Road, with other examples in the immediate locality (albeit on separate sites). To our knowledge there have been no traffic issues or complaints raised,
- In terms of parking, Units 3-8 will each be provided with a parking space which is able to achieve on-site manoeuvring onto the JOAL, while Units 1 and 2 will need reverse manoeuvring onto Stanley Road. Here we note again that reverse manoeuvring onto Stanley Road is not uncommon and to our knowledge there has been no issues. It is considered that through the compliant design of the crossings and unobstructed sightlines that the safety and effective movements to and from Stanley Road will be less than minor.

It is noted that a traffic engineer has been engaged to prepare an assessment in relation to the matters assessed above. This will be provided to Council in due course and it is intended that this will support the proposal in its current form, thereby confirming the assessments above.

**Summary**

Overall, and considering the above assessments, the proposal is a conventional medium density residential infill development which is supported by the National Policy Statement-Urban Design 2020 and will result in adverse effects that will be less than minor. The proposal represents an appropriate density of development that can be suitably accessed and serviced and will not result in adverse impacts upon the amenity and character of the surrounding area.

## 8.2 Subdivision

### 8.2.1 C10.1.6.1 – General Standards for all Subdivisions

Section C10.1.6.1(a – f) details the general standards for all subdivisions. It is considered that compliance or otherwise of the proposed development against these general standards provides the baseline against which the effects of the proposed activity are able to be assessed – noting that such an application would otherwise be assessed as a Controlled Activity. Where the proposal is unable to comply with a particular standard, it is then necessary to consider the scale of effects that may subsequently arise. The assessment of the proposal against these matters follows.

#### A. *Subdivisions shall comply with C2 – Built Environment, Infrastructure and Energy and C9.2 Esplanade Reserves and Strips*

An assessment of the activity against the relevant provisions of C2 has been undertaken in the submitted TRMP Compliance Analysis (**Appendix 7**).

With reference to C9.2, the proposed subdivision is located within the Gisborne Urban Area and creates allotments of less than 4ha, however the site does not abut the coastal marine area, or a river specified in General Standard C9.2.6.1(D). As such, there is no requirement to provide an Esplanade Reserve nor Strip.

#### B. *Allotment Sizes and Dimensions*

Subdivisions shall comply with the rules for allotment sizes, shape factor and road frontage. For the (reticulated) General Residential Zone the minimum lot size is 400m$^2$ per unit where it is a standalone unit and 320m$^2$ for a duplex unit. There are no relevant shape factors or road frontage requirements specified in relation to the General Residential zone.

As the development contains no standalone units, the minimum 400m$^2$ limit is not applicable to this proposal. The proposal cannot comply with the minimum 320m$^2$ net area requirement, with net lot sizes of 121m$^2$ – 255m$^2$ for duplex units. A detailed assessment in relation to the potential effects generated by the reduced lot sizes has been undertaken above and will be expanded upon further below however in summary, it has been demonstrated that any potential effects will be less than minor.

#### C. *Building Platforms*

The proposed building platforms (and building typologies) have been identified in the Development Plans (**Appendix 2**). This proposed layout, combined with the geotechnical information, and ground conditions for the site furnished in the submitted Geotechnical Assessment (**Appendix 6**) will ensure that the proposed lots are provided with a stable building platform that are contoured to provide for controlled discharge of stormwater and will not be affected by any potentially unstable land.

#### *D. Existing Buildings*

The development will require all existing buildings to be removed from the site.

#### *E. Boundary Adjustment*

The proposal does not include any boundary adjustments.

#### *F. Easements*

The subject site is not subject to any easements that would affect the proposal.

The multiple easements associated with the proposed subdivision are contained within the subdivision scheme plan (**Appendix 3**).

Easements include rights of way, rights to convey three waters, party walls and power and telecommunications which are contained within the JOAL.

### 8.2.2 C10.1.6(1) – Matters of Control for Subdivision

As detailed above, where a subdivision can comply with the General Standards detailed in Chapter C10, the application would be assessed as a Controlled Activity. The application is unable to comply with matters in relation to minimum lot sizes and requires assessment as a Discretionary Activity where discretion is unrestricted. However, the following matters of control are considered appropriate to guide the assessment of effects as follows.

#### *a) Suitability of building platforms*

The Development Plans and geotechnical report (**Appendices 2 and 6**) detail the eight proposed building platforms to be established on the proposed lots. As discussed in Section 7 and within this AEE, these platforms are considered to be suitable with regard to both land stability and the inclusion of engineer designed foundations, finished floor levels, and proposed land contouring which will reduce the potential for flooding and maintain overland flow paths.

#### **b)** *Suitability of Infrastructure, Works, and Services*

The proposed infrastructure works and services to service the development are detailed in the Development Plans, associated Scheme Plan and Servicing Report (**Appendices 2 – 4**) and are considered to be consistent with the scale and type of servicing that would otherwise be anticipated for medium density residential development within the General Residential Zone. An assessment in relation to access is provided in Section 8.1 above. Here it is determined that the adverse effects of the proposed access arrangement will be less than minor and is suitable for the development.

#### *b) The extent to which the amenity values of the surrounding areas are affected.*

The extent to which the proposed activity will have on the effects of the surrounding locality has been assessed in relation to the land use above where it was determined that the amenity values of the surrounding locality will be maintained.

While the proposed subdivision cannot meet the minimum site areas, the amenity of the surrounding area will not be compromised or otherwise affected for the following reasons:

- The proposal incorporates a high level of design in terms of lot and dwelling layout, landscaping, fencing, access and parking. Adverse effects associated with failing to meet the minimum lot size largely mitigated through the utilisation of two-story and duplex dwellings, the provision of separate and adequate service and outdoor living spaces as well as landscaping proposed throughout the proposal.
- The external boundaries of the sites will be screened via a mix of existing fencing and screen planting that will reduce visual impacts between the site and surrounding properties.
- The development complies with all external boundary controls. As such, any potential effects from infringements will be internal to the site and privacy, shading and bulk dominance effects toward neighbours are within a level which is anticipated by the plan.
- The layout and area of the proposed lots, although below the 320m$^2$ minimum, are not incompatible with the surrounding area which provides for a variety of sites with varying lot size and density not dissimilar to the proposed development. This is particularly evident by the development on the adjacent site to the south (i.e

***c) Financial Contributions***

It is anticipated that the development will be subject to assessment under the Development Contributions policy, noting that the developer will be installing and constructing all infrastructure related to access and three waters servicing as part of the subdivision development. All services will remain private. There are no special circumstances considered to apply that would warrant the calculation or application of financial contributions.

***d) Any adverse effects of exotic flora and fauna on values identified in the overlays of Chapter C9 – Natural Heritage***

The site is not located within any identified natural heritage overlay and thus this matter is not applicable. Notwithstanding this, the development will incorporate significant landscape elements and permeable area commensurate with this urban location.

Noting the above assessment, it is considered that any potential effects arising from the subdivision will be effectively managed and mitigated to a level which is less than minor.

## 8.3 NES for Assessing and Managing Contaminants in Soil to Protect Human Health

As outlined above, a DSI has been undertaken by EAM confirming that the soil contamination exceeds the applicable standards towards the centre and north-western corner of the site. The associated soil disturbance associated with the proposal and the subsequent subdivision and land use therefore fall to be assessed as a Restricted Discretionary Activity pursuant to Regulation 10 of the NESCS.

Regulation 10(3) sets out the following matters to be considered:

a) *the adequacy of the detailed site investigation, including—*
    i. *site sampling:*
    ii. *laboratory analysis:*
    iii. *risk assessment:*
b) *the suitability of the piece of land for the proposed activity, given the amount and kind of soil contamination:*
c) *the approach to the remediation or ongoing management of the piece of land, including—*
    i. *the remediation or management methods to address the risk posed by the contaminants to human health:*
    ii. *the timing of the remediation:*
    iii. *the standard of the remediation on completion:*
    iv. *the mitigation methods to address the risk posed by the contaminants to human health:*
    v. *the mitigation measures for the piece of land, including the frequency and location of monitoring of specified contaminants:*
d) *the adequacy of the site management plan or the site validation report or both, as applicable:*
e) *the transport, disposal, and tracking of soil and other materials taken away in the course of the activity:*
f) *the requirement for and conditions of a financial bond:*
g) *the timing and nature of the review of the conditions in the resource consent:*
h) *the duration of the resource consent.*

In summary:

- A copy of the DSI prepared by EAM is attached at **Appendix 5**. The report contains an outline of the sampling undertaken together with the results of that sampling. It is considered that the author of the report is a Suitably Qualified and Experienced Person and that Clauses 10(3)(a)(i)-(iii) are appropriately satisfied.
- The EAM site investigation works identified an exceedance of lead and arsenic above the human health criteria (residential 10%) in ten of the five sample locations.
- EAM recommended that, given the density of the development, soils should remain on site and that options would be to use these for pile foundations for the new buildings rather than excavate for concrete rafts. Alternatively, topsoil could be geotechnically engineered to create structurally compliant building platforms. If the soils are to be removed then these will be to a licensed Class A landfill facility.

It is considered that with appropriate conditions of consent, that any potential effects in terms of contaminated soils can be appropriately managed and avoided to a level which is less than minor.

## 8.4 Freshwater

Rule 6.2.3(2) outlines the following:

> *Contaminant reduction methods shall be designed and implemented to treat stormwater from the impervious area in accordance with TP 10, or by alternative methods that are demonstrated to achieve an equivalent level of contaminant removal as TP 10 devices. These methods include but are not limited to constructed wetlands, swales, vegetative filters or infiltration practices.*

*Advisory Note: Demonstration of compliance with this Rule is required to be given to the Council. Compliance with this rule will be deemed to have occurred where the stormwater treatment is undertaken in accordance with Stormwater Management Devices: Design Guidelines Manual 2003. Technical Publication 10 (TP10) of the Auckland Council.*

The proposal includes a combined stormwater treatment system whereby runoff from roofs will be individually attenuated on each site before being discharged to the main. The runoff being directed into this system will first pass through a Hynds First Defence high capacity stormwater treatment system.

Runoff from roofs will not be treated as the roof material will be inert and the discharge will not comprise contaminants from a water quality perspective. Only discharge volume matters will be managed as described above.

Details in relation to the first defence system are included at the end of the servicing report. In summary, the system is an enhanced vortex separator that combines an effective stormwater treatment chamber with an integral peak flow bypass to efficiently remove sediment, total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captures pollutants. It is therefore considered an appropriate method of contaminant reduction resulting in compliance with TP 10.

The below ground attenuation system is proposed to manage stormwater volume matters, reducing post development discharge rates to predevelopment runoff rates.

Overall, any potential downstream effects in respect to water quality and quantity matters are considered to be less than minor.

## 8.5 Construction Effects

The construction effects of the proposal are limited to the site's clearance, proposed earthworks, installation of services and the construction of the eight new dwellings and associated access(s).

Construction activities are a function of reality when developing urban environments. Nuisance effects still need to be managed however, and in this regard:

- A Construction Management Plan addressing construction traffic, sediment control and hours of operation will be provided to Council prior to the commencement of any works on site. It is anticipated that the construction works will be limited to daytime/working hours, being 7.30am – 6.00pm Monday – Saturday
- All construction activity will be undertaken in accordance with the New Zealand Standard NZS 6803:1999 "Acoustics – Construction Noise".

In conjunction with the relative temporary duration of such effects, these initiatives will ensure that overall, effects with regard to construction can be managed to be less than minor.

## 8.6 Summary

Overall, in terms of the land use component, potential adverse effects of the proposed construction and use of eight dwellings will be less than minor and will not compromise the existing amenity or character of the surrounding residential environment.

Further, as guided by the applicable criteria of the plan, the effects of the proposed subdivision are less than minor and will result in urban development that is generally consistent with the existing residential character of the surrounding area.

In terms of servicing and land suitability, expert reporting by Infir and LDE provides suitable solutions for three waters servicing and foundation design. Although not affected by an identified flood hazard, the application entails earthworks and provides minimum ground and floor levels and appropriate storm water management and any adverse effects in this respect will be less than minor.

# 9. NOTIFICATION

There is no presumption in the RMA itself as to whether or not an application will be notified, and a consent authority has discretion in determining whether or not notification is necessary. This assessment is primarily governed by Section 95A and Section 95B of the RMA.

## 9.1 Section 95A Assessment – Wider Environmental Effects

Section 95A of the RMA considers the need for public notification and sets out four steps in a specific order to be considered in determining whether to publicly notify.

In terms of Step (1), public notification has not been requested, Section 95C pertaining to notification in the event that further information is not provided under Section 92 is not applicable, and the application is not being made jointly with an application to exchange recreation reserve land under Section 15AA of the Reserves Act 1977.

In terms of Step (2), none of the circumstances precluding public notification are applicable as the application is for a Discretionary Activity and not a Controlled Activity or boundary activity.

Moving to Step 3, notification is not required by a rule in a Plan, and the adverse effects of the proposal on the wider environment (in terms of Section 95D) have been demonstrated in Section 8 of this report to be less than minor. In particular, the proposed development is generally in accordance with subdivision anticipated by the TRMP, excepting minimal areas of non-compliance. Further, all infrastructure to service the site has been carefully considered and designed, such that the proposed development will not contribute too, nor exacerbate stormwater effects from the site under design events. As such, effects with regard to character and amenity within the wider locale will be less than minor.

Finally, under step 4 it is not considered that any special circumstances apply to the application for the following reasons:

1. The subject site is located within the General Residential zone, therefore, to utilise this large tract of land for residential purposes is entirely consistent with the existing, surrounding land use character.
2. The subdivision has been designed to ensure residential density, which is provided for, and anticipated by the TRMP, and is generally consistent with the densities evident within the surrounding locale.
3. The proposed land contouring and stormwater design (including detention and attenuation) across the site ensures that all stormwater can be discharged effectively, without resulting in any additional flooding and/or natural hazard effects within the surrounding locale during design events.

Considering the above, public notification is not considered to be required under any of the pathways under Section 95A of the RMA.

## 9.2 Section 95B Assessment – Effects on the Local Environment and Particular Parties

While public notification is not necessary, any effects of the proposal on the local environment and upon particular parties must still be considered. This is addressed through Section 95B of the RMA, which has four steps similar to Section 95A.

In terms of Step (1), being outside the coastal marine area we understand there are no affected protected customary rights or customary marine title groups in terms of Subclause (2).

In terms of Subclause (3), and whether the proposed activity is on or adjacent to or may affect land that is the subject of a statutory acknowledgement made in accordance with an Act specified in Schedule 11, the site is located within an Area of interest but is not located within or adjacent to a Statutory Acknowledgment Area referred to in Schedule 11 in the context of S95B.

In terms of Step (2), none of the circumstances in subsection (6) apply that would preclude limited notification of the application and thus we progress to step 3.

Step 3 requires Council to determine in accordance with Section 95E whether there are any affected parties. Adjacent land (identified in **Figure 9**) is considered to include the following properties:

- 99 and 97 Stanley Road (north),
- 507A Childers Road (east),
- 495, 497, 499 & 501 Childers Road (south), and
- 98 Stanley Road and 493 Childers Road (west).

**Figure 16:** Adjacent Parties

It is considered that any adverse effect upon the above properties will be less than minor for the following reasons:

- The proposed dwellings are fully compliant with external boundary controls. It is noted that the proposed building coverage is compliant on a site wide basis as such when viewed from the surrounding locality the development will be indiscernible to that of a compliant scheme.
- Further to the above, the layout of the site has been carefully considered to manage external boundary effects in relation to this immediately adjoining land in line with outcomes of the TRMP. The design has employed a combination of both single- and two-story dwellings to provide varied and reduced bulk across the site.
- The perimeter fencing and landscaping proposed around the boundary of the site will retain privacy from ground floor indoor and outdoor living areas. Careful placement of second storey windows toward external boundaries mitigates overlooking from this higher level. The side façades of Units 2 and 6 include only a high level window in a bedroom and frosted bathroom windows so as to avoid overlooking neighbors. While a standard bedroom window is utilised on the second floor of Units 3 and 4 which have outlook toward the boundary, these dwellings are setback at least 3.8m which mitigates privacy effects towards neighbours.
- Specimen trees and assorted screen planting interspersed along the external boundaries and throughout the site provide added value in softening the interface of the development with adjoining sites and reducing perceived bulk of the dwellings.

- Notwithstanding the above, it is noted that changes in amenity values need not, of themselves, be considered an adverse effect.
- Proposed traffic engineering solutions have been designed to ensure that the activity can be provided with vehicle and pedestrian access in a manner which will ensure that any adverse impacts upon vehicle and pedestrian safety in the immediate area will be less than minor.
- Servicing solutions and in particular stormwater measures, will ensure that the development will not result in the exacerbation of any adverse stormwater effects upon adjacent land during design events.
- An earthworks and sediment plan is to be submitted prior to the Building Consent stage which will ensure that no sediment laden discharge will adversely affect the surrounding area during the construction phase of the development.

The following further comments are made in relation to the specific adjoining parties:

- The property at 97 Stanley Road is located to the north and will be located adjacent to the JOAL and proposed Lots 7 and 8. Initial mitigation of visual impacts is provided in the form of existing screen fencing, the proposed landscape elements and that all dwellings comply with the boundary controls (yard setbacks and recession planes) required by the Plan. Overall, given the separation distance and limited interaction with the development, any adverse effects will be mitigated and less than minor.

- The property at 99 Stanley Road, is located to the north and will be located adjacent to the JOAL and the eastern boundary of proposed Lot 8. With particular regard to Lot 8, the proposed dwelling will be delineated from the boundary via two vehicle parking spaces and the proposed driveway. Units 1 and 3 will additionally be separated via the JOAL. In both cases, potential adverse visual and privacy effects will be mitigated via the separation distances afforded from these access and parking spaces, compliance with yards and recession planes, as well as existing screen fencing and that only the top of the windows of the dwelling on proposed Lot 8 will be visible. It is further noted that outdoor living spaces will not be located along this common boundary. Overall, noting the above, any adverse effects will be mitigated and less than minor.

- 495, 497, 499 & 501 Childers Road are located adjacent to the southern boundary of subject site and are occupied by four conjoined dwellings. As it relates to this site, Units 2 - 6 being three 2-storey duplex dwellings are adjacent the common boundary and will be setback 3.8m. Initial mitigation of visual and amenity impacts will be provided via existing perimeter fencing and landscaping which will maintain privacy from ground floor areas and outdoor living spaces and only high level bedroom, and frosted bathroom windows face the site on the upper level of Unit 2. As such, potential privacy effects will be mitigated. Additionally, the proposed buildings along the southern boundary will screen the remaining of the development and reducing the scale of the development when viewed from the south and thus reduces the perceived bulk of the development by maintaining a sense of spaciousness. As such, any adverse effects in terms of residential amenity on these persons will be avoided or mitigated and less than minor.

- 507A Childers Road is situated to the west of the subject site and is currently occupied by a single storey dwelling at the rear of the site. As it relates to this site, proposed Units 6 & 7 lie adjacent to the common boundary. It should be noted that Unit 6 is located adjacent to the accessway of 507A Childers Road and complies with the setbacks and height in relation to boundary standards and thus is considered to have a less than minor effect. In regard to Unit 7, this will be located 3.5m from the common boundary and single story in height, resulting in full compliance with TRMP standards as it relates to this boundary and residential amenity outcomes which are within the levels anticipated by the Plan. Further we note that the outdoor living space is orientated to the north and that potential privacy effects from the west are mitigated through the provision of the existing perimeter fencing along the boundary. As such, any adverse effects on these persons are considered to be avoided or mitigated and less than minor.

Overall, and particularly in relation to amenity values, the analysis undertaken in Section 8 and 9 confirms that the effects arising from the proposed density of development under this design package are not inconsistent with what is provided for under the District Plan when assessing density and weighing the scale of effects along property boundaries.

Given compliance with external yard controls and variations in dwelling typology proposed, it is not a proposal that gives rise to excessive bulk along boundaries which could otherwise occur on the site through the provision of consecutive terraced houses. The proposal does not result in unreasonable overlooking of boundaries, nor will adjoining properties access to sunlight be compromised.

On this basis, applying the tests in Section 95E, in addition noting that no special circumstances are considered to apply in terms of Step 4, the application may be processed on a non-notified basis without the need to obtain any affected persons consents.

# 10. RELEVANT OBJECTIVES AND POLICIES

In accordance with Section 104(1)(b) of the RMA, a consent authority must, subject to Part 2 of the RMA, have regard to the relevant provisions of any statutory plans and policy statements. This includes any relevant provisions of:

- National Environmental Standards (**NES**)
- Other regulations
- National Policy Statements
- The New Zealand Coastal Policy Statement (**NZCPS**)
- Regional Policy Statements or proposed Regional Policy Statements (**RPS**)
- A Plan or Proposed Plan.

Of these documents, the National Policy Statement on Urban Development Capacity as well as the TRMP are considered relevant. It is noted that the TRMP includes both the Regional Policy Statement, as well as the relevant District Objectives and Policies related to subdivision and the Residential Zone. Consideration of the application with reference to each of these matters follows.

## 10.1 National Policy Statement on Urban Development Capacity (Section 104(1)(b)(iii))

The National Policy Statement on Urban Development (NPS-UD) came into effect in 2020 (updated May 2022). Its preamble includes the following statement:

> *This national policy statement provides direction to decision-makers under the Resource Management Act 1991 (RMA) on planning for urban environments. It recognises the national significance of well-functioning urban environments, with particular focus on ensuring that local authorities, through their planning, both:*
>
> - *enable urban environments to grow and change in response to the changing needs of the communities, and future generations; and*
> - *provide enough space for their populations to happily live and work. This can be both through allowing development to go "up" by intensifying existing urban areas, and "out" by releasing land in greenfield areas.*

The NPS-UD (2020) includes the following in 'Part 2: Policies and Objectives':

> *Objective 1: New Zealand has well-functioning urban environments that enable all people and communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future.*
>
> *Objective 2: Planning decisions improve housing affordability by supporting competitive land and development markets.*
>
> *Objective 3: 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:*
>
> - *(d) the area is in or near a centre zone or other area with many employment opportunities*
> - *(e) the area is well-serviced by existing or planned public transport*
> - *(f) there is high demand for housing or for business land in the area, relative to other areas within the urban environment*
>
> *Objective 4: New Zealand's urban environments, including their amenity values, develop and change over time in response to the diverse and changing needs of people, communities, and future generations.*

The most relevant policy of the NPSUD to this application is:

> *Policy 1: Planning decisions contribute to well-functioning urban environments, which are urban environments that, as a minimum:*
>
> - *(a) have or enable a variety of homes that:*
>     - *(i) meet the needs, in terms of type, price, and location, of different households; and*

  - (ii) *enable Māori to express their cultural traditions and norms; and National Policy Statement on Urban Development 2020 – updated May 2022 11*
- (b) *have or enable a variety of sites that are suitable for different business sectors in terms of location and site size; and*
- (c) *have good accessibility for all people between housing, jobs, community services, natural spaces, and open spaces, including by way of public or active transport;*

Although the NPS-UD (2020) objectives and policies provide high level direction, it is considered that the proposed subdivision and residential development is generally consistent with these objectives, particularly in regard to providing dwellings that incorporate and will achieve positive urban design outcomes for occupants and adjoining landowners. The sites are also well positioned to enable future occupants with access to retail and community facilities.

The proposed subdivision and residential development will provide benefit to the wellbeing of the future owners and residents of the proposed sites. The configuration of the dwellings, and the scale of the development has been balanced to achieve a best fit for the site, also having regard to the surrounds, and seeks to provide a balance between the provision of onsite amenity and density, thus resulting in a more efficient use of residential land.

Adopting a comprehensive design approach ensures the provision of onsite amenity and utility in an efficient and overall effective manner, resulting in a higher density residential outcome whilst still delivering a high amenity residential living environment and ensuring that adverse effects are avoided and mitigated, and also catering to provide housing at a scale, and value within Gisborne.

In this regard the proposal is considered to be consistent with the higher-level directions signalled in the NPS-UD (2020).

## 10.2 Regional Policy Statement

Part B of the TRMP provides the Regional Policy Statement for the Gisborne District. Relevant matters covered in the RPS include:

- Involvement of Tangata Whenua in Resource Management
- Transport and Infrastructure
- Environmental Risk including Natural Hazards

With reference to these matters, the following comments are made:

- The proposed design of the subdivision has sought to utilize low impact stormwater design mechanisms, recognizing the environmental outcomes sought by Tangata Whenua in relation to freshwater.
- The proposal incorporates one JOAL and two additional vehicle crossings which provide access to the road in a safe and efficient manner. Pedestrian access is provided through the site to the road.

- The site is not affected by a known flood hazard, but mitigation is still provided in the form of minimum floor levels, land contouring and stormwater management.

## 10.3 Tairāwhiti Resource Management Plan

The relevant objectives and policies of the TRMP have been introduced in Section 5.1 of this report above. Further to this introduction of the policy context applicable to the assessment of the application, a more detailed assessment of the application against these relevant matters follows.

Rather than reproducing the entire provisions, of which there are many, the following references the specific Objective with a comment beneath and the relevant Policy with a comment alongside.

### 10.3.1 C2.1.3 (Infrastructure)

With reference to the five relevant Objectives of C2.1.3, the following comments are made:

- The proposed infrastructure to be installed to service the proposed subdivision ensures that future dwellings on these lots are appropriately provided for, and will enhance the environmental, social, cultural, and economic wellbeing of future owners.
- The proposed infrastructure to be installed ensures that the subdivision will generate a safe and healthy environment and provide an efficient use of resources and suitably avoids adverse effects on the environment.
- We understand capacity exists within the local network to service the development with all on site services remaining in private ownership meaning there will be no unanticipated costs to the community because of the development.
- The proposal seeks to establish a subdivision that achieves a high degree of urban design outcomes – connectivity, low impact design, high architectural and landscaped aesthetic and largely reflects the existing residential character of the locale. The development has been architecturally designed, achieves a high level of compliance, and will provide occupants and surrounding land with a high degree of amenity.

The following considers the relevant Policies in C2.1.4.

C2.1.4.2 – Funding and Provision of Infrastructure

1. The proposed infrastructure required to service the development is to remain in private ownership and will be undertaken at the developers cost, while it is noted that the establishment of each residential site will be subject to the calculation of development contributions in accordance with the Councils Policy.

4-7 There are no effects resulting from the proposed development that would require the payment of financial contributions to mitigate effects.

C2.1.4.3 – Design and Reticulation of Infrastructure

1. The design of infrastructure and the proposed construction of this infrastructure promotes an efficient use of physical resources, avoids adverse effects on the environment and actively responds to the environmental context of the development site.
2. It is considered both environmentally and financially feasible to provide infrastructure to the site at no cost to the ratepayer.

C2.1.4.5 - Works and Services

1. Access has been designed in a manner which will not compromise safety and efficiency of vehicle and pedestrian circulation in the surrounding area.
2. The proposed access points and associated vehicle traffic generation will not compromise the residential character and amenity of the local area.
3. We understand there is an adequate supply of water in terms of both volume and quality for each of the sites.
4. The proposal will promote the efficient use of water.
5. The proposed subdivision will be suitably serviced for firefighting with access available to suitable fire hydrants.
6. The disposal of wastewater from the site is to be conveyed by laterals to the main located in Stanley Road. This ensures that there will be no risk to public health or safety.
7. The supply of both underground power and telecommunications is to be provided for within the JOAL (lot 100),

### 10.3.2 C10.1.3 (Subdivision)

With reference to the two Objectives contained in Section C10.1.3, the following comments are made:

- The proposal seeks to enable subdivision that ensures adverse environmental effects are able to be adequately avoided, remedied, or mitigated.
- The proposed subdivision is considered to represent a high-quality urban environment, including a good degree of amenity both for residents and adjacent properties and a safe environment that provides emphasis on pedestrian access as well as vehicle access, and an efficient development of land and provision of infrastructure that does not result in adverse effects on the environment.

In respect to the relevant Policies in C10.1.4 the proposed building platforms have been identified for each site and are considered by LDE to be geotechnically appropriate for development subject to recommendations contained within that report.

### 10.3.3 DD1.3 Objectives (Residential Zones)

With reference to the three relevant Objectives of DD1.3, the following comments are made:

- The proposed development will result in eight new residential units consisting of a mix of 2-3 bed typologies which will meet varying community needs for housing.
- The proposed subdivision has been architecturally designed to maximise residential amenity values, through use of carefully considered lot design and layout.

- The location of the site within an existing urban neighbourhood is an efficient use of this land resource and while the proposed density is not fully compliant for the proposed housing typologies proposed on each lot, it is considered that mitigation has been provided in terms of site layout, building design, landscape elements, boundary fencing and by the characteristics of the immediate area which contains a range of housing typologies and lot sizes.

The following considers the relevant Policies in DD1.4:

DD1.4.1 – Residential Styles Policy

- The proposed land use and subsequent subdivision will provide eight additional dwellings which have been designed and arranged in a manner which will not detract from the character and amenity of the surrounding area.
- The development presents as a high standard of amenity both as experienced from within the site, and from external viewpoints.
- The proposal is not considered to compromise the amenity experienced within adjacent sites.
- The site can be serviced in terms of three waters without affecting capacity in the surrounding area.

DD1.4.2 – Amenity Values Policy

- The proposed development provides for car-parking and compliant manoeuvring for Lots 3-8, with Lots 1 and 2 safely reverse manoeuvring onto Stanley Road. The car parking and manoeuvring areas have been designed in a manner which will not dominate the streetscape with no garages or carports proposed and the majority of parking located remote from the road frontage, with the exception of Lots 1 and 2.
- The eight proposed units will be a mix of one and two-story dwellings and will be largely located upon rear sites. The proposal is not considered to give rise to any privacy and/or amenity effects for adjacent properties which will be further reduced by screen fencing and landscape planting an all external boundaries.
- Traffic generation associated with the additional dwellings will easily assimilate into the local road network without creating any congestion issues or safety concerns for vehicles or pedestrians.

DD1.4.4 – Location and Densities Policy

- The proposed development is a new development that will have minimal effects on Councils infrastructural assets where capacity exists to accommodate the activity, and to this end, the development should be encouraged to occur on the site located within the General Residential zone.
- The density of development proposed, and the associated stormwater generated from roofed areas and associated hardstand areas will be commensurate with the mitigation proposed in terms of proposed detention, attenuation and discharge which will ensure pre-development discharge rates can be achieved during design events.

# 11. PART 2 OF THE RESOURCE MANAGEMENT ACT 1991

The assessments contained in Sections 8 and 10 of this report are subject to the matters contained in Part 2 of the RMA, which contains Sections 5, 6, 7 and 8.

Section 5 sets out the purpose of the RMA, which is to promote the sustainable management of natural and physical resources and is supported by Sections 6, 7 and 8 of the RMA. Sections 6 and 7 contain the "matters of national importance" and "other matters" respectively and Section 8 provides for the principles of the Treaty of Waitangi. These sections are hierarchical and provide for a different level of consideration to be given to each.

The proposal is consistent with the purpose of the Act for the following reasons:

- The proposal represents an efficient use of significant land holding, providing for eight household units to be developed on the site in a manner that is appropriately and efficiently serviced in terms of infrastructure.
- The proposed density of the subdivision is not totally anticipated by the TRMP but is not considered incompatible in the context of the nature of the surrounding built environment.
- The development has been designed to achieve a high level of rule compliance and the provision of good amenity outcomes for future occupants and surrounding landowners.

Sections 6(a), (b) and (c) are not applicable to an urban development of this nature. Likewise, access along rivers as provided for in Section 6(d) is not a relevant matter in this particular case. There are no heritage values in terms of Section 6(f), while the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga will not be threatened as a result of the activity. Lastly, it has been determined by expert inputs that it is reasonable to accommodate development on the site recognising and providing for Section 6(h) and the management of significant risks from natural hazards.

Section 7(b) relates to the efficient use and development of natural and physical resources. The proposal optimises infill potential while being in keeping with its surrounds and each lot can be suitably serviced.

Lastly, Sections 7(c) and 7(f) relate to the maintenance and enhancement of amenity values and the quality of the environment. These matters have been considered throughout the body of this report and it has been demonstrated that the activity is not inappropriate for the site and will not compromise reasonable amenity expectations. No other matters of Part 2 are specifically relevant.

In summary, the proposal can be considered consistent with the principles and purpose of the RMA and deserving of consent.

# 12. CONCLUSION

In summary, this proposal is to undertake a joint land use and fee simple subdivision on the subject site at 99A Stanley Road in Gisborne involving foundation earthworks, installation of accesses and infrastructure services, the construction of eight new residential dwellings and the associated eight residential lot (and JOAL) subdivision. Overall, the proposal is to be assessed as a Discretionary Activity.

**Figure 17:** Streetscape Perspective

It is considered that given the relatively minor nature of the infringements and mitigation provided, the proposal will result in less than minor adverse effects and will not be contrary to the Objectives and Policies of the TRMP, or any of the other statutory documents referred to in Section 104(1)(b).

Furthermore, having considered the proposal subject to Part 2 of the RMA, it is not expected to compromise the principles and purpose of the Act, and is subsequently considered to be deserving of consent pursuant to Section 104 and 104B and can be approved on a non-notified basis in accordance with Sections 95-59F.

# Appendix 1

## Record of Title

# RECORD OF TITLE
# UNDER LAND TRANSFER ACT 2017
# FREEHOLD
## Search Copy

R.W. Muir
Registrar-General
of Land

**Identifier** GS3D/818

**Land Registration District** Gisborne

**Date Issued** 15 January 1974

**Prior References**
GS103/191

---

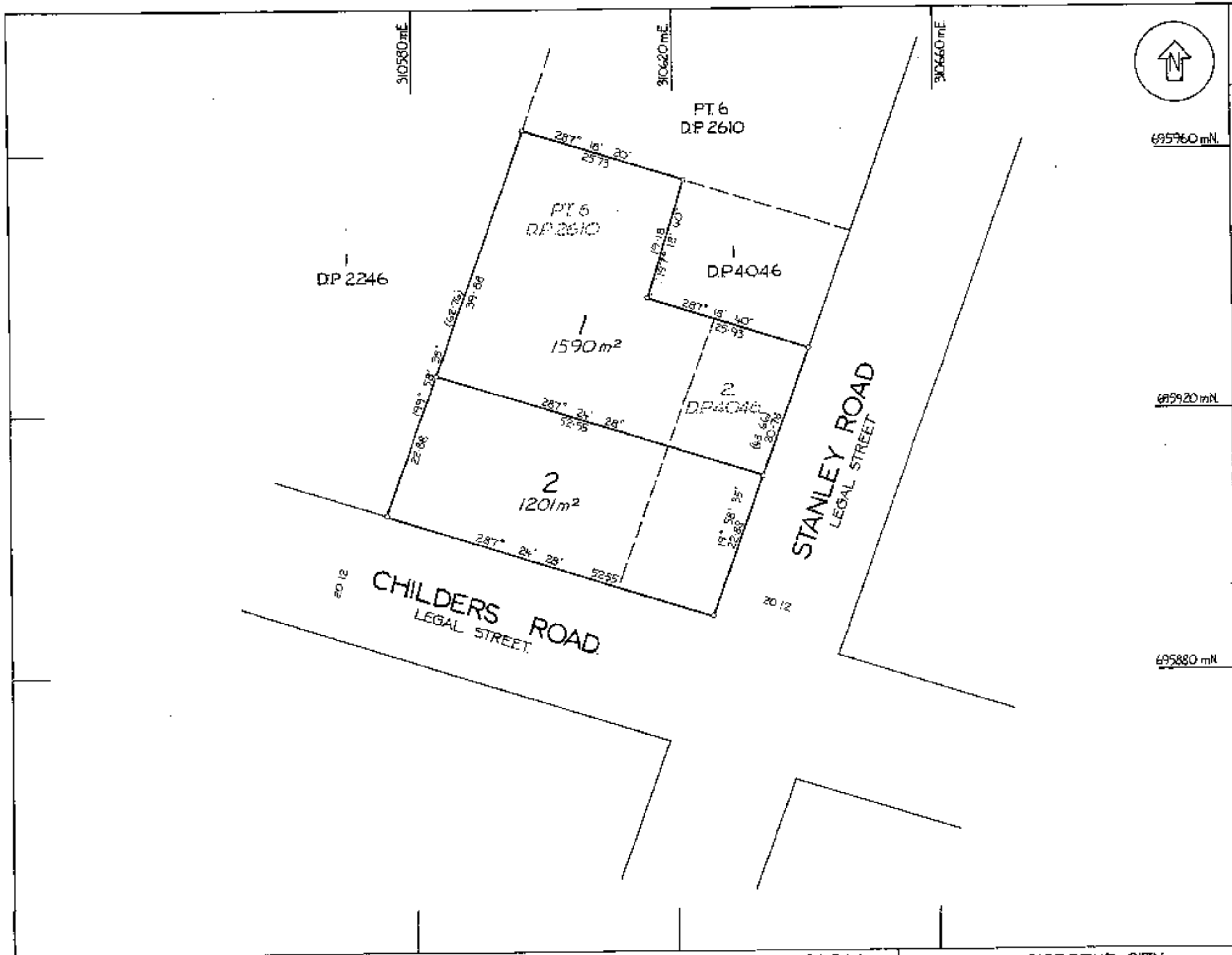
| | |
|---|---|
| **Estate** | Fee Simple |
| **Area** | 1590 square metres more or less |
| **Legal Description** | Lot 1 Deposited Plan 5799 |

**Registered Owners**

Stephen John Dimery and Anne Marie Dimery

**Interests**

5483649.2 Mortgage to (now) The Co-operative Bank Limited - 11.2.2003 at 9:00 am



APPROVED ~

M. M. Parker.

REGISTERED OWNER.

Pursuant to Section 351 of the Municipal Corporations Act 1954 and to a resolution passed on the 2nd day of October 1973, the Gisborne City Council hereby approves the subdivision shown hereon.

Pursuant Section 30 Town and Country Planning Act 1953 the Gisborne City Council hereby certifies that the subdivision shown hereon complies with the current requirements and provisions of the operative district scheme relating hereto.

In witness whereof the Common Seal of the Corporation of the City of Gisborne was hereto affixed in the presence of:

.......... Mayor

.......... Town Clerk

STREET LEGALITY - CROWN GRANT

Total Area 2791 m².

Comprised in C.T. 103/191(all)

I, CAMPBELL BURNE TAYLOR of GISBORNE, Registered Surveyor and holder of an annual practising certificate hereby certify that this plan has been made from Surveys executed by me or under my direction: that both plan and Survey are correct and have been made in accordance with the regulations under the Surveyors Act 1966

Dated at Gisborne, this 30th day of November 1973 Signature

Field Book 1115 p. 31 Traverse Book 102 p. 246

Reference Plans DPs 2807, 5104, 3787, 4046, 2610, 2246

Examined A. Aldridge Correct

Approved as to Survey

J. A. Jobin
Chief Surveyor

4/1/74

Deposited this ____ day of January 1974

District Land Registrar

File ____

Received 30 Nov 1973

Instructions ____

DP 5799

LAND DISTRICT GISBORNE

SURVEY BLK. & DIST. ____

NZMS 177 SHEET No. N.98

LOTS 1 AND 2 BEING SUBDIVISION OF PART LOT 6 D.P. 2610 AND LOT 2 D.P. 4046.

LOCAL AUTHORITY GISBORNE CITY

Surveyed by GRANT & COOKE

Scale 1-400 Date NOV. 1973.

# Appendix 2

## Development Plans

**Sheet Index**

| Layout ID | Layout Name | Status Code |
|---|---|---|
| 02 | Site Aerial and Existing Plan | KO |
| 03 | Neighbourhood Context | KO |
| 04 | Proposed Site Plan | KO |
| 05 | Unit Plan & Coverage | KO |
| 06 | Site Fencing & Landscaping | KO |
| 07 | Proposed Floor Plans | KO |
| 08 | Site Outer Elevations | KO |
| 09 | Site Inner Elevations | KO |
| 10 | 3D Images | KO |

ARTISTIC IMPRESSION ONLY, REFER ELEVATIONS
FOR PROPOSED COLOURS

# Resource Consent

Issue Date: 26/10/2023
99a Stanley Road
Gisborne
New Zealand

# NZHG Stanley Road

AHA
ATKINSON HARWOOD
ARCHITECTURE
e: sol@atkinsonharwood.co.nz
p: 027 465 9236

## SITE INFORAMTION

Site Address: 99a Stanley Road
Gisborne
New Zealand
Site Legal: Lot 1 DP 5799

**ZONE**
General Residential
**WIND ZONE**
Medium
**EXPOSURE ZONE**
Zone C
**EARTHQUAKE ZONE**
Zone 3
**SOIL TYPE**
Refer Geotech
**RAINFALL INTENSITY**
60 - 70
**SITE AREA**
1,590m²

**EXISTING SERVICES**

SS Sewer
SW Stormwater
WM Water Supply

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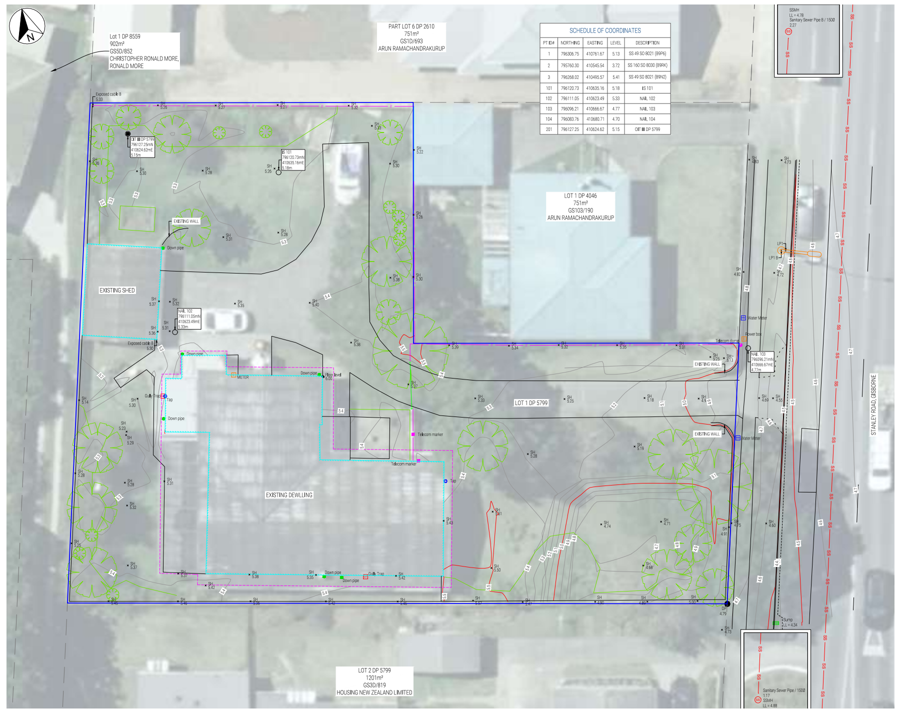
ARCHITECTURE

## Site Aerial



## Existing Site Survey Plan

## Existing Site Plan

Scale 1:300

| Rev | Revision | Date |
|---|---|---|

## Site Aerial and Existing Plan

Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:1.7477, 1:6.0209, 1:300
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

02

AHA

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🚌 Indicates bus stop

| Rev | Revision | Date |
|---|---|---|
| | | |

## Neighbourhood Context

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NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:5000
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

| Fence Key | |
|---|---|
| 2D Plan Preview | Element ID |
| ─ | #1. 1.2m Timber Batten Fence 50% visually permeable |
| ─ | #2 1.2m Timber Pailing Fence |
| ─ | #3 . 1.5m Timber Fence with visually permeable upper section |
| ─ | #4 1.8m Timber Pailing Fence |
| ─ | #5. 1.8m Timber Fence with visually permeable upper section |
| ─ | Existing Boundary Fence |
| ⌐ | Gate - 1.2m Aluminium |
| ⌐ | Gate - 1.8m Timber Paling on Metal frame |

| Site Works | |
|---|---|
| 2D Plan | Element ID |
| ▨ | Concrete Paving (Broom Finish with 4% Oxide) |
| ▨ | Concrete Private Carpark (Broom Finished with Sawcuts) |
| ▨ | Concrete Service Court (Broom Finish) |
| 🟩 | Garden Bed with Mulch |
| ☐ | Shared Driveway - refer Civil |

| Site Features | |
|---|---|
| 2D Plan Preview | Element ID |
| ▤ | 28m Washing Line |
| ▭ | 2000L APD Tank |
| ■ | Garden Master Shed 1.53 x 0.785 |
| ■ | Garden Storage Box |
| ▯ | Misc: Letter Box |
| ☐ | Rubbish Bins |

## SITE INFORAMTION

Site Address: 99a Stanley Road
Gisborne
New Zealand
Site Legal: Lot 1 DP 5799

**ZONE**
General Residential
**WIND ZONE**
Medium
**EXPOSURE ZONE**
Zone C
**EARTHQUAKE ZONE**
Zone 3
**SOIL TYPE**
Refer Geotech
**RAINFALL INTENSITY**
60 - 70
**SITE AREA**
1,590$m^2$
**PERMITTED COVERAGE**
35% of NET

AWAITING CIVIL FOR
PROPOSED SITE CONTOURS

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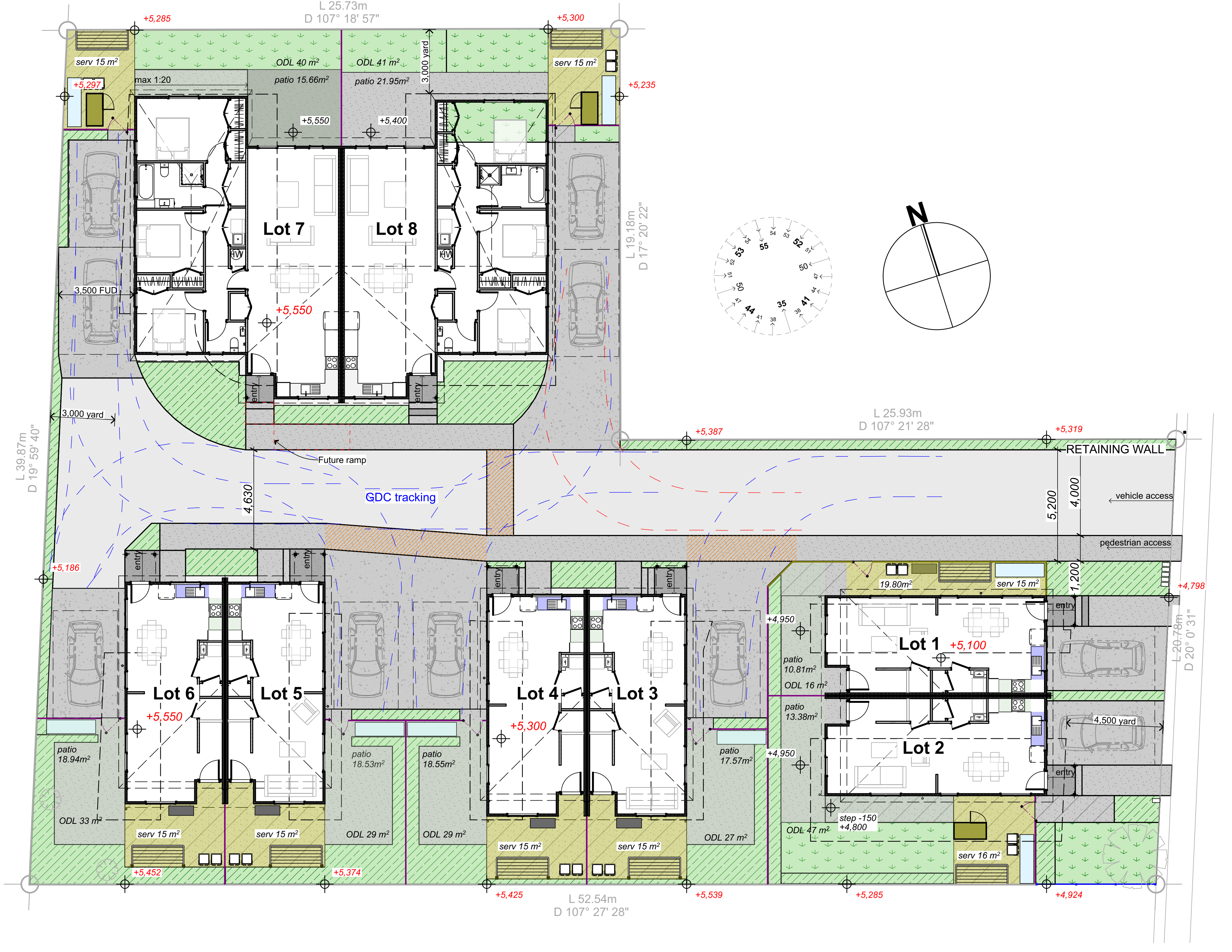
| Typologies | | |
|---|---|---|
| ID | Typology | GF Area ($m^2$) |
| Lot 1 | I2 Two-story Duplex | 90.2 |
| Lot 2 | I2 Two-story Duplex | 90.2 |
| Lot 3 | I2 Two-story Duplex | 90.2 |
| Lot 4 | I2 Two-story Duplex | 90.2 |
| Lot 5 | I2 Two-story Duplex | 90.2 |
| Lot 6 | I2 Two-story Duplex | 90.2 |
| Lot 7 | Z3 Duplex FUD | 113.7 |
| Lot 8 | Z3 Duplex | 112.8 |

| Outdoor Living Space | | |
|---|---|---|
| ID | KO M-255 | Area Achieved ($m^2$) |
| Lot 1 ODL | 20$m^2$ | 15.86 |
| Lot 2 ODL | 20$m^2$ | 47.35 |
| Lot 3 ODL | 20$m^2$ | 27.06 |
| Lot 4 ODL | 20$m^2$ | 28.56 |
| Lot 5 ODL | 20$m^2$ | 28.55 |
| Lot 6 ODL | 20$m^2$ | 32.87 |
| Lot 7 ODL | 35$m^2$ | 39.95 |
| Lot 8 ODL | 35$m^2$ | 41.02 |



| Rev | Revision | Date |
|---|---|---|
| | | |

## Proposed Site Plan

Resource Consent

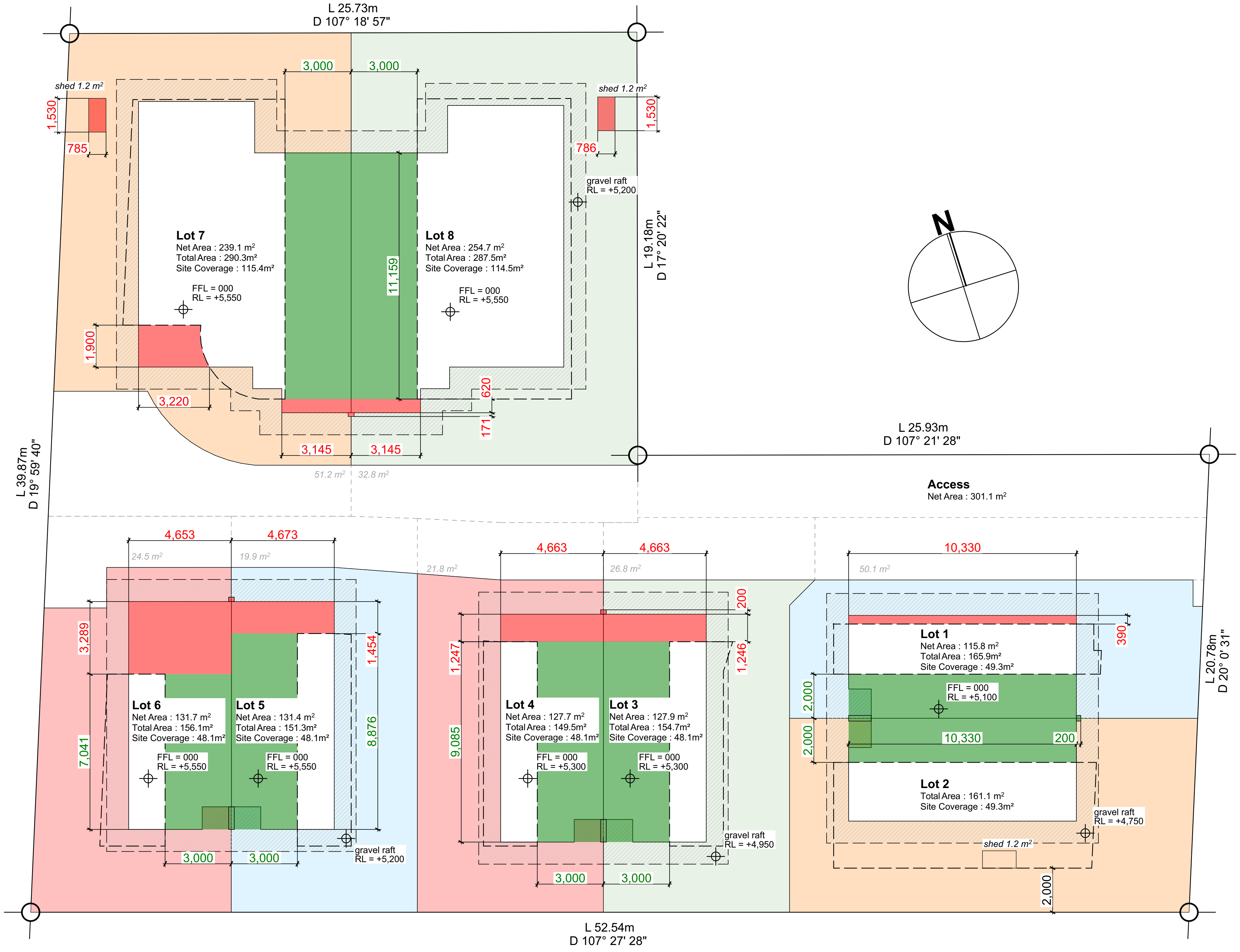
NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

**Lot Sizes and HDC Site Coverage - 35% allowed**

| Lot | Net Area (m$^2$) | Total Area (m$^2$) | GDC Allowed Coverage (m$^2$) | Proposed Building Coverage (m$^2$) | Proposed Site Coverage (%) |
|---|---|---|---|---|---|
| Lot 1 | 115.78 | 165.9 | 58.1 | 49.3 | 29.7 |
| Lot 2 | 161.07 | 159.6 | 55.9 | 49.3 | 30.9 |
| Lot 3 | 127.85 | 154.7 | 54.1 | 48.1 | 31.1 |
| Lot 4 | 127.73 | 149.5 | 52.3 | 48.1 | 32.2 |
| Lot 5 | 131.42 | 151.3 | 54.3 | 48.1 | 31.7 |
| Lot 6 | 131.68 | 156.1 | 55.9 | 48.1 | 30.8 |
| Lot 7 | 239.07 | 290.3 | 99.6 | 115.4 | 39.6 |
| Lot 8 | 254.69 | 287.5 | 98.9 | 114.5 | 39.9 |

Total site coverage: 519.7m$^2$
Total site area: 1,590.4m$^2$
**Overall Site Coverage: 32.7%**



YARDS
2m side and rear yards, 4.5m front yard for front sites
3m all yards for rear sites

| | |
|---|---|
| 🟥 | Indicates yard infringement |
| 🟩 | Indicates yard infringement with adjoining duplex wall |

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| Rev | Revision | Date |
|---|---|---|
| | | |

## Unit Plan & Coverage

Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

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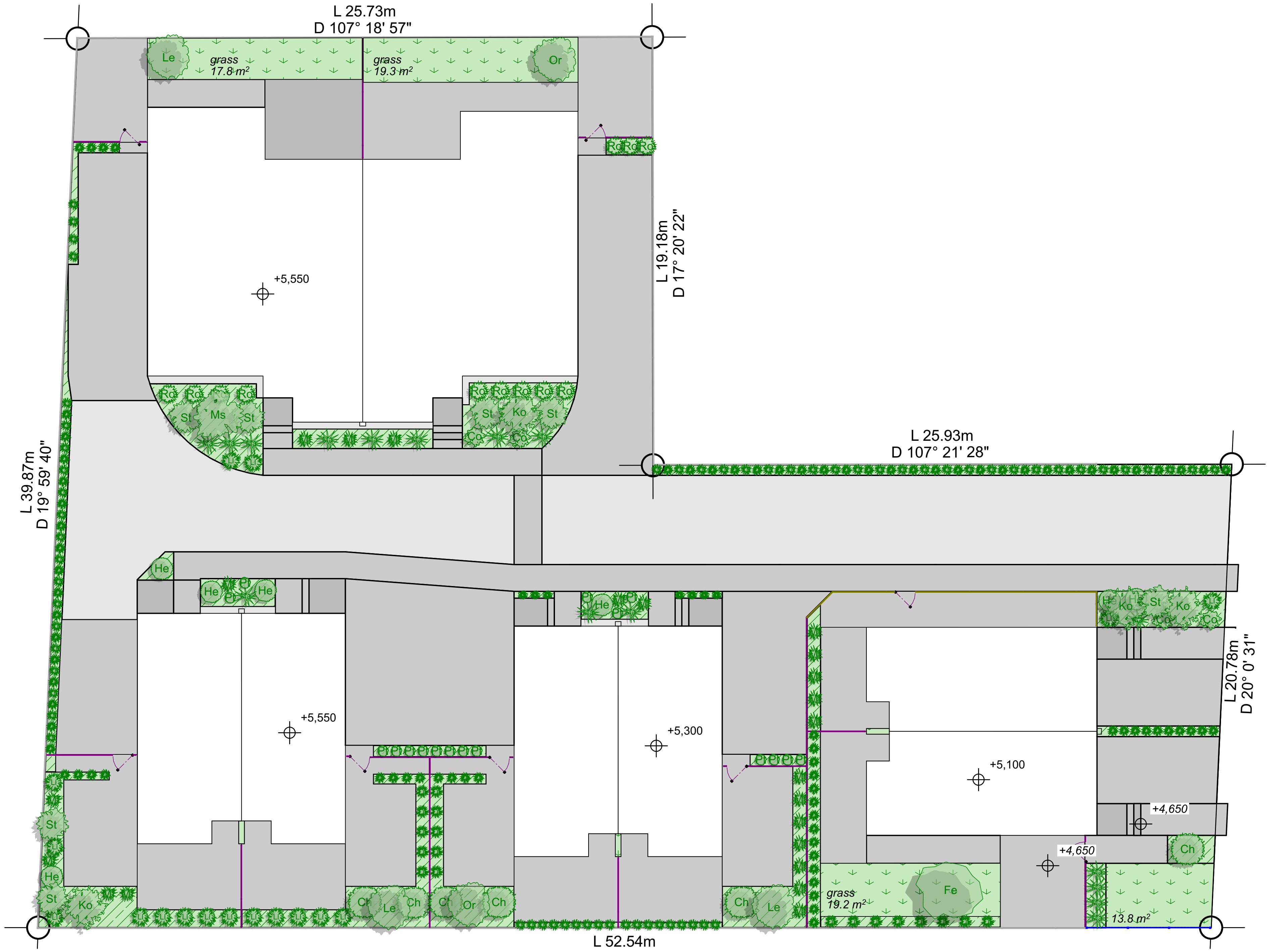


| **Fence Key** | |
|---|---|
| 2D Plan Preview | Element ID |
| ┅ | #1. 1.2m Timber Batten Fence 50% visually permeable |
| — | #2 1.2m Timber Pailing Fence |
| — | #3 . 1.5m Timber Fence with visually permeable upper section |
| — | #4 1.8m Timber Pailing Fence |
| — | #5. 1.8m Timber Fence with visually permeable upper section |
| — | Existing Boundary Fence |
| ⌐ | Gate - 1.2m Aluminium |
| ⌐ | Gate - 1.8m Timber Paling on Metal frame |

| Rev | Revision | Date |
|---|---|---|
| | | |

| **Site Planting** | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2D Plan Preview | Element ID | Common Name | PB Size | Clearance / Spacing | Mature (H) | Mature (W) | Sun or Shade |
| Pi | Large Underplaning: Pittosporum Tenuifolium | Pittosporum | 3 | 750 | 500 | 500 | Full sun |
| St | Large Underplaning: Trachelospermum Jasminoides | Star Jasmine | 3 | 600 | Climbing | 5,000 | Full sun / part shade |
| Ro | Large Underplant: Arthropodium Cirratum | Rengarenga | 3 | 600 | 1,000 | 1,000 | Part shade / full shade |
| ✱ | Large Underplant: Astelia Nervosa | Mountain Astelia | 3 | 600 | 1,000 | 1,000 | Full sun / part shade |
| Ch | Large Underplant: Chionochloa Flavicans | Miniature Toe Toe | 3 | 750 | 1,200 | 1,500 | Full sun / part shade |
| ✱ | Large Underplant: Dietes Grandiflora | Wild Iris | 3 | 750 | 1,000 | 600 | Full sun |
| He | Large Underplant: Hebe Topiara | Hebe | 3 | 600 | 1,000 | 1,000 | Full sun |
| ✱ | Large Underplant: Lomandra Longifolia | Lomandra | 3 | 750 | 400 - 900 | 400 - 900 | Full sun / part shade / shade |
| ✱ | Large Underplant: Phormium Cookianum 'Emerald Green' | Dwarf Mountain Flax | 3 | 750 | 800 | 800 | Part shade / full shade |

| **Site Planting** | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2D Plan Preview | Element ID | Common Name | PB Size | Clearance / Spacing | Mature (H) | Mature (W) | Sun or Shade |
| Co | Large Underplanting: Coprosma Repens 'Middlemore' | Mirror Plant | 3 | 750 | 1500 | 1000 | Part Shade |
| ✱ | Small Underplant: Carex Dissita | Forest Sedge | 3 | 500 | 500 | 500 | Part shade / full shade |
| ✱ | Small Underplant: Libertia Peregrinans | Tukauki | 3 | 500 | 500 | 500 | Full sun / part shade / full shade |
| ✱ | Small Underplant: Phormium Tenax 'Sweet Mist' | Sweet Mist | 3 | 400 | 400 | 400 | Full sun / part shade |
| Fe | Specimen Tree: Acca Sellowiana | Feijoa | 40 | 1,000 | 3,000 | 2,000 | Full sun / part shade |
| Or | Specimen Tree: Citrus 'Harwoods Late' | Orange | 40 | 750 | 2,000 | 2,000 | Full sun / part shade |
| Le | Specimen Tree: Citrus x meyeri | Meyer Lemon | 40 | 1,000 | 2,000 | 2,000 | Full sun / part shade |
| Ms | Specimen Tree: Meryta sinclairii 'Puka' | Puka | 95 | 1,500 | 4,000 | 2,000 | Full sun / part shade (evergreen) |
| Ko | Specimen Tree: Sophora Fulvida 'West Coast Kōwhai' | West Coast Kōwhai | 95 | 1,000 | 4,000 | 2,000 | Full sun / part shade (deciduous) |

# Site Fencing & Landscaping

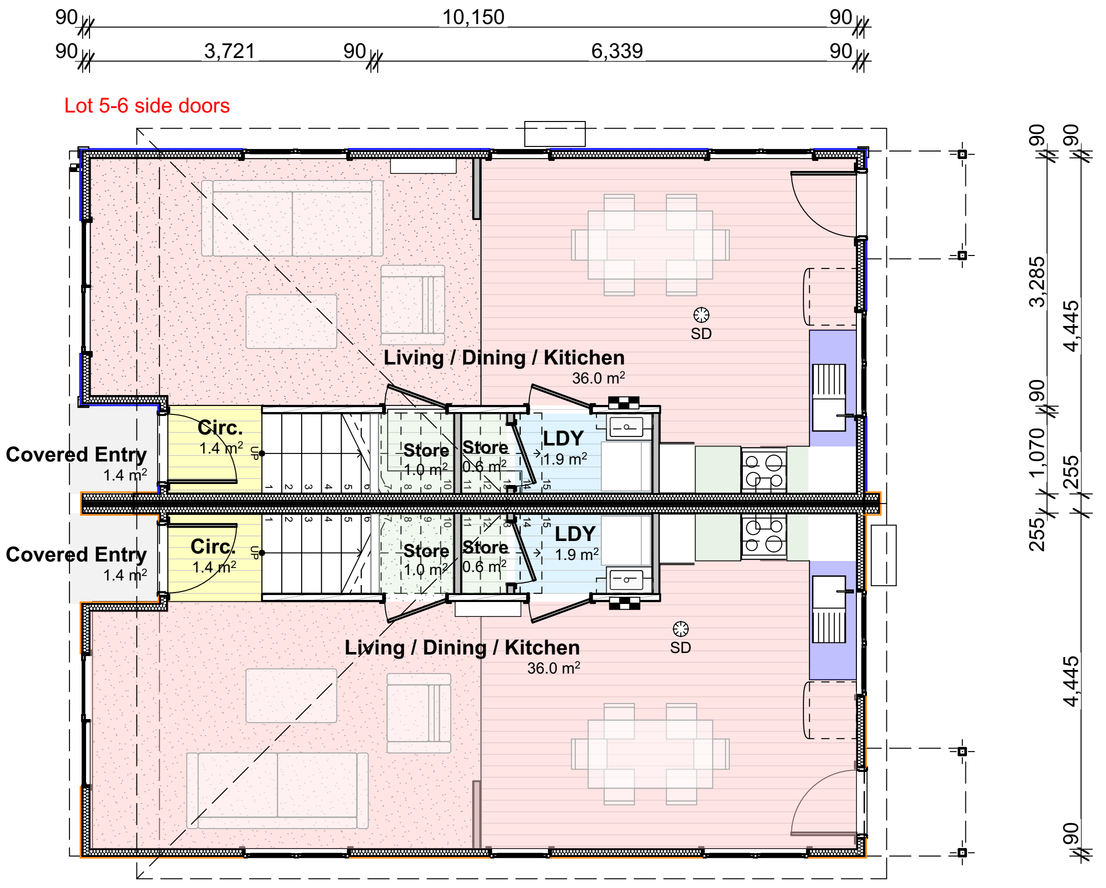
Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:227.2727
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

## Z3 Duplex Floor Plan: Lot 7 FUD

Scale 1:150



## I2 Duplex Ground Floor Plan

Scale 1:100

## I2 Duplex First Floor Plan

Scale 1:100

| Areas | | |
|---|---|---|
| | Space Name | Area (m²) |
| Footprint Per Unit | | |
| | First Floor Footprint | 43.4 |
| | Ground Floor Footprint | 46.8 |
| | | 90.2 m² |
| Unit 1 | | |
| | Bath | 4.1 |
| | Bedroom 1 | 10.0 |
| | Bedroom 2 | 9.2 |
| | Circ. | 1.4 |
| | Covered Entry | 1.4 |
| | Hall | 5.3 |
| | HWC | 0.7 |
| | LDY | 1.9 |
| | Linen | 0.7 |
| | Living / Dining / Kitichen | 36.0 |
| | Stair Void | 5.2 |
| | Store | 1.0 |
| | Store | 0.6 |
| | Str. | 0.4 |
| | WR 1 | 0.7 |
| | WR 2 | 1.3 |
| | | 79.9 m² |
| Unit 2 | | |
| | Bath | 4.1 |
| | Bedroom 1 | 10.0 |
| | Bedroom 2 | 9.2 |
| | Circ. | 1.4 |
| | Covered Entry | 1.4 |
| | Hall | 5.3 |
| | HWC | 0.7 |
| | LDY | 1.9 |
| | Linen | 0.7 |
| | Living / Dining / Kitchen | 36.0 |
| | Stair Void | 5.2 |
| | Store | 0.6 |
| | Store | 1.0 |
| | Str. | 0.4 |
| | WR 1 | 0.7 |
| | WR 2 | 1.3 |
| | | 79.9 m² |
| | | 250.0 m² |

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|---|---|---|
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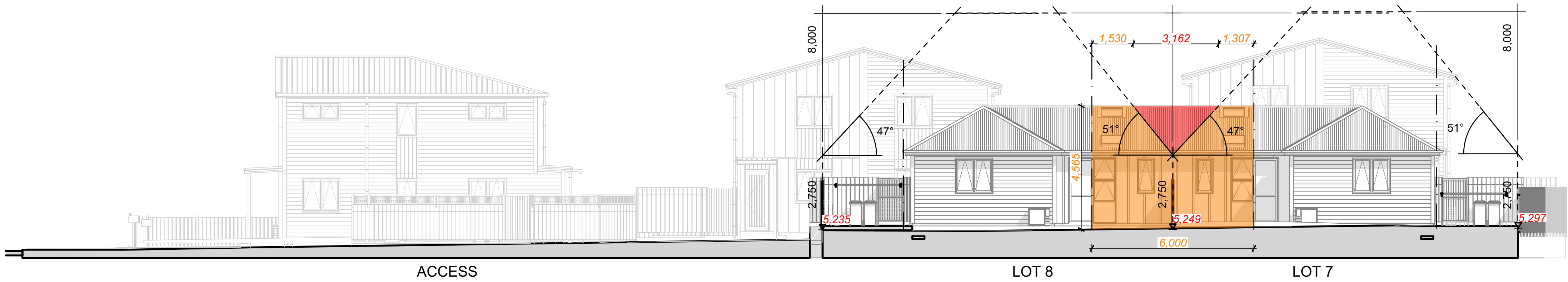
| | | |

# Proposed Floor Plans

Resource Consent

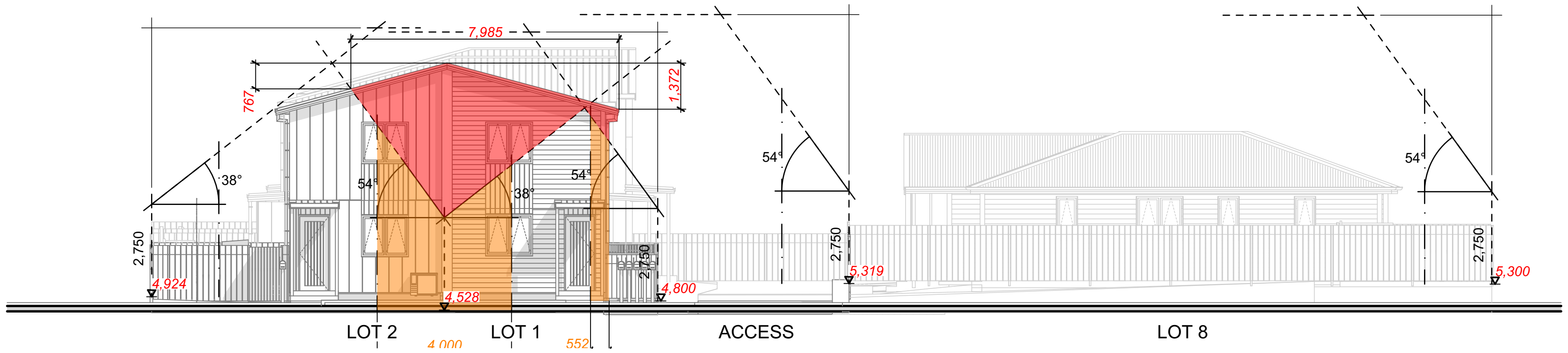
NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:150, 1:100, 1:1.2500
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236



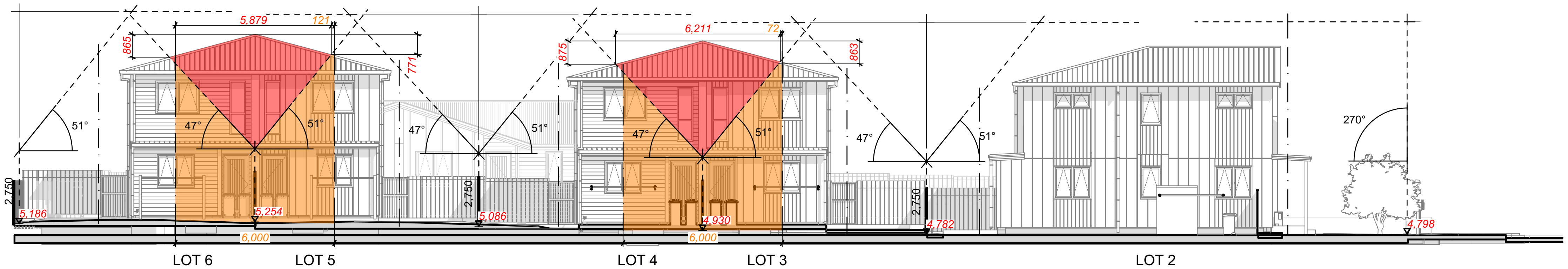
## North Elevation

Scale 1:200



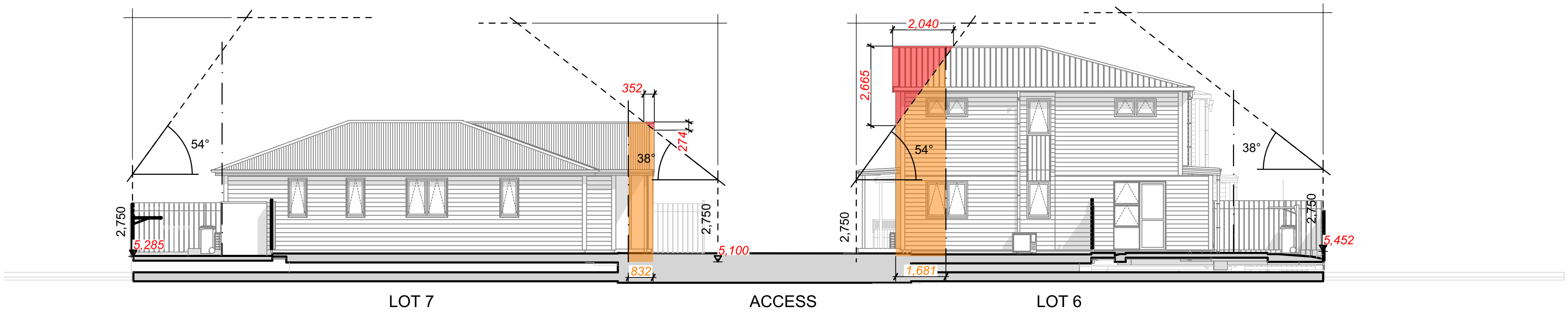
## East Elevation

Scale 1:200



## South Elevation

Scale 1:200



## West Elevation

Scale 1:200

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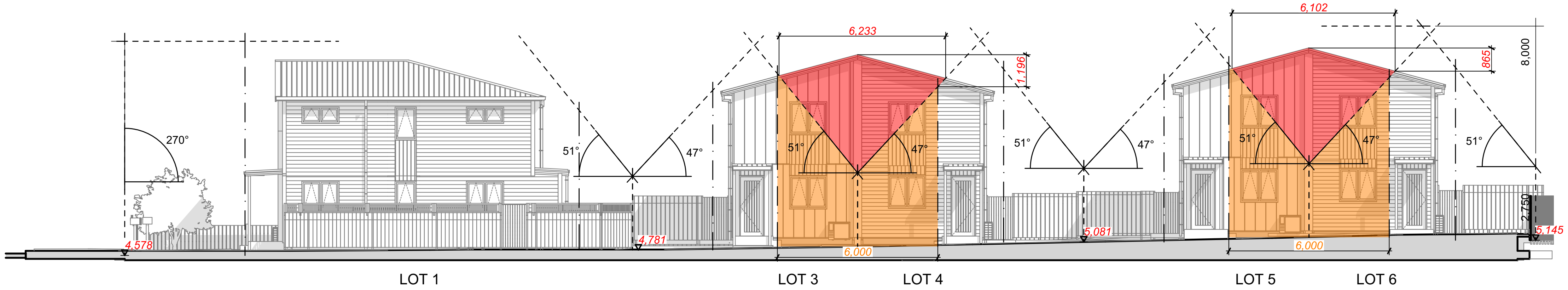
| Rev | Revision | Date |
|---|---|---|
| | | |

## Site Outer Elevations

Resource Consent

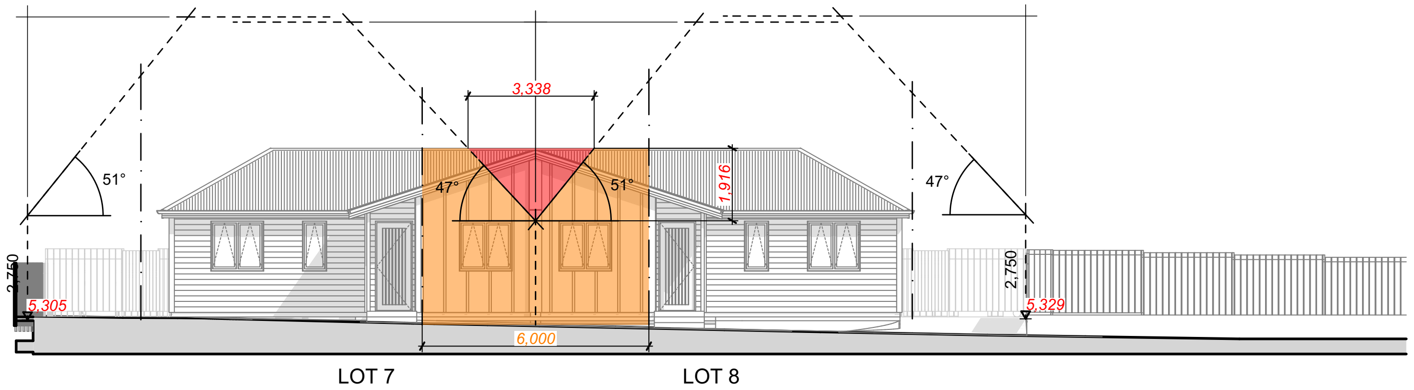
NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236



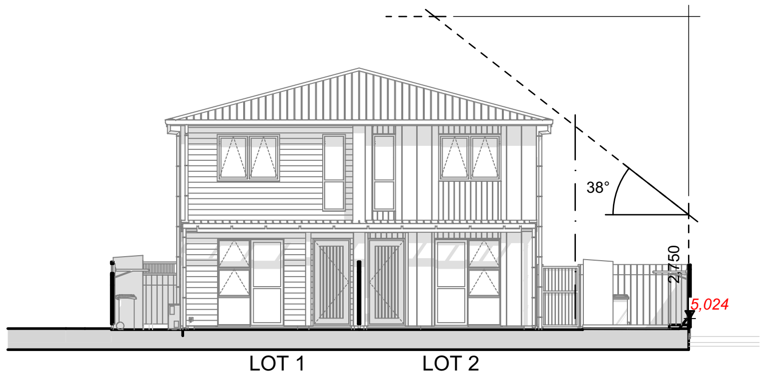
## North Inner Elevation

Scale 1:200



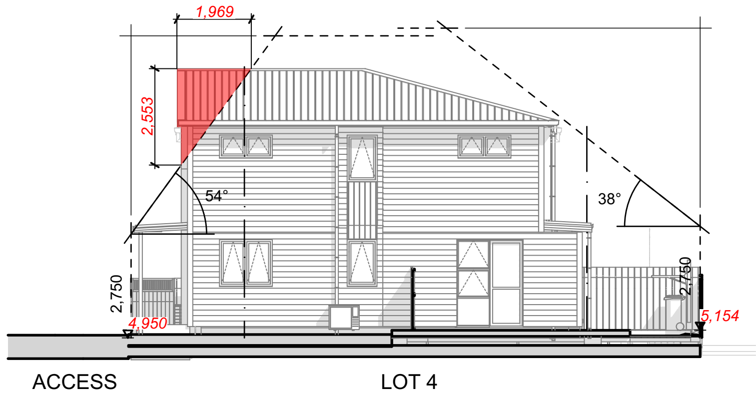
## South Inner Elevation

Scale 1:200



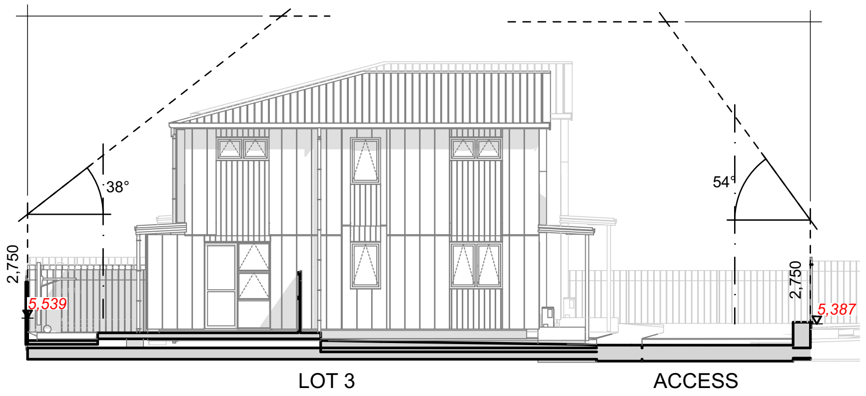
## West Elevation Lot 1 & 2

Scale 1:200



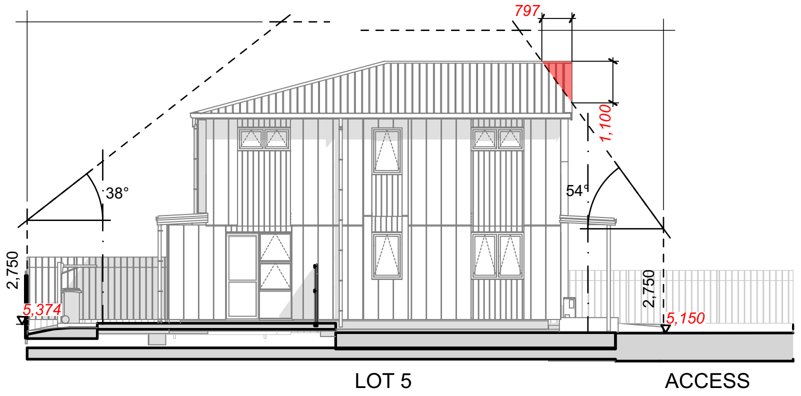
## West Elevation Lot 4

Scale 1:200



## East Elevation Lot 3

Scale 1:200



## East Elevation Lot 5

Scale 1:200

**PROPOSED COLOUR SCHEME**

Lot 01 & 02

**Roof:** Gull Grey
**Joinery:** Matt Appliance White Joinery
**Front Door:** Matt Flaxpod
**Bevelback Weatherboard:** Double Sea Fog
**Sheet Cladding:** Pale Leaf

Lot 03 & 04

**Roof:** Gull Grey
**Joinery:** Matt Appliance White Joinery
**Front Door:** Matt Flaxpod
**Bevelback Weatherboard:** Double Sea Fog
**Sheet Cladding:** Dingley

Lot 05 & 06

**Roof:** Gull Grey
**Joinery:** Matt Appliance White Joinery
**Front Door:** Scoria
**Bevelback Weatherboard:** Double Sea Fog
**Sheet Cladding:** Coral Tree

Lot 07 & 08

**Roof:** Gull Grey
**Joinery:** Matt Appliance White Joinery
**Front Door:** New Denim Blue
**Bevelback Weatherboard:** Double Sea Fog
**Sheet Cladding Lot 7:** Yuma
**Sheet Cladding Lot 8:** Streetwise

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| Rev | Revision | Date |
|---|---|---|

## Site Inner Elevations

Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236


ARTISTIC IMPRESSION ONLY, REFER ELEVATIONS
FOR PROPOSED COLOURS


ARTISTIC IMPRESSION ONLY, REFER ELEVATIONS
FOR PROPOSED COLOURS

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| Rev | Revision | Date |
|---|---|---|
| | | |
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| | | |

## 3D Images

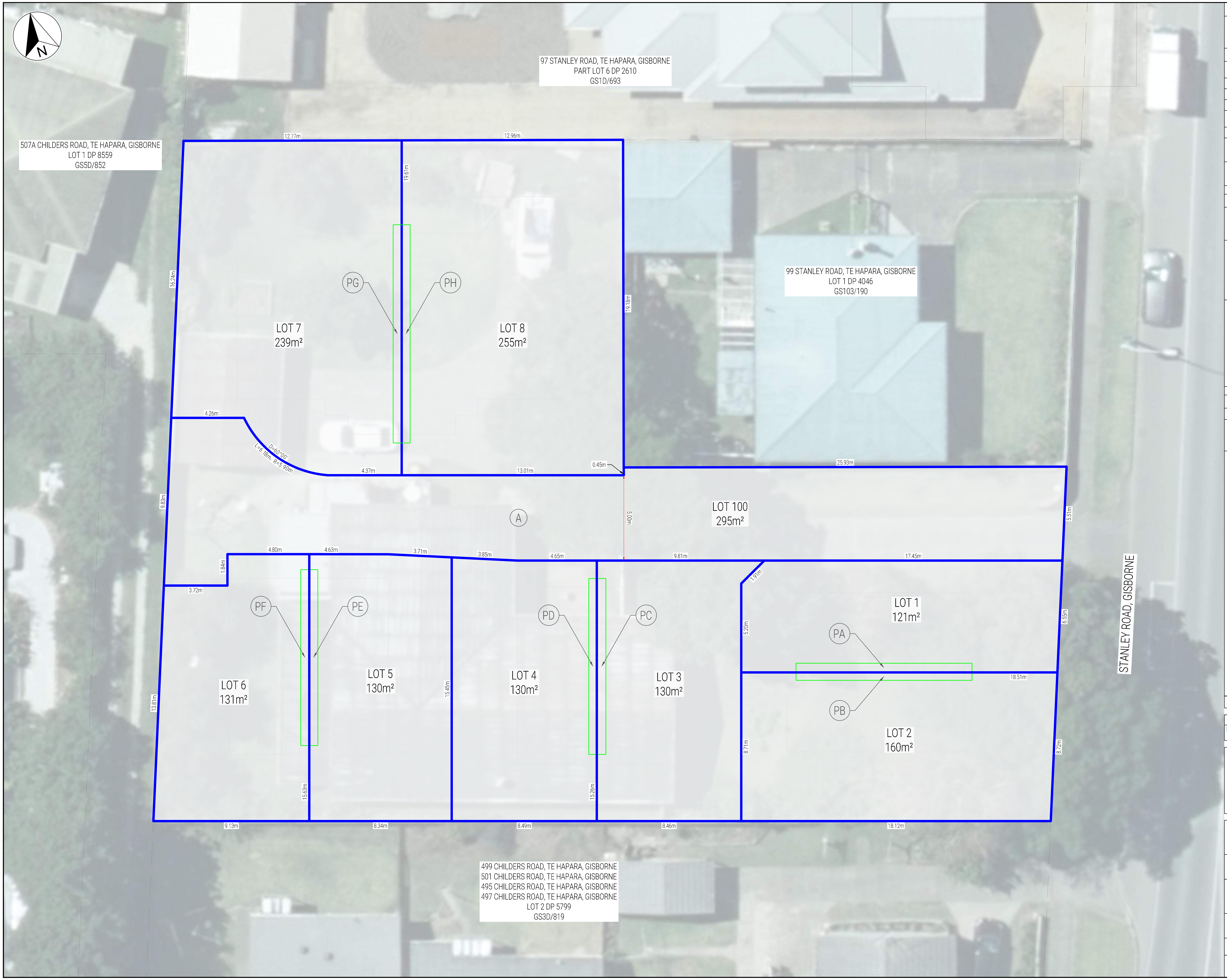
Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3:
Date Issued: 26/10/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

# Appendix 3

## Scheme Plan



## NOTES:

1. THE COPYRIGHT AND INTELLECTUAL PROPERTY RIGHTS FOR THE INFORMATION SHOWN ON THIS PLAN REMAIN THE PROPERTY OF DEFINITION SURVEYING LTD.

## SITE LOCATION

| | |
|---|---|
| ADDRESS: | 99A STANLEY ROAD, TE HAPARA, GISBORNE |
| APPELATION: | LOT 1 DP 5799 |
| ZONE: | GENERAL RESIDENTIAL |
| RECORD OF TITLE: | GS3D/818 |
| REGISTERED OWNERS: | ANNE MARIE DIMERY, STEPHEN JOHN DIMERY |

**NOTES**

THIS PLAN HAS BEEN PREPARED FOR RESOURCE CONSENT PURPOSES ONLY AND IS NOT INTENDED FOR ANY OTHER USE. ANY AREAS AND DIMENSIONS SHOWN ON THIS PLAN ARE INDICATIVE AND ARE SUBJECT TO FINAL SURVEY

AERIAL IMAGERY HAS BEEN SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY THE DISTRICT/CITY COUNCIL, FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE

## MEMORANDUM OF EASEMENTS

| PURPOSE | IDENTIFIER | BURDENED LAND (SERVIENT TENEMENT) | BENEFITED LAND (DOMINANT TENEMENT) |
|---|---|---|---|
| RIGHT OF WAY, RIGHT TO CONVEY TELECOMMUNICATIONS, RIGHT TO CONVEY ELECTRICITY, RIGHT TO CONVEY WATER, RIGHT TO DRAIN WATER, RIGHT TO DRAIN SEWAGE | A | LOT 100 | LOTS 3-8 |
| PARTY WALL | PA | LOT 1 | LOT 2 |
| | PB | LOT 2 | LOT 1 |
| | PC | LOT 3 | LOT 4 |
| | PD | LOT 4 | LOT 3 |
| | PE | LOT 5 | LOT 6 |
| | PF | LOT 6 | LOT 5 |
| | PG | LOT 7 | LOT 8 |
| | PH | LOT 8 | LOT 7 |

## AMALGAMATION CONDITION

*Subject to s220(1)(b)(iv)*

THAT LOT 100 (LEGAL ACCESS) BE HELD AS TO 7 UNDIVIDED ONE-SEVENTH SHARES BY THE OWNERS OF LOTS 1 & 3-8 AS TENANTS IN COMMON IN THE SAID SHARES AND THAT INDIVIDUAL RECORDS OF TITLE BE ISSUED IN ACCORDANCE THEREWITH. SEE LINZ #.

| REV: | DESCRIPTION: | BY: | DATE: |
|---|---|---|---|
| A | ISSUED FOR INFORMATION | DM | 04/10/2023 |

STATUS: ISSUED AS DRAFT

DEFINITION SURVEYING LTD.
BAY OF PLENTY | HAWKES' BAY | CANTERBURY
WWW.DEFINITION.NZ

CLIENT: TW GROUP OF COMPANIES

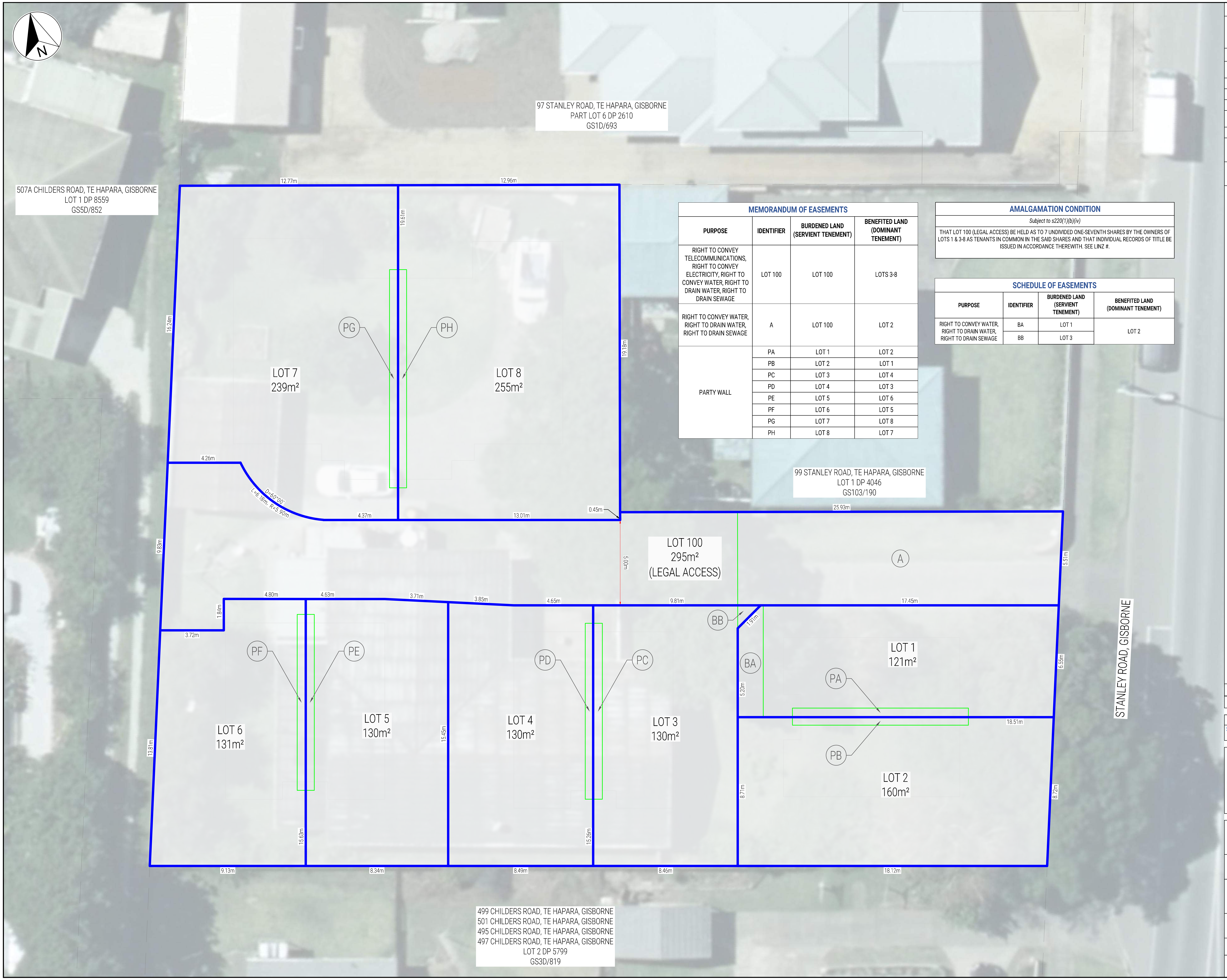
SURVEYOR:
DEFINITION SURVEYING LTD
HAWKES BAY

SITE:
LOT 1 DP 5799
99A STANLEY ROAD, TE HAPARA, GISBORNE

TITLE:
SCHEME PLAN

| SCALE AT A1: | DATE: | DRAWN: | CHECKED: |
|---|---|---|---|
| 1:100 | 04/10/2023 | KN | DM |

| PROJECT NO: | DRAWING NO: | REVISION: |
|---|---|---|
| N230007.14 | V200 | A |



## MEMORANDUM OF EASEMENTS

| PURPOSE | IDENTIFIER | BURDENED LAND (SERVIENT TENEMENT) | BENEFITED LAND (DOMINANT TENEMENT) |
|---|---|---|---|
| RIGHT TO CONVEY TELECOMMUNICATIONS, RIGHT TO CONVEY ELECTRICITY, RIGHT TO CONVEY WATER, RIGHT TO DRAIN WATER, RIGHT TO DRAIN SEWAGE | LOT 100 | LOT 100 | LOTS 3-8 |
| RIGHT TO CONVEY WATER, RIGHT TO DRAIN WATER, RIGHT TO DRAIN SEWAGE | A | LOT 100 | LOT 2 |
| PARTY WALL | PA | LOT 1 | LOT 2 |
| | PB | LOT 2 | LOT 1 |
| | PC | LOT 3 | LOT 4 |
| | PD | LOT 4 | LOT 3 |
| | PE | LOT 5 | LOT 6 |
| | PF | LOT 6 | LOT 5 |
| | PG | LOT 7 | LOT 8 |
| | PH | LOT 8 | LOT 7 |

## AMALGAMATION CONDITION

*Subject to s220(1)(b)(iv)*

THAT LOT 100 (LEGAL ACCESS) BE HELD AS TO 7 UNDIVIDED ONE-SEVENTH SHARES BY THE OWNERS OF LOTS 1 & 3-8 AS TENANTS IN COMMON IN THE SAID SHARES AND THAT INDIVIDUAL RECORDS OF TITLE BE ISSUED IN ACCORDANCE THEREWITH. SEE LINZ #.

## SCHEDULE OF EASEMENTS

| PURPOSE | IDENTIFIER | BURDENED LAND (SERVIENT TENEMENT) | BENEFITED LAND (DOMINANT TENEMENT) |
|---|---|---|---|
| RIGHT TO CONVEY WATER, RIGHT TO DRAIN WATER, RIGHT TO DRAIN SEWAGE | BA | LOT 1 | LOT 2 |
| | BB | LOT 3 | |

## NOTES:

1. THE COPYRIGHT AND INTELLECTUAL PROPERTY RIGHTS FOR THE INFORMATION SHOWN ON THIS PLAN REMAIN THE PROPERTY OF DEFINITION SURVEYING LTD.

## SITE LOCATION

| | |
|---|---|
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| ZONE: | GENERAL RESIDENTIAL |
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THIS PLAN HAS BEEN PREPARED FOR RESOURCE CONSENT PURPOSES ONLY AND IS NOT INTENDED FOR ANY OTHER USE. ANY AREAS AND DIMENSIONS SHOWN ON THIS PLAN ARE INDICATIVE AND ARE SUBJECT TO FINAL SURVEY

AERIAL IMAGERY HAS BEEN SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY THE DISTRICT/CITY COUNCIL, FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE

| REV: | DESCRIPTION: | BY: | DATE: |
|---|---|---|---|
| B | ADD EASEMENTS | DM | 17/10/2023 |
| A | ISSUED FOR INFORMATION | DM | 04/10/2023 |

STATUS: ISSUED FOR CONSENT

DEFINITION SURVEYING LTD.
BAY OF PLENTY | HAWKES' BAY | CANTERBURY
WWW.DEFINITION.NZ

CLIENT: TW GROUP OF COMPANIES

SURVEYOR:
DEFINITION SURVEYING LTD
HAWKES BAY

SITE:
LOT 1 DP 5799
99A STANLEY ROAD, TE HAPARA, GISBORNE

TITLE:
SCHEME PLAN

| SCALE AT A1: | DATE: | DRAWN: | CHECKED: |
|---|---|---|---|
| 1:100 | 17/10/2023 | DM | DM |

| PROJECT NO: | DRAWING NO: | REVISION: |
|---|---|---|
| N230007.14 | V200 | B |

# Appendix 4

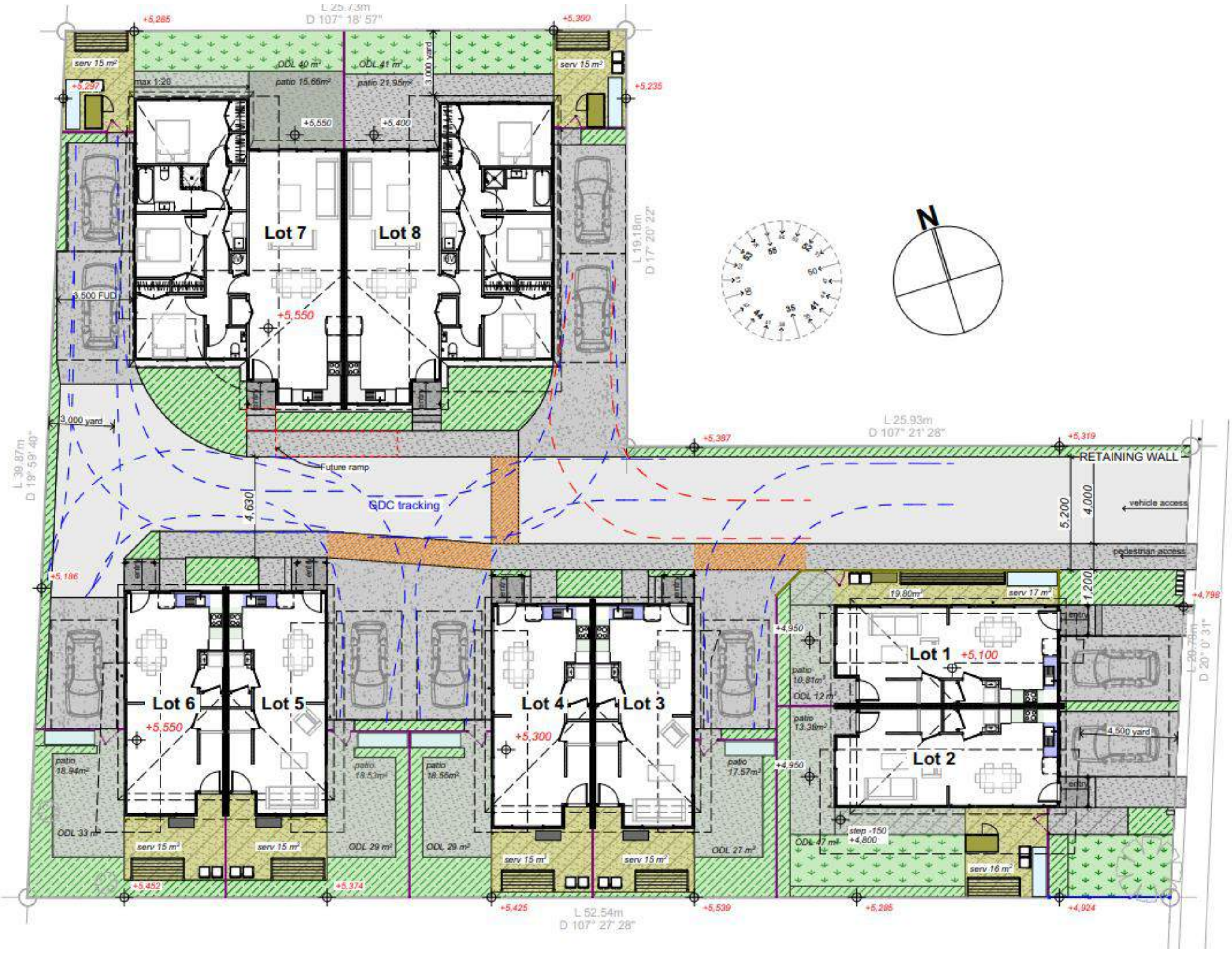
## Servicing Report

# 99A STANLEY ROAD, GISBORNE
# REPORT J23231/3

## FOR RESOURCE CONSENT

Report prepared by Sarath Sasidharan

24 November 2023



| REPORT | PREPARED BY | CHECKED BY |
|---|---|---|
| J23231/3 – 24 November 2023 | Sarath Sasidharan | Johan Ehlers |

# Table of Contents

# Table of Tables

# Table of Figures

# 1 Brief

TW Property Group has engaged Infir Limited to prepare a servicing report for a proposed housing development at 99A Stanley Road, Gisborne. The development is proposed to take place on Lot 1 DP 5799. This report is to be used as part of a subdivision consent application for the development. Note that detailed design and specifications will be required for building consent.

# 2 Background

The existing site consists of one parcel (Lot 1 DP 5799), occupied by a house and an outbuilding. The site is 1,590m$^2$ in size.

Stormwater drainage is to the kerb on Stanley Road, and wastewater drains to a DN225 sewer main at the front of the property. Potable water is available from a DN150 cast iron water main in the western berm of Stanley Road.

This site is not in a flood hazard overlay zone. The rain on grid model (2090 1% AEP) shows isolated ponding areas on the site and some ponding on Stanley Road's berms. The water level in the berm in Stanley Road at the proposed access point is at RL4.74 (NZVD2016), flowing to a ponding area south of Childers Road where the flood level is at RL4.60. This is considered to be the controlling water body in the area, setting a minimum floor level of RL5.10 to provide a 500mm freeboard. Building Code requirements, such as a minimum of 150mm clearance above surrounding sealed ground, may require floor levels to be higher.

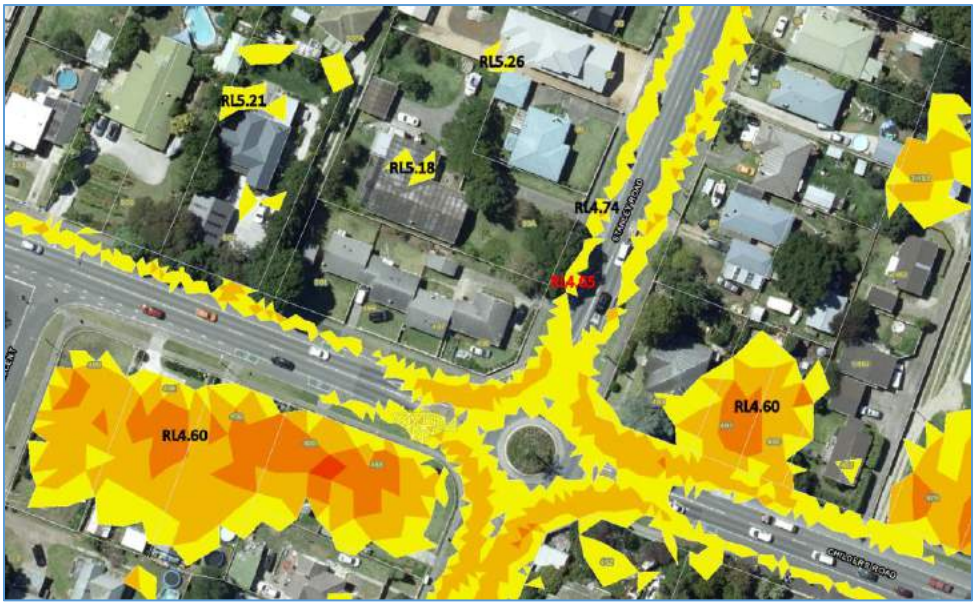


*Figure 1 - Rain on grid 2090 1% AEP*

The Scheme Plan is **attached** in Appendix A.

Drawings are **attached** in Appendix B.

Stormwater calculations are **attached** in Appendix C.

A topographical survey plan is **attached** in Appendix D.

# 3 Consent and Compliance requirements

## 3.1 Flood zones

The site is not in a flood hazard overly area. However, the berm in Stanley Road is an overland flow path as shown on the 2090 1% AEP rain-on-grid map in Figure 1. The overland flow path drains to a ponding area south of Childers Road with a flood level of RL4.60. Post-development peak discharge rates should not exceed pre-development peak discharge rates.

## 3.2 Building consent

All work on the site will be privately owned. Engineering approval is therefore not required, but building consent will be required for all the works in the scope of this report that fall within the definition of building work, including stormwater, wastewater, water supply, structural, access, and servicing works.

## 3.3 Service connections

Service connection applications will be required for all services.

## 3.4 Vehicle Crossing

An application will be required to construct a vehicle crossing.

## 3.5 Engineering approval

Other than service laterals in the road reserve, no assets will vest in Council. It is therefore considered that engineering approval will not be required.

# 4 Earthworks

A topographical survey was carried out by Definition Surveying on 11 September 2023.

## 4.1 Proposal

Earthworks will be required to shape the site such that stormwater runoff is controlled by draining all lots to the access road, to provide well-defined overland flow paths, and to avoid adverse stormwater effects on adjoining lots.

## 4.2 Preparing the Site for Future Construction

The earthworks drawings show existing site levels, proposed finished levels, cut and fill depths, and net earthworks volumes.

In summary, earthworks will be required to ensure that:

- Stormwater flows are directed away from new buildings and ensure that minimum grades are achieved to prevent ponding over paved areas; and
- Overland flows from the new Lots are directed to the new access road and then to Stanley Road, and away from neighbouring private properties.

The extent of the earthworks is outlined in Appendix B, which shows drawings indicating the existing contours on the site, the proposed finished contours, and the proposed cut-and-fill areas on the site.

#### 4.2.1 Lot Development

The net earthworks volume consists of 99 $m^3$ fill and 273 $m^3$ cut, measured solid in place.

Level changes at the property boundary will be less than 600mm along the site perimeter. Along the parts of the northern and southern boundaries where the level difference between the proposed development and neighbouring lots will exceed 300mm, it is proposed to install retaining walls. Where the level difference between the proposed development and neighbouring lots will be less than 300mm, the height difference can be accommodated by fence nibs. The changes to ground levels will not affect neighbouring properties because the existing property is fenced by a solid wall without any permeability.

#### 4.2.2 General Matters

Following the demolition of the buildings, the duration of the earthworks is expected to be in the order of 2-3 weeks. Access to the site shall be provided off Stanley Road.

Hours of operation for all stages should be limited to comply with District Plan rules. All works should be required to comply with NZS6803: 1999 Acoustics – Construction Noise.

Erosion and sediment control will be undertaken following an approved Erosion and Sediment Control Plan to be developed specifically for the site. In summary, the Erosion and Sediment Control Plan will require that:

- A silt fence is installed and maintained for the duration of the earthworks around the perimeter of the site; and
- Stabilised entrances are provided and maintained for construction vehicles.

An Accidental Discovery Protocol should be adopted.

# 5 Site Services

The proposed design of a stormwater drainage system, potable and fire-fighting water supply system, wastewater system, and a typical road cross section for the development are detailed in the following sections.

## 5.1 Stormwater Drainage

Stormwater will be discharged to the existing DN450 RC stormwater main. A connection to the stormwater main is required to drain the below-ground attenuation storage. Post-development 1 in 10-year discharge rates will be limited to the predevelopment discharge rates. The site drains to a flood-prone area and the attenuation system is therefore designed for 1% AEP events.

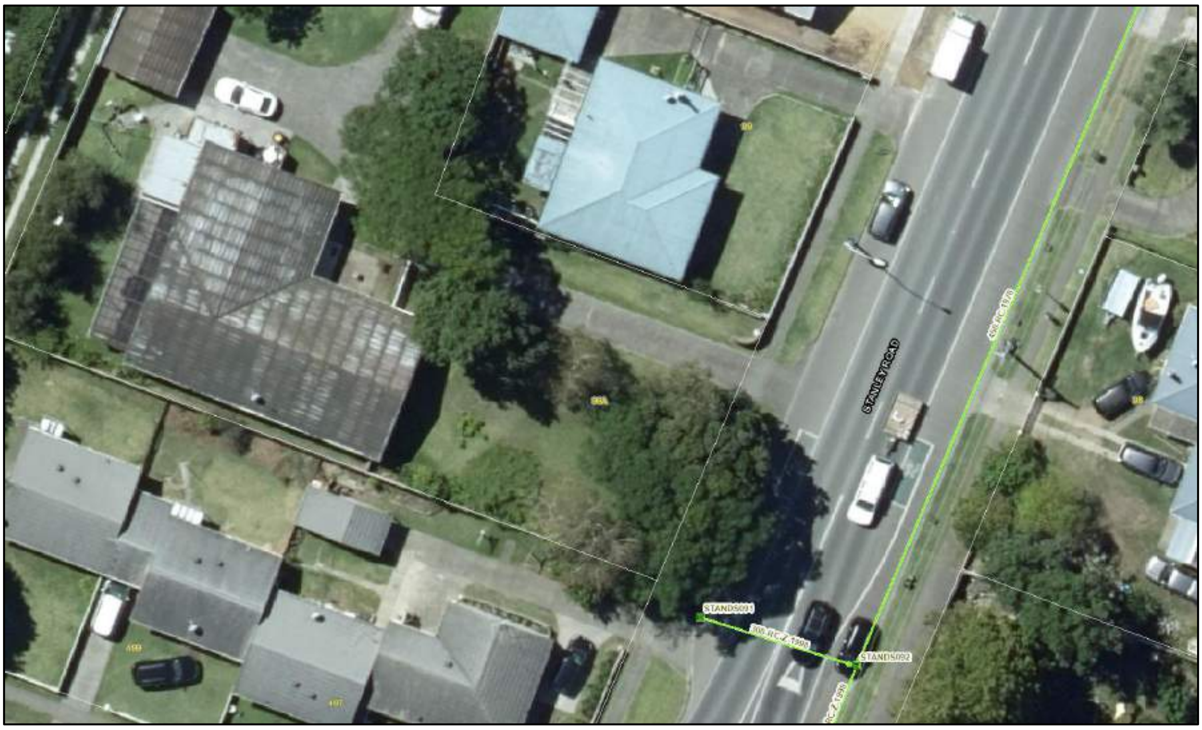


Figure 2 - Stormwater reticulation

### 5.1.1 Rational Formula

The Ministry for Business, Innovation, and Employment verification method E1/VM1 was used to satisfy Clause E1 – Surface water to determine the runoff from the site.

Surface water runoff for the catchment was calculated using the Rational Method. The formula to be used is:

$$Q = \frac{CIA}{360}$$

Where;

Q = Runoff rate ($m^3/s$)
C = Runoff coefficient (fraction)
I = Rainfall intensity (mm/hr)
A = Catchment area (ha)

### 5.1.2 Rainfall Intensities

Rainfall intensities for the period 2081 to 2100 were obtained from NIWA's HIRDS V4 system with a RCP8.5 (Representative Concentration Pathway). The site location is Longitude: 178.0077 and Latitude: -38.6595. The 10% AEP and 1% AEP rainfall intensities are included in Table 1.

*Table 1 – RCP8.5 Rainfall Intensities for 2081-2100 (mm/hr)*

| ARI | AEP | 10m | 20m | 30m | 1h | 2h | 6h | 12h | 24h |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 0.5 | 54.6 | 38.6 | 31.8 | 23.1 | 16.7 | 9.45 | 6.38 | 4.13 |
| 5 | 0.2 | 77.1 | 54.2 | 44.5 | 32.1 | 23 | 12.9 | 8.68 | 5.58 |
| **10** | **0.1** | **95.3** | **66.7** | **54.7** | **39.3** | **28** | **15.7** | **10.5** | **6.69** |
| 20 | 0.05 | 115 | 80.4 | 65.7 | 47 | 33.4 | 18.6 | 12.3 | 7.85 |
| 30 | 0.033 | 128 | 89 | 72.7 | 51.9 | 36.8 | 20.4 | 13.5 | 8.57 |
| 40 | 0.025 | 137 | 95.3 | 77.8 | 55.4 | 39.2 | 21.7 | 14.4 | 9.1 |
| 50 | 0.02 | 145 | 101 | 82 | 58.4 | 41.2 | 22.8 | 15 | 9.51 |
| 60 | 0.017 | 151 | 105 | 85.4 | 60.7 | 42.8 | 23.7 | 15.6 | 9.87 |
| 80 | 0.013 | 162 | 112 | 91.1 | 64.7 | 45.5 | 25 | 16.5 | 10.4 |
| **100** | **0.01** | **170** | **117** | **95.5** | **67.7** | **47.6** | **26.2** | **17.2** | **10.9** |
| 250 | 0.004 | 206 | 141 | 115 | 80.9 | 56.6 | 30.9 | 20.2 | 12.7 |

### 5.1.1 Time of Concentration

Time of concentration is defined as the time taken for runoff from the furthest point on the site to the design point. It is defined as –

Time of Concentration ($t_c$) = $t_e + t_f$

Where $t_e$ = Time of entry (minutes)

and $t_f$ = Time of network flow (minutes)

A time of concentration ($t_c$) of 10 minutes has been adopted because the site is small.

### 5.1.2 Runoff Coefficients

Runoff coefficients are based on E1/VM1. After adjusting gradients on the site being less than 5% and assuming roof slopes steeper than 20%, runoff coefficients as shown in Table 2 were used for 10% AEP and 1% AEP events.

*Table 2 - Runoff Coefficients*

| SURFACE TYPE | COEFFICIENT OF RUNOFF |
|---|---|
| Mainly grassed | 0.25 |
| Roof surfaces | 1.00 |
| Asphalt and concrete | 0.80 |

Pre- and post-development cA values are shown in Table 3.

*Table 3 - pre-and post-development cA Values*

| | PRE-DEVELOPMENT | | | POST-DEVELOPMENT | | |
|---|---|---|---|---|---|---|
| **Surface type** | ***Runoff Coefficient (c)*** | ***Area (A)*** | ***cA*** | ***Runoff Coefficient (c)*** | ***Area (A)*** | ***cA*** |
| Roofs | 1.00 | 368 | 368 | 1.00 | 521 | 521 |
| Sealed | 0.80 | 270 | 216 | 0.80 | 970 | 776 |
| Pervious | 0.25 | 953 | 238 | 0.25 | 99 | 25 |
| Total | | **1,590** | **822** | | | **1,322** |
| **$c_{effective}$** | | | **0.52** | | | **0.83** |

The effective post-development runoff coefficient is significantly higher than the predevelopment runoff coefficient and attenuation will be required.

Pre- and unattenuated post-development runoff rates are shown in Table 4 and Table 5.

*Table 4 - pre-and unattenuated post-development – 10% AEP*

| | RUNOFF RATES | |
|---|---|---|
| | Pre-development | Post development |
| | *L/s* | *L/s* |
| Roofs | 9.7 | 13.8 |
| Sealed | 5.7 | 20.6 |
| Pervious | 6.3 | 0.7 |
| Total | **21.7** | **35.0** |

*Table 5 - pre-and unattenuated post-development – 1% AEP*

| | RUNOFF RATES | |
|---|---|---|
| | Pre-development | Post development |
| | *L/s* | *L/s* |
| Roofs | 17.4 | 24.6 |
| Sealed | 10.2 | 36.7 |
| Pervious | 11.2 | 1.2 |
| Total | **38.8** | **62.4** |

### 5.1.3 Attenuation

It is proposed to provide attenuation in a combination of above-ground roof attenuation tanks and in-ground attenuation storage within the accessway.

To manage post-development stormwater runoff, above-ground attenuation storage is needed. A total of 10m$^3$ of rainwater tank storage is required. Lots 1-6 need a 1m$^3$ storage tank each discharging water at 0.29L/s. Lots 7-8 need a 2m$^3$ tank each discharging water at 0.58L/s to control stormwater runoff for 10% AEP events. During 1% AEP events the tanks will overflow and discharge through a combination of primary and secondary overland flow.

The in-ground attenuation storage is required because uncontrolled runoff during 10% AEP events from the sealed surfaces will exceed the predevelopment discharge rates.

Attenuation storage will be provided at the following locations:

- Attenuation of roof runoff prior to discharge from individual lots.
- In-ground storage within the accessway.

An in-ground storage device providing 4.15m$^3$ of storage will enable water to be stored on-site such that the total post-development discharge rates for 10-minute duration events will not exceed 17.2 L/s during 10% AEP events and 38.8 L/s during 1% AEP events.  The discharge rate during 10% AEP events and 1%AEP events will be within pre-development discharge rates.

When stormwater is attenuated, the effective discharge coefficients for a 10% AEP event and a 1% AEP event are obtained as 0.41 and 0.52, respectively. These values are lower than the predevelopment values.  Post-development peak discharge rates will therefore be lower than current peak discharge rates.

# 6 Water Supply

It is proposed to install a DN63 PE100 SDR17 PN10 water main in the carriageway and 550mm in front of the face of the northern kerb. DN20 connections will be provided to each lot. The DN63 main will be connected to the DN150 cast iron water main in Stanley Road. It is proposed to install an above ground testable backflow prevention device in the berm of Stanley Road.

Peak water demand will be 8,400 litres per day, based on 8 households, 3.2 people per household, and 330 litres peak demand per person per day.

The instantaneous peak flow rate, based on a peak factor of 10, will be 0.98L/s, which will generate a flow velocity of 0.5m/s in a 50mm internal diameter DN63 pipe.

*Figure 3 - Water reticulation*

The GDC network pressure is approximately 500-550kPa. This hydraulic assessment was done by using a conservative pressure of 450-500kPa to allow for future pressure reduction in the GDC network.

The head loss in the DN63 PE rider main in the joint accessway from the council main to the furthest point of supply is 103 kPa, consisting of the head loss from the above ground reduced pressure zone backflow prevention unit, minor losses, and pipe friction losses. The pressure at the point of supply at ground level will be 347kPa.

In addition, four of the buildings are two storeys with bathrooms on the first floor, 2.75m above ground level. The height difference causes a further 27kPa pressure loss. The pressure at the first floor, excluding friction and minor losses in the building plumbing, will be 320kPa. This is sufficient to service the buildings.

Head loss is calculated as shown in Table 6.

*Table 6 – Head loss for water supply*

| Head Losses | | |
|---|---|---|
| By Darcy-Weisbach equation Friction loss, $h_f$ | 4.75 | kPa |
| Minor Friction loss, 1 Nos Branch flow, flanged Tee | 0.03 | kPa |
| Minor Friction loss, 5 Nos regular flanged 90º Elbow | 0.19 | kPa |
| Minor Friction loss, 7 Nos Branch flow, threaded Tee | 17.73 | kPa |
| Head loss by Backflow prevention device | 80.00 | kPa |
| Total Head loss | 102.69 | kPa |
| Minimum Conservative pressure in GDC network | 450.00 | kPa |
| **The minimum pressure available at each dwelling unit** | **347.31** | **kPa** |

Pipe friction losses were calculated using the Colebrook-White formula and a pipe roughness of 0.3mm.

## 6.1 Firefighting Requirements

The New Zealand Fire Fighting Code of Practice SNZ PAS 4509 sets out the requirements for firefighting purposes. Fire hydrants must be provided within 135m of fire risks, such that 12.5L/s is available within 135m run distance and 25L/s is available within 270m run distance from a maximum of two fire hydrants. The existing fire hydrants opposite 91 Stanley Road and 497 Childers Road satisfies these requirements.

# 7 Wastewater Disposal

It is proposed to install a DN150 gravity main discharging to the existing DN225 sewer main on Stanley Road. A new manhole will be required at the connection point. Services have been surveyed and it is possible to connect to the DN225 as shown on the drawings.

NZS4410 requires a minimum gradient of 0.55% for DN150 mains which has been adopted for the design.

Design wastewater discharge, based on 8 household units, 3.2 persons per household, 200 litres per person per day average dry weather flow (ADWF), peak dry weather flow (PDWF) two times ADWF, and peak wet weather flow (PWWF) four times ADWF is as follows:

*Table 7 - Wastewater Discharge*

| Conditions | Litres per day | L/s |
|---|---|---|
| ADWF | 5,120 | 0.06 |
| PDWF | 12,800 | 0.15 |
| PWWF | 20,480 | 0.24 |

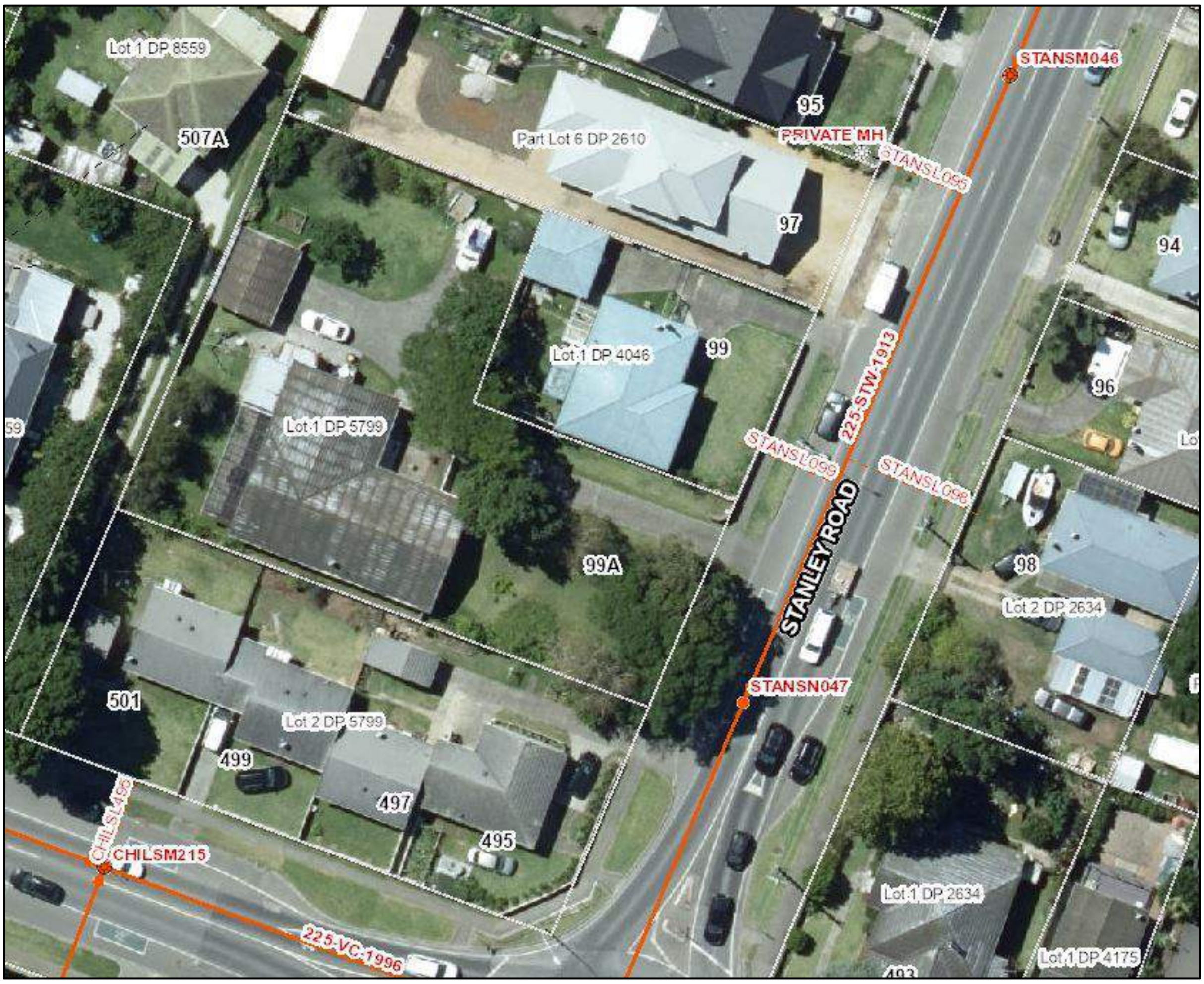


*Figure 4 - Wastewater reticulation*

# 8 Accessways

A new vehicle crossing will be constructed to provide common access for all 6 internal lots. Additionally, separate vehicle crossings will be constructed for the remaining two lots.

Section 2.1.7.1I8 of the Tairāwhiti Resource Management Plan (TRMP) sets the following standards for multiple site access:

*Table 8 – Tairāwhiti Resource Management Plan Standard for multiple site access.*

| DWELLING SITES TO BE SERVICED | LEGAL WIDTH (m) | MINIMUM CARRIAGE-WAY WIDTH(m) |
|---|---|---|
| 2 to 4 | 4 | 3 |
| 5 to 7 | 5 | 4 |
| 8 to 10 | 6 | 5.5 |

A 4.0m wide accessway and a 1.2m wide footpath is provided.

A typical accessway cross-section is shown on the drawings.

Drainage will be by way of a 3% cross slope to the kerb and channel along the western edge of the proposed accessway and a longitudinal gradient towards Stanley Road.

## 8.1 Pavement Design

To accommodate stormwater attenuation requirements, an in-ground storage device must be provided in the accessway.

# 9 Landscaping

Landscaping is shown on the architectural drawings.

# 10 Power and telecommunication services

Power and telecommunications will be installed as shown on the cross sections.

# 11 Appendices

# Appendix A Scheme Plan

| Fence Key | |
|---|---|
| 2D Plan Preview | Element ID |
| — | #1. 1.2m Timber Batten Fence 50% visually permeable |
| — | #2 1.2m Timber Pailing Fence |
| — | #3 . 1.5m Timber Fence with visually permeable upper section |
| — | #4 1.8m Timber Pailing Fence |
| — | #5. 1.8m Timber Fence with visually permeable upper section |
| — | Existing Boundary Fence |
| ⌐ | Gate - 1.2m Aluminium |
| ⌐ | Gate - 1.8m Timber Paling on Metal frame |

| Site Works | |
|---|---|
| 2D Plan | Element ID |
| ▨ | Concrete Paving (Broom Finish with 4% Oxide) |
| ▨ | Concrete Private Carpark (Broom Finished with Sawcuts) |
| ▨ | Concrete Service Court (Broom Finish) |
| 🟩 | Garden Bed with Mulch |
| □ | Shared Driveway - refer Civil |

| Site Features | |
|---|---|
| 2D Plan Preview | Element ID |
| ▤ | 28m Washing Line |
| □ | 2000L APD Tank |
| ■ | Garden Master Shed 1.53 x 0.785 |
| ■ | Garden Storage Box |
| ▯ | Misc: Letter Box |
| ▯ | Rubbish Bins |

## SITE INFOROMATION

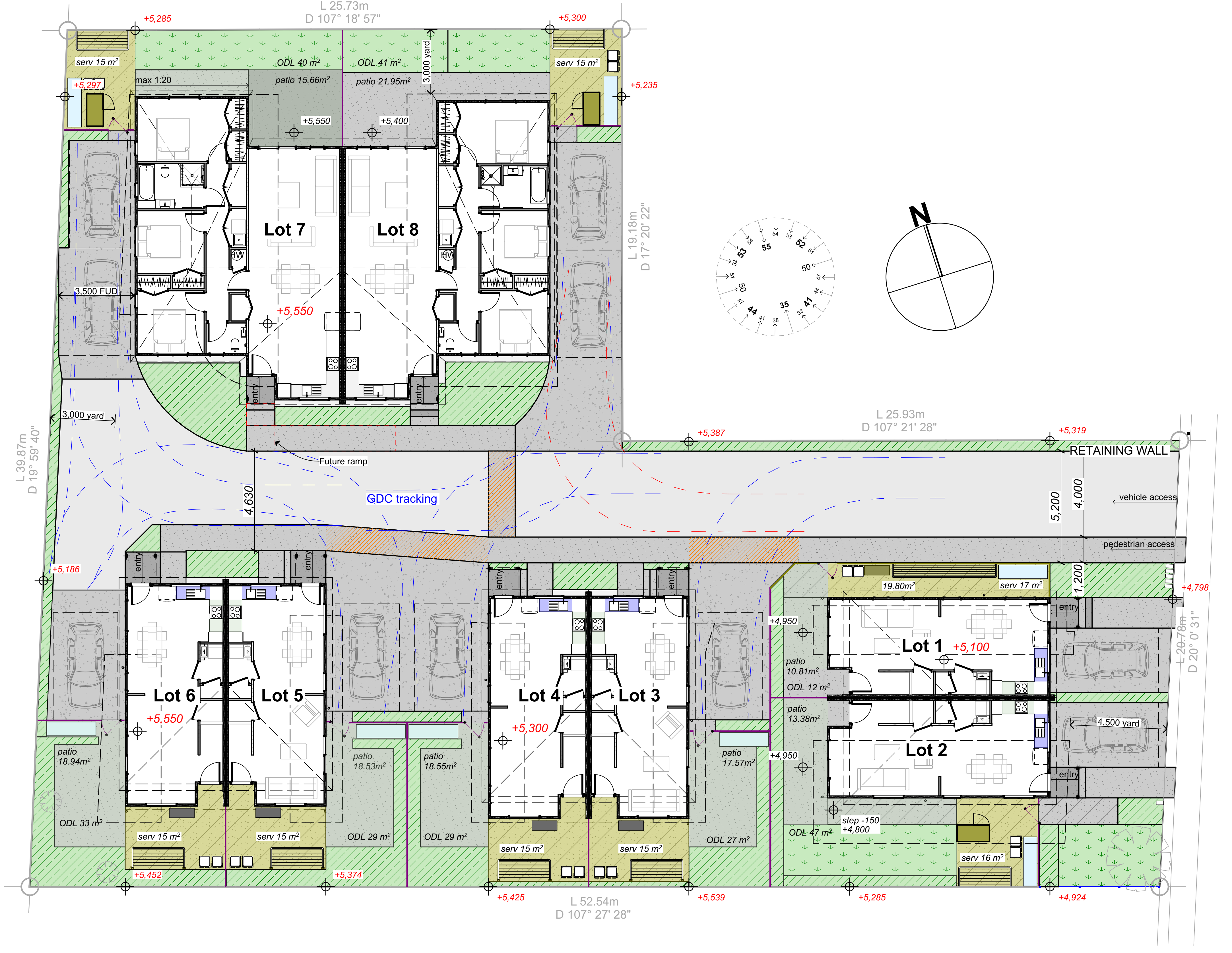
Site Address: 99a Stanley Road
Gisborne
New Zealand
Site Legal: Lot 1 DP 5799

**ZONE**
General Residential
**WIND ZONE**
Medium
**EXPOSURE ZONE**
Zone C
**EARTHQUAKE ZONE**
Zone 3
**SOIL TYPE**
Refer Geotech
**RAINFALL INTENSITY**
60 - 70
**SITE AREA**
1,590m²
**PERMITTED COVERAGE**
35% of NET

AWAITING CIVIL FOR
PROPOSED SITE CONTOURS

| Typologies | | |
|---|---|---|
| ID | Typology | GF Area (m²) |
| Lot 1 | I2 Two-story Duplex | 90.2 |
| Lot 2 | I2 Two-story Duplex | 90.2 |
| Lot 3 | I2 Two-story Duplex | 90.2 |
| Lot 4 | I2 Two-story Duplex | 90.2 |
| Lot 5 | I2 Two-story Duplex | 90.2 |
| Lot 6 | I2 Two-story Duplex | 90.2 |
| Lot 7 | Z3 Duplex FUD | 113.7 |
| Lot 8 | Z3 Duplex | 112.8 |

| Outdoor Living Space | | |
|---|---|---|
| ID | KO M-255 | Area Achieved (m²) |
| Lot 1 ODL | 20m² | 12.40 |
| Lot 2 ODL | 20m² | 47.35 |
| Lot 3 ODL | 20m² | 27.06 |
| Lot 4 ODL | 20m² | 28.56 |
| Lot 5 ODL | 20m² | 28.55 |
| Lot 6 ODL | 20m² | 32.87 |
| Lot 7 ODL | 35m² | 39.95 |
| Lot 8 ODL | 35m² | 41.02 |



**AHA**

ATKINSON HARWOOD
ARCHITECTURE

| Rev | Revision | Date |
|---|---|---|
| | | |

## Proposed Site Plan

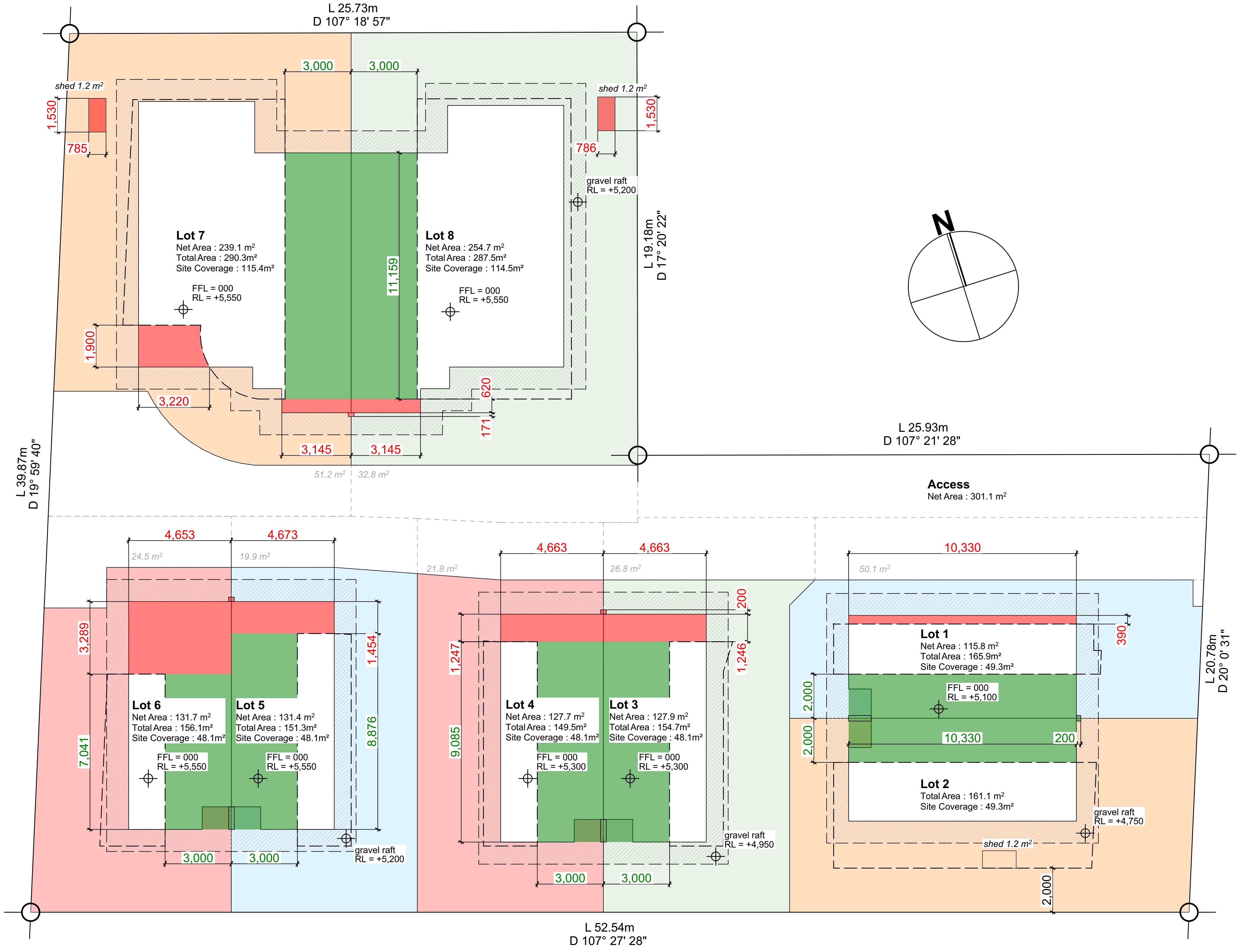
Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 23/11/2023

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

| Lot Sizes and HDC Site Coverage - 35% allowed | | | | | |
|---|---|---|---|---|---|
| Lot | Net Area (m$^2$) | Total Area (m$^2$) | GDC Allowed Coverage (m$^2$) | Proposed Building Coverage (m$^2$) | Proposed Site Coverage (%) |
| Lot 1 | 115.78 | 165.9 | 58.1 | 49.3 | 29.7 |
| Lot 2 | 161.07 | 159.6 | 55.9 | 49.3 | 30.9 |
| Lot 3 | 127.85 | 154.7 | 54.1 | 48.1 | 31.1 |
| Lot 4 | 127.73 | 149.5 | 52.3 | 48.1 | 32.2 |
| Lot 5 | 131.42 | 151.3 | 54.3 | 48.1 | 31.7 |
| Lot 6 | 131.68 | 156.1 | 55.9 | 48.1 | 30.8 |
| Lot 7 | 239.07 | 290.3 | 99.6 | 115.4 | 39.6 |
| Lot 8 | 254.69 | 287.5 | 98.9 | 114.5 | 39.9 |

Total site coverage: 519.7m$^2$
Total site area: 1,590.4m$^2$
**Overall Site Coverage: 32.7%**



| Rev | Revision | Date |
|---|---|---|
| | | |
| | | |
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| | | |

## Unit Plan & Coverage

Resource Consent

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 23/11/2023

YARDS
2m side and rear yards, 4.5m front yard for front sites
3m all yards for rear sites

🟥 Indicates yard infringement

🟩 Indicates yard infringement with adjoining duplex wall

e: sol@atkinsonharwood.co.nz
p: 027 465 9236

# Appendix B Drawings

| | |
|---|---|
| **PROJ. NUMBER** | **J23231** |
| **PROJ. NAME** | **RESIDENTIAL DEVELOPMENT - STANLEY** |
| **PROJ. ADDRESS** | **99A STANLEY ROAD, GISBORNE'** |
| **CLIENT** | **TW PROPERTY GROUP** |

# DRAWING / DOCUMENT ISSUE REGISTER

| DRWG NUM. | DRAWING TITLE | LATEST REVISION | ISSUE DATE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 08.11.23 | 23.11.23 | | | | | | | | | | | | | | | | | | |
| **Sheet count (per issue) - Infir drawing sheets only :** | | | **14** | **2** | | | | | | | | | | | | | | | | | | |
| **000s** | **COVER & NOTES** | | | | | | | | | | | | | | | | | | | | | |
| 000 | COVER | 0 | X | | | | | | | | | | | | | | | | | | | |
| 001 | GENERAL NOTES | 0 | X | | | | | | | | | | | | | | | | | | | |
| 010 | OVERALL SITE DEVELOPMENT PLAN | 0 | X | | | | | | | | | | | | | | | | | | | |
| **100s** | **EARTHWORKS** | | | | | | | | | | | | | | | | | | | | | |
| 100 | EXISTING GROUND LEVEL (EGL) CONTOURS | 0 | X | | | | | | | | | | | | | | | | | | | |
| 110 | FINISHED GROUND LEVEL (FGL) CONTOURS | 0 | X | | | | | | | | | | | | | | | | | | | |
| 120 | CUT & FILL VOLUMES (EGL TO FGL) | 0 | X | | | | | | | | | | | | | | | | | | | |
| 130 | LOGITUDINAL SECTIONS | 0 | X | | | | | | | | | | | | | | | | | | | |
| **200s** | **ROADING** | | | | | | | | | | | | | | | | | | | | | |
| 200 | OVERALL ROADING PLAN & LONGITUDINAL SECTION | 0 | X | | | | | | | | | | | | | | | | | | | |
| 210 | CROSS-SECTION | 0 | X | | | | | | | | | | | | | | | | | | | |
| **300s** | **OVERALL SERVICES** | | | | | | | | | | | | | | | | | | | | | |
| 300 | OVERALL SERVICES PLAN | 2 | X | X | | | | | | | | | | | | | | | | | | |
| **400s** | **STORMWATER** | | | | | | | | | | | | | | | | | | | | | |
| 410 | DETAILED PLAN AND LONG SECTION | 1 | X | | | | | | | | | | | | | | | | | | | |
| 420 | RAINSMART SYSTEM TYPICAL DETAILS | 0 | X | | | | | | | | | | | | | | | | | | | |
| **500s** | **WASTEWATER** | | | | | | | | | | | | | | | | | | | | | |
| 510 | DETAILED PLAN AND LONG SECTION | 0 | X | | | | | | | | | | | | | | | | | | | |
| **600s** | **WATER SUPPLY** | | | | | | | | | | | | | | | | | | | | | |
| 610 | TYPICAL DETAILS | 0 | | X | | | | | | | | | | | | | | | | | | |
| 620 | HYDRANT RANGE | 0 | X | | | | | | | | | | | | | | | | | | | |

| **ISSUED TO ...** | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLIENT | | X | X | | | | | | | | | | | | | | | | | | |
| LOCAL COUNCIL | | X | X | | | | | | | | | | | | | | | | | | |
| REG.COUNCIL | | | | | | | | | | | | | | | | | | | | | |
| CONTRACTOR | | | | | | | | | | | | | | | | | | | | | |
| ARCHITECT | | | | | | | | | | | | | | | | | | | | | |
| PLANNER | | | | | | | | | | | | | | | | | | | | | |
| GEOTECH | | | | | | | | | | | | | | | | | | | | | |
| SURVEYOR | | | | | | | | | | | | | | | | | | | | | |
| OTHER | | | | | | | | | | | | | | | | | | | | | |

| **ISSUED FOR ...** | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DISCUSSION / INFORMATION | | | | | | | | | | | | | | | | | | | | | |
| TENDER / SCHEDULE OF QUANTITIES | | | | | | | | | | | | | | | | | | | | | |
| RESOURCE CONSENT | | X | X | | | | | | | | | | | | | | | | | | |
| BUILDING CONSENT | | | | | | | | | | | | | | | | | | | | | |
| ENGINEERING APPROVAL | | | | | | | | | | | | | | | | | | | | | |
| CONSTRUCTION | | | | | | | | | | | | | | | | | | | | | |
| AS-BUILT | | | | | | | | | | | | | | | | | | | | | |
| OTHER | | | | | | | | | | | | | | | | | | | | | |

| **ISSUE DETAILS ...** | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EMAIL | | | | | | | | | | | | | | | | | | | | | |
| CLOUD | | | | | | | | | | | | | | | | | | | | | |
| USB / DISC | | | | | | | | | | | | | | | | | | | | | |
| PRINT | | | | | | | | | | | | | | | | | | | | | |
| CAD FILE(S) | *See separate sheet -* ***"DWG Issue Register"*** | | | | | | | | | | | | | | | | | | | | |

TW PROPERTY GROUP

INFRASTRUCTURE SOLUTIONS
PROJECT MANAGEMENT
PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz
www.infir.nz

# Residential Development
# 99A STANLEY ROAD
# Gisborne

SITE LOCATION PLAN
( NOT TO SCALE )

**FOR RESOURCE CONSENT**

## GENERAL NOTES

1. All construction work outside the property boundary shall comply with the Gisborne Engineering Code of Practice (GECOP). Where conflict exists between the requirements set out in the specification and the GECOP, the Code shall take precedence.
2. All work inside the property boundary shall comply with the New Zealand Building Code, unless such works will be vested with council, in which case, GECOP takes precedence.
3. Horizontal datum: ESPG:2107 NZGD/Poverty Bay Circuit 2000
4. Vertical datum: ESPG:1169 New Zealand Vertical Datum 2016
5. Horizontal & Vertical Origin: SS 49 SO 8021 (B9P6)
6. Drawings are intended to be read in conjunction with any and all information provided by the Development Architect, in addition to information provided by the Landscape Architect if applicable.
7. All measurements to be confirmed on site.
8. Dimensions are in meters unless otherwise stated.
9. 3rd decimal place in setting-out and level data is for purpose of accuracy only, to avoid or highlight rounding errors, and does not represent construction tolerances.
10. All services are to be marked on site and located before construction.
11. All work on site is to be in accordance with the Contractor's Health and Safety Plan and the Health and Safety at Work Act 2015.
12. Connections to the Gisborne District Council water supply and wastewater and stormwater networks must only be undertaken by the Gisborne District Council.
13. Concrete grades: Slabs and other in-situ work 32MPa minimum except where otherwise noted.
14. Concrete work shall comply with NZS4210.
15. Trench details shall be in accordance with the GECOP for works outside property boundary.

## EARTHWORKS

16. Any fill must be tested in accordance with NZS4402.
17. Subgrade testing is required to confirm pavement design before pavement construction.
18. During construction, stormwater runoff shall be controlled on site in accordance with an approved erosion and sediment control plan.

## ROADWORKS

19. All road signs and markings shall comply with the Gisborne Engineering Code of Practice, and the New Zealand Transport Agency Manual of Traffic Signs and Markings (MOTSAM).
20. Should any conflicts arise between the GECOP and MOTSAM, the MOTSAM standard shall take precedence.
21. Final pavement design shall be subject to site testing.

## STORMWATER

22. Downpipe location and sizing shall be provided by the architect.
23. All stormwater works within the development site shall comply with document E1 / AS1 Surface Water of the New Zealand Building Code.
24. All stormwater works outside the property boundary shall comply with the Gisborne District Council Code of Practice. Where conflict exists between the requirements set out in the specification and the Code of Practice, the Code shall take precedence.
25. Concrete pipe shall comply with AS/NZS4058, minimum Class 2, unless noted otherwise.
26. PVC pipes shall comply with AS/NZS1254 of AS/NZS1260, minimum SN8, unless noted otherwise.
27. Downpipe location and sizing shall be provided by the architect.
28. Downpipe and level entry connections shall be provided as DN150 SN8 pipelines at not less than 1:200 grade or DN100 SN8 pipelines at not less than 1:120 grade.
29. Level entry thresholds shall be in accordance with E2/AS1 External Moisture of the New Zealand Building Code.
30. Manholes / inspection chambers within the development site shall generally be in accordance with Figure 11 and Figure 12 of Compliance Document E1/AS1 Surface Water of the New Zealand Building Code:
    - Minimum DN450 for pipelines 100mm diameter of less and depths less than 1.0m
    - Minimum DN600 for depths less than 1.0m
    - Minimum DN1050 for depths greater than 1.0m\

## WASTEWATER

31. All wastewater works outside the property boundary shall comply with the Gisborne District Council Code of Practice. Where conflict exists between the requirements set out in the specification and the Code of Practice, the Code shall take precedence.
32. All wastewater works within the development site shall comply with document G13 / AS3 of the New Zealand Building Code, unless such work is to be vested in Gisborne District Council as public infrastructure, whereby the council's code will take precedence.
33. The location of existing services shall be confirmed on site prior to construction.
34. PVC pipes shall comply with AS/NZS1254 of AS/NZS1260, minimum SN8.
35. PE pipelines (pressure systems only) shall be PE100 PN10 conforming to AS/NZS4130.

## WATER RETICULATION

36. All water supply works within the property shall comply with NZ Building Code - Acceptable Solutions & Verifiable Methods (G12 / AS1).
37. All water supply works outside the property boundary shall comply with the Gisborne District Council Code of Practice. Where conflict exists between the requirements set out in the specification and the Code of Practice, the Code shall take precedence.
38. The location of existing services shall be confirmed on site prior to construction.
39. PVC pipes shall comply with AS/NZS1477, minimum pressure rating PN9.
40. PE pipelines shall be PE100 SDR17 Series 1, in accordance with AS/NZS4130.
41. Ductile iron flanges shall conform to AS/NZS4087 Figure B5.
42. The connection point to the Girborne District Council network is shown indicative only and shall be confirmed prior to the commencement of works.

## SERVICES

43. Where indicated on the plans, existing service locations have been determined from Before-U-Dig plans or Gisborne District Council GIS data and may not fully reflect the true location or extent of existing services.
44. Location and extent of all services shall be verified on site prior to commencing construction and installing new services.
45. Connection points to existing services are indicative only and shall be confirmed prior to the commencement of works.
46. works.

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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TW PROPERTY GROUP

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RESIDENTIAL DEVLOPMENT
99A STANLEY ROAD
GISBORNE

INFRASTRUCTURE SOLUTIONS ‖ PROJECT MANAGEMENT
PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
GENERAL NOTES

| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
|---|---|---|---|---|
| DRAWN BY : KP | A1 DWG SCALE : AS SHOWN | PROJ / DWG / SHEET : J23231 / 001 | REVISION : 0 | |

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**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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DRAWING TITLE
SCHEME PLAN
OVERALL SITE DEVELOPMENT PLAN

PROPOSAL CHECKED :
CAD CHECKED :
PROPOSAL APPROVED :
CLIENT APPROVED :
ENGINEER APPROVED :
DRAWN BY : KP
A1 DWG SCALE : 1:200
PROJ / DWG / SHEET : J23231 / 010
REVISION : 0

FOR RESOURCE CONSENT

| | | | |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |
| REV | DESCRIPTION TO REVISION | REV BY | DATE |

NOTES :

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RESIDENTIAL DEVELOPMENT
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DRAWING TITLE
EARTHWORKS
EXISTING GROUND CONTOURS (EGL)

| | | | | |
|---|---|---|---|---|
| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
| DRAWN BY : KP | A1 DWG SCALE : 1:200 | PROJ / DWG / SHEET : J23231 / 100 | REVISION : 0 | |

FOR RESOURCE CONSENT

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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TW PROPERTY GROUP

PROJECT
RESIDENTIAL DEVELOPMENT
99A STANLEY ROAD
GISBORNE

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DRAWING TITLE
EARTHWORKS
FINISHED GROUND CONTOURS (FGL)

PROPOSAL CHECKED :
CAD CHECKED :
PROPOSAL APPROVED :
CLIENT APPROVED :
ENGINEER APPROVED :
DRAWN BY : KP
A1 DWG SCALE : 1:200
PROJ / DWG / SHEET : J23231 / 110
REVISION : 0

## Cut & Fill Details

| Band No. | From Depth (m) | To Depth (m) | Vol. (cu.m) | Colour |
|---|---|---|---|---|
| 1 | -0.67 | -0.50 | 4 | 🟥 |
| 2 | -0.50 | -0.30 | 54 | 🟨 |
| 3 | -0.30 | 0.00 | 212 | 🟩 |
| 4 | 0.00 | 0.20 | 87 | 🟦 |
| 5 | 0.20 | 0.41 | 12 | 🟪 |
| | | TOTAL CUT = | $270m^3$ | |
| | | TOTAL FILL = | $99m^3$ | |
| | | NET = | $171m^3$(CUT) | |

NOTE:

- CUT AND FILL ARE MEASURED FROM PRE-DEVELOPMENT GROUND LEVELS TO FINISHED SURFACE LEVELS.
- ALL VOLUMES ARE GROSS IN-SITU VALUES AND ARE NOT ADJUSTED FOR BULKING OR COMPACTION.
- ⌖9.99 DENOTES CUT / FILL DEPTH FROM EXISTING SURFACE TO FINISHED SURFACE GROUND LEVELS AND FLOOR LEVELS.

NOTE:

Retaining wall to be installed inside border along perimeter where cut levels exceed 300mm.
(at locations shown)
Refer to detail: J23231 / 210

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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DRAWING TITLE
EARTHWORKS
OVERALL CUR & FILL (EGL TO FGL)

| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
|---|---|---|---|---|
| DRAWN BY : KP | A1 DWG SCALE : 1:200 | PROJ / DWG / SHEET : J23231 / 120 | | REVISION : 0 |

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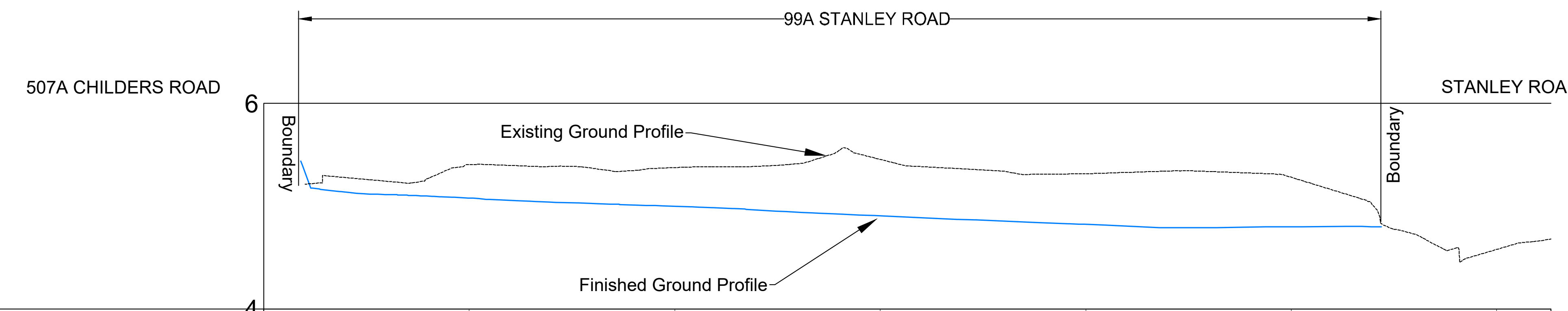
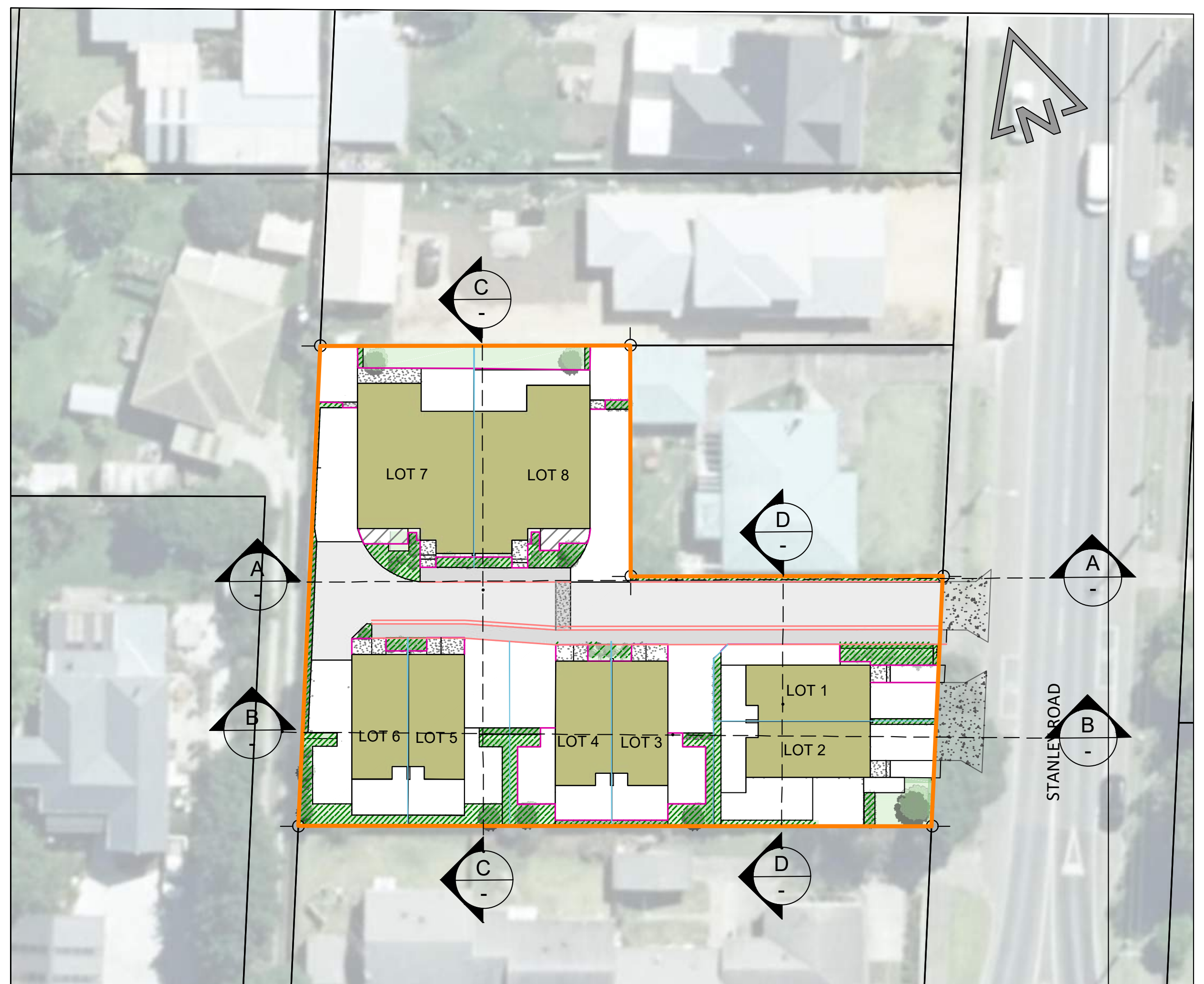


| CHAINAGE | 0.00 | 10.00 | 20.00 | 30.00 | 40.00 | 50.00 | 60.00 |
|---|---|---|---|---|---|---|---|
| EXISTING GROUND LEVEL | | 5.40 | 5.38 | 5.46 | 5.32 | 5.28 | 4.58 |
| FINISHED LEVEL | | 5.08 | 5.00 | 4.91 | 4.82 | 4.80 | |
| −CUT / +FILL (From Existing Ground Level) | | -0.33 | -0.38 | -0.55 | -0.49 | -0.48 | |

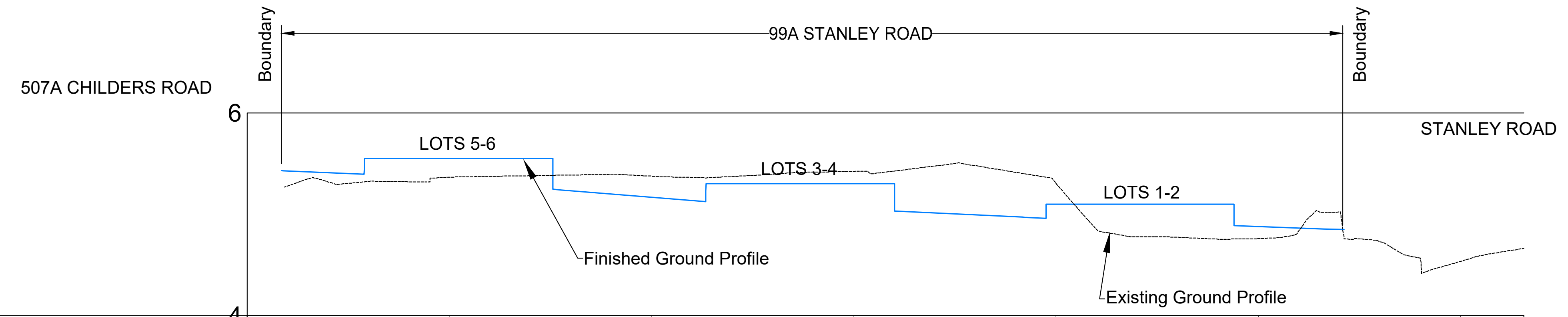
LONGITUDINAL SECTION - A-A

{SCALES: HOR 1:250 & VERT 1:50}



PLAN

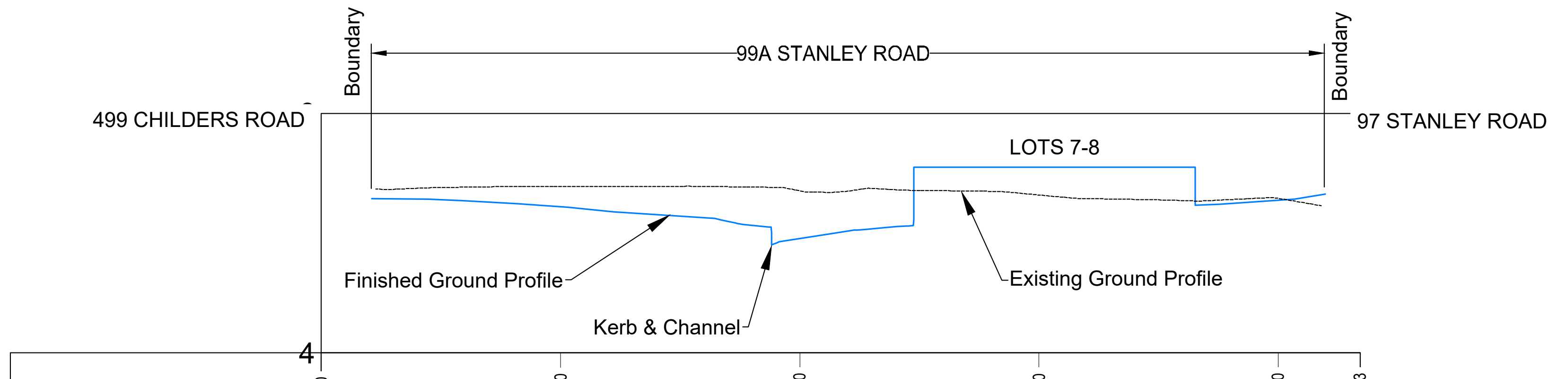
SCALE 1:500



| CHAINAGE | 0.00 | 10.00 | 20.00 | 30.00 | 40.00 | 50.00 | 60.00 |
|---|---|---|---|---|---|---|---|
| EXISTING GROUND LEVEL | | 5.40 | 5.38 | 5.46 | 5.32 | 5.28 | 4.58 |
| FINISHED LEVEL | | 5.55 | 5.17 | 5.30 | 5.10 | 4.88 | |
| −CUT / +FILL (From Existing Ground Level) | | +0.19 | -0.21 | -0.12 | -0.20 | +0.12 | |

LONGITUDINAL SECTION - B-B

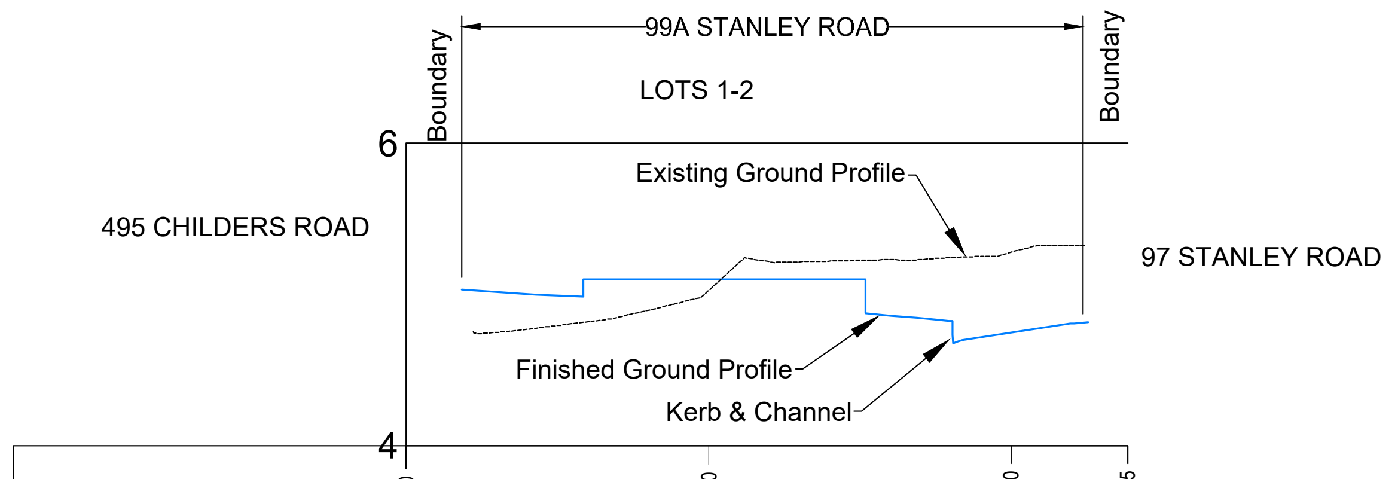
{SCALES: HOR 1:250 & VERT 1:50}



| CHAINAGE | 0.00 | 10.00 | 20.00 | 30.00 | 40.00 | 43.43 |
|---|---|---|---|---|---|---|
| EXISTING GROUND LEVEL | | 5.39 | 5.35 | 5.32 | 5.29 | |
| FINISHED LEVEL | | 5.22 | 4.95 | 5.55 | 5.27 | |
| −CUT / +FILL (From Existing Ground Level) | | -0.17 | -0.40 | +0.23 | -0.02 | |

LONGITUDINAL SECTION - C-C

{SCALES: HOR 1:250 & VERT 1:50}



| CHAINAGE | 0.00 | 10.00 | 20.00 | 23.85 |
|---|---|---|---|---|
| EXISTING GROUND LEVEL | | 5.03 | 5.28 | |
| FINISHED LEVEL | | 5.10 | 4.75 | |
| −CUT / +FILL (From Existing Ground Level) | | +0.07 | -0.53 | |

LONGITUDINAL SECTION - D-D

{SCALES: HOR 1:250 & VERT 1:50}

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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TW PROPERTY GROUP

PROJECT

RESIDENTIAL DEVELOPMENT
99A STANLEY ROAD
GISBORNE

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PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz
www.infir.nz

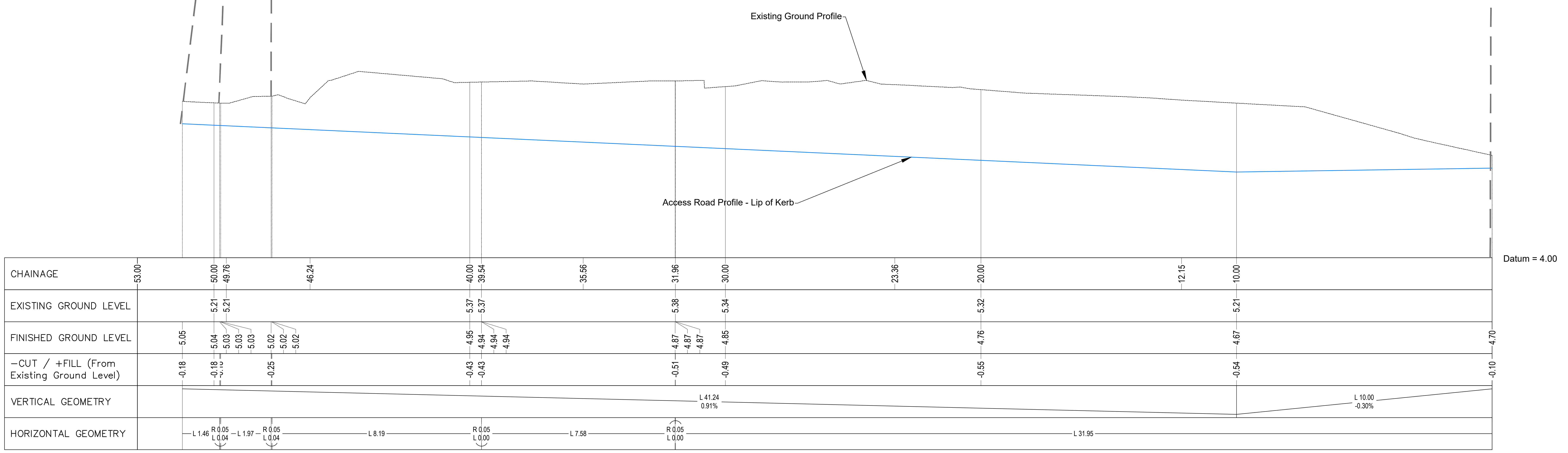
DRAWING TITLE

EARTHWORKS
LONG SECTIONS

PROPOSAL CHECKED :
CAD CHECKED :
PROPOSAL APPROVED :
CLIENT APPROVED :
ENGINEER APPROVED :
DRAWN BY : SE
A1 DWG SCALE : AS SHOWN
PROJ / DWG / SHEET : J23231 / 130
REVISION : 0

**LEGEND**

| | |
|---|---|
| ▨ | FOOTPATH |
| ▨ | CARRIAGEWAY |
| ▨ | VEHICLE CROSSING |
| 🟧 | RETAINING WALL |



LONGITUDINAL SECTION - Accessway - Lip of Kerb

SCALES: HOR 1:250 & VERT 1:50

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| 0 | | | |
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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RESIDENTIAL DEVELOPMENT
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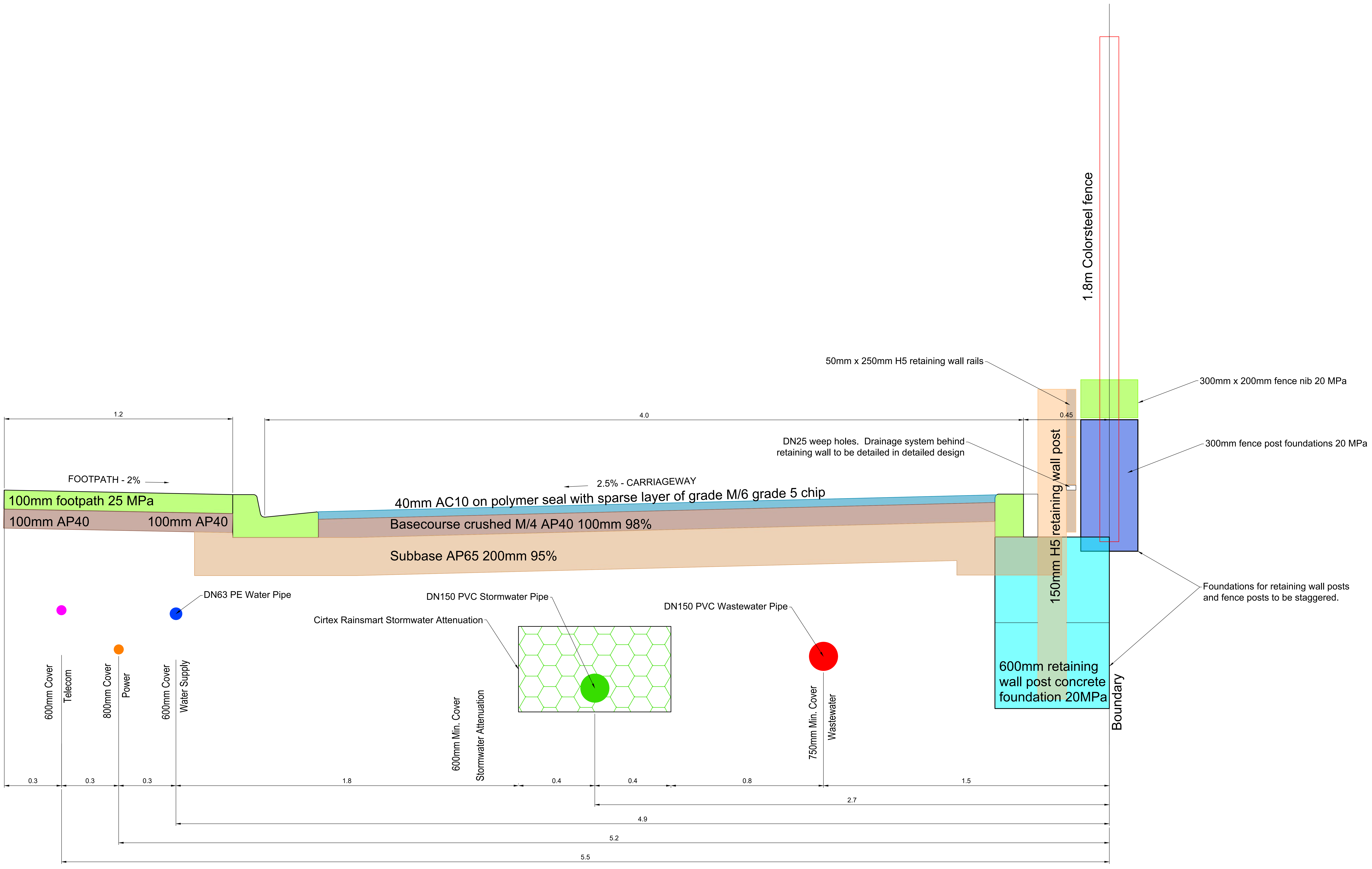
Phone : 06 650 5565 Email : admin@infir.nz
www.infir.nz

DRAWING TITLE
ROADING
OVERALL PLAN & LONGITUDINAL SECTION

| | | | | |
|---|---|---|---|---|
| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
| DRAWN BY : KP | A1 DWG SCALE : 1:100 | PROJ / DWG / SHEET : J23231 / 200 | | REVISION : 0 |



## TYPICAL CROSS-SECTION (E)

**Scale 1:10**

**DRAFT (WORK IN PROGRESS)**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

CLIENT
TW PROPERTY GROUP

PROJECT
RESIDENTIAL DEVELOPMENT
99A STANLEY ROAD
NAPIER

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PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
ROADING
CROSS-SECTIONS

PROPOSAL CHECKED :
CAD CHECKED :
PROPOSAL APPROVED :
CLIENT APPROVED :
ENGINEER APPROVED :
DRAWN BY : KP
A1 DWG SCALE : AS SHOWN
PROJ / DWG / SHEET : J23231 / 210
REVISION : 0

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FOR RESOURCE CONSENT

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 2 | WATER SUPPLY CONNECTION UPDATED | KP | 23.11.2023 |
| 1 | SILT PIT STORMWATER TREATMENT UPDATED | KP | 08.11.2023 |
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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TW PROPERTY GROUP

PROJECT
RESIDENTIAL DEVELOPMENT
99A STANLEY ROAD
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INFRASTRUCTURE SOLUTIONS ‖ PROJECT MANAGEMENT
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Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
SERVICES
OVERALL SERVICES PLAN

PROPOSAL CHECKED :
CAD CHECKED :
PROPOSAL APPROVED :
CLIENT APPROVED :
ENGINEER APPROVED :
DRAWN BY : KP
A1 DWG SCALE : 1:100
PROJ / DWG / SHEET : J23231 / 300
REVISION : 2

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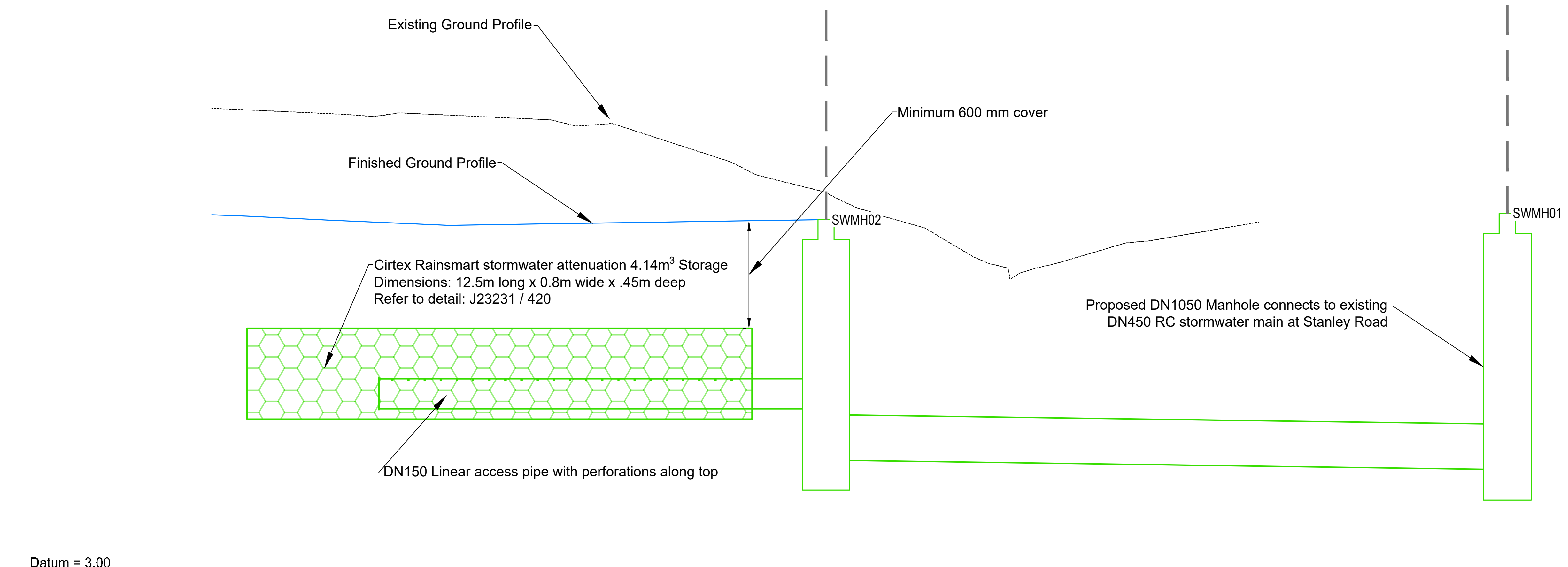
NOTE:

Pipe invert levels to be confirmed upon surveyed verification of existing stormwater pipe levels in Stanley Road.



| | | |
|---|---|---|
| CHAINAGE | 8.40<br>13.48<br>18.87<br>25.93<br>32.08 | |
| FINISHED GROUND LEVEL | 4.72<br>4.73<br>4.75 | |
| INVERT LEVEL | 3.81<br>3.81<br>3.55<br>3.51 | |
| DEPTH TO INVERT | 0.92<br>0.94<br>1.19 | |
| PIPE LENGTH & GRADE (Length to MH centres) | 11.08 @ 0.000% | 16.87 @ 0.285% |
| PIPE DESCRIPTION | DN150 PVC-U | DN225 PVC-U |

LONGITUDINAL SECTION - Stormwater
SCALES HORIZ 1 : 250 VERT 1 : 50

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 1 | SILT PIT STORMWATER TREATMENT UPDATED | KP | 08.11.2023 |
| 0 | ORIGINAL | KP | 19.10.2023 |

NOTES :

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TW PROPERTY GROUP

PROJECT
RESIDENTIAL DEVELOPMENT
99A STANLEY ROAD
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Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
STORMWATER
LONG-SECTION

PROPOSAL CHECKED :
CAD CHECKED :
PROPOSAL APPROVED :
CLIENT APPROVED :
ENGINEER APPROVED :
DRAWN BY : KP
A1 DWG SCALE : 1:100
PROJ / DWG / SHEET : J23231 / 410
REVISION : 1

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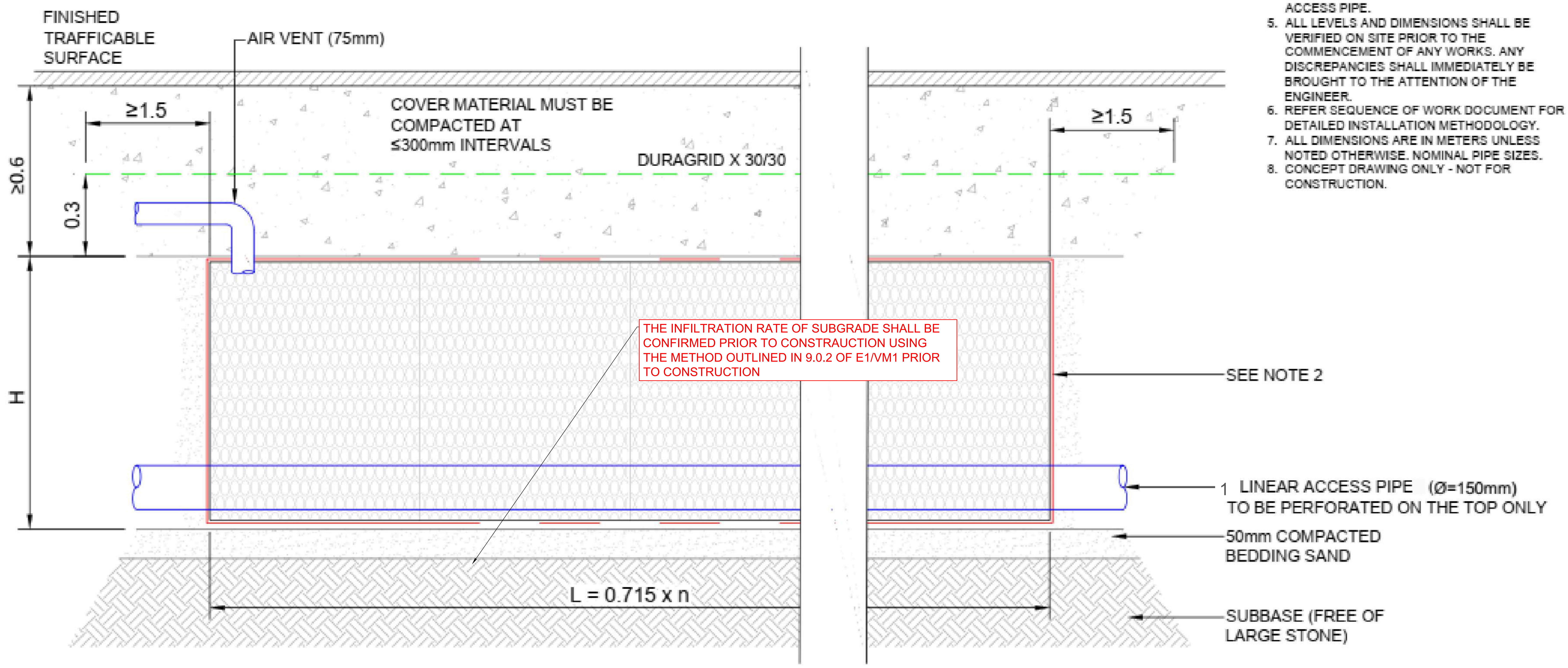
- REFER TO THE ARCHITECTS DRAWINGS FOR ROOF PIPELINE ALIGNMENTS AND SIZING.
- THE SUBGRADE AT THE BAKP OF THE RAINSMART SYSTEMS SHALL BE INSPECTED AND APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION.
- THE INFILRATION RATE OF THE SUBGRADE AT THE LOCATION OF THE RAINSMART SYSTEMS SHALL BE TESTED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION,

NOTES :

1. ALL RAINSMART SYSTEM WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE SPECIFICATIONS, METHOD STATEMENTS AND RECOMMENDATIONS OF CIRTEX INDUSTRIES LTD AND THE ENGINEER.
2. FOR SOAKAGE SYSTEMS, THE RAINSMART SYSTEM SHALL BE WRAPPED WITH A SINGLE LAYER OF AS410 GEOTEXTILE.
3. MANHOLES AS PER ENGINEERS SPECIFICATION.
4. ENGINEER TO ENSURE CAPABILITY OF LINEAR ACCESS PIPE.
5. ALL LEVELS AND DIMENSIONS SHALL BE VERIFIED ON SITE PRIOR TO THE COMMENCEMENT OF ANY WORKS. ANY DISCREPANCIES SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
6. REFER SEQUENCE OF WORK DOCUMENT FOR DETAILED INSTALLATION METHODOLOGY.
7. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE. NOMINAL PIPE SIZES.
8. CONCEPT DRAWING ONLY - NOT FOR CONSTRUCTION.



THE INFILTRATION RATE OF SUBGRADE SHALL BE CONFIRMED PRIOR TO CONSTRAUCTION USING THE METHOD OUTLINED IN 9.0.2 OF E1/VM1 PRIOR TO CONSTRUCTION

CIRTEX
GAIN MORE GROUND

16 QUEEN STREET, KOPU, THAMES, 3578
PHONE: 0800 247 839 • FAX: 07 868 3435
WWW.CIRTEX.CO.NZ

RAINSMART® STORMWATER SYSTEM
SOAKAGE SYSTEM
LINEAR ACCESS - 150mm
SECTION A-A

**CLIENT:** -
**ENGINEER:** -
**PROJECT DESIGN LEVEL:** TECHNICAL SUPPORT

SCALE: NTS
DRAWN BY: SHS
DATE: 16/10/2020
REVISION No: -
DRAWING No: TDT G 010 010

FOR RESOURCE CONSENT

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 2023.10.06 |

NOTES :

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TW PROPERTY GROUP

PROJECT
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99A STANLEY ROAD
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PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
STORMWATER
RAINSMART SYSTEM TYPICAL DETAILS

PROPOSAL CHECKED : -
CAD CHECKED : -
PROPOSAL APPROVED : -
CLIENT APPROVED : -
ENGINEER APPROVED : -
DRAWN BY : KP
A1 DWG SCALE : AS SHOWN
PROJ / DWG / SHEET : J23231/420
REVISION : 0

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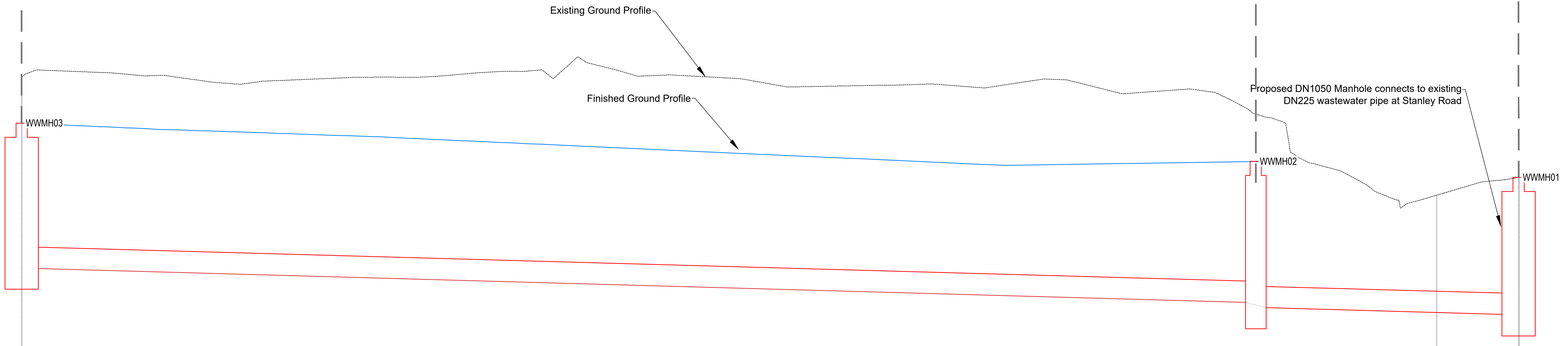

NOTE:

Pipe invert levels to be confirmed upon surveyed verification of existing wastewater pipe levels in Stanley Road.

Datum = 3.00

| | |
|---|---|
| CHAINAGE | 10.91<br>21.03<br>32.15<br>42.17<br>50.00<br>52.41 |
| FINISHED GROUND LEVEL | 4.97<br>4.85<br>4.76<br>4.78 |
| INVERT LEVEL | 4.03<br>3.79<br>3.75<br>3.71<br>3.70 |
| DEPTH TO INVERT | 1.02<br>0.99<br>1.03 |
| PIPE LENGTH & GRADE (Length to MH centres) | 43.61 @ 0.560%<br>9.29 @ 0.560% |
| PIPE DESCRIPTION | DN150 PVC-U<br>DN150 PVC-U |

LONGITUDINAL SECTION - Wastewater
SCALES HORIZ 1 : 100 VERT 1 : 20

**FOR RESOURCE CONSENT**

| | | | |
|---|---|---|---|
| 0 | | | |
| 0 | ORIGINAL | KP | 19.10.2023 |
| REV | DESCRIPTION TO REVISION | REV BY | DATE |

NOTES :

CLIENT
TW PROPERTY GROUP

PROJECT
RESIDENTIAL DEVELOPMENT
99A STANLEY ROAD
GISBORNE

INFRASTRUCTURE SOLUTIONS ‖ PROJECT MANAGEMENT
PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
WASTEWATER
LONG-SECTION

| | | | | |
|---|---|---|---|---|
| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
| DRAWN BY : KP | A1 DWG SCALE : 1:100 | PROJ / DWG / SHEET : J23231 / 510 | | REVISION : 0 |

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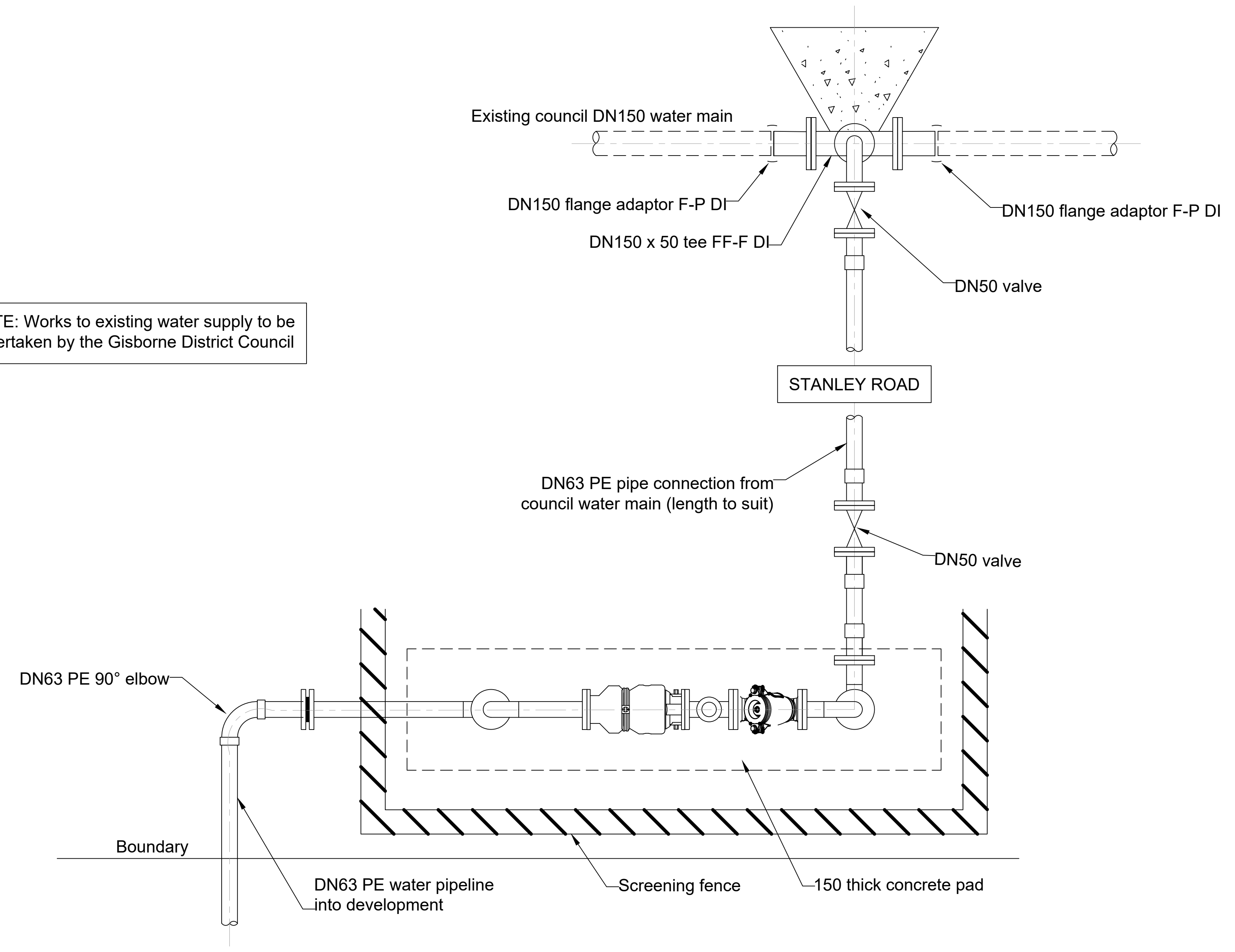
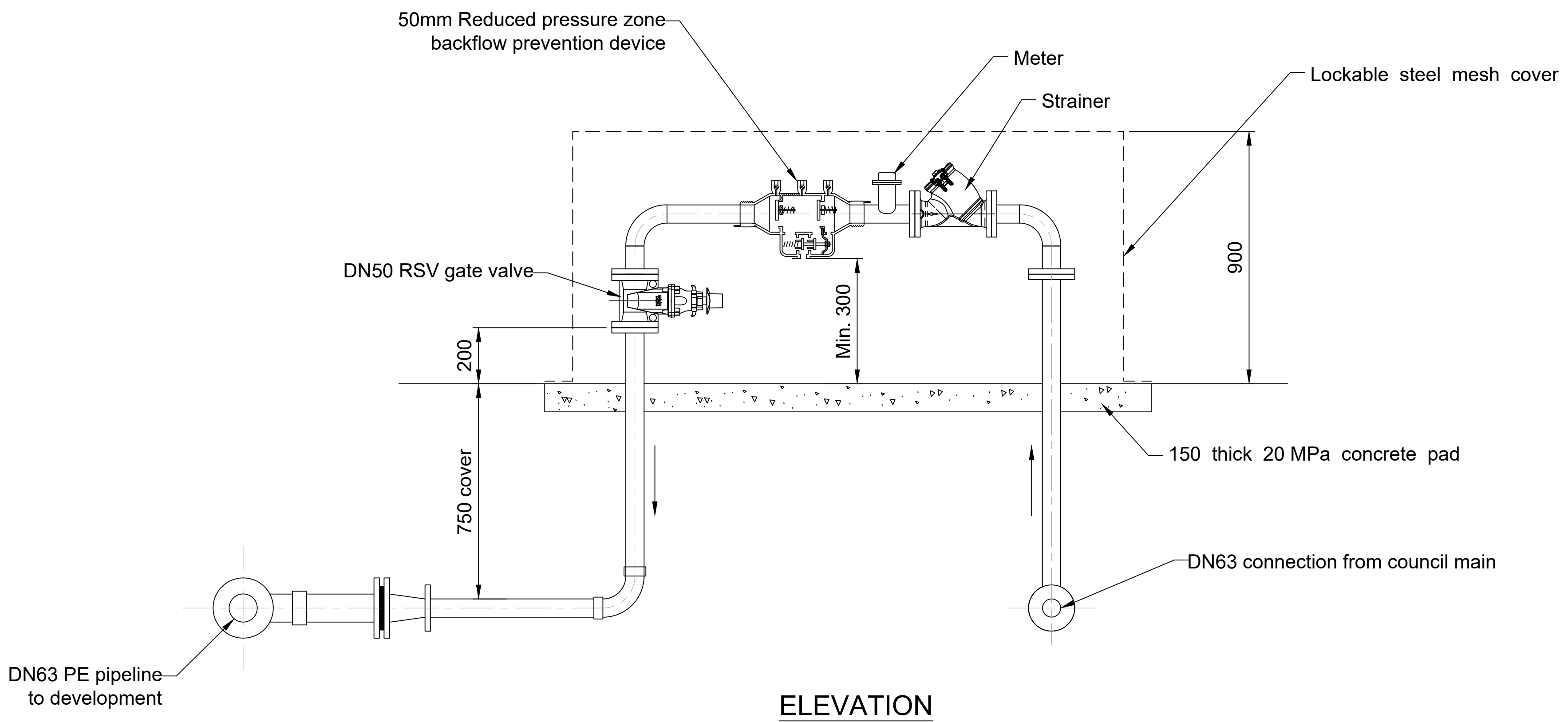
NOTE: Works to existing water supply to be undertaken by the Gisborne District Council



PLAN



ELEVATION

## CONNECTION FROM COUNCIL MAIN TO BACKFLOW INSTALLATION

Scale 1:20

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 23.11.2023 |

NOTES :

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TW PROPERTY GROUP

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99A STANLEY ROAD
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INFRASTRUCTURE SOLUTIONS ‖ PROJECT MANAGEMENT
PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
WATER SUPPLY
TYPICAL DETAILS

| | | | | |
|---|---|---|---|---|
| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
| DRAWN BY : KP | A1 DWG SCALE : AS SHOWN | PROJ / DWG / SHEET : J23231 / 610 | | REVISION : 0 |

www.infir.nz

Existing Fire Hydrant #1
Distance = 134 Meters

Existing Fire Hydrant #2
Distance = 136 Meters

**LEGEND**

| | |
|---|---|
| FH | Nearest Existing Fire Hydrants |
| - - - - - (green) | Path to Hydrant #1 |
| - - - - - (orange) | Path to Hydrant #2 |

**FOR RESOURCE CONSENT**

| REV | DESCRIPTION TO REVISION | REV BY | DATE |
|---|---|---|---|
| 0 | ORIGINAL | KP | 2023.10.06 |

NOTES :

CLIENT
TW PROPERTY GROUP

PROJECT
# RESIDENTIAL DEVELOPMENT 99A STANLEY ROAD GISBORNE

INFRASTRUCTURE SOLUTIONS ‖ PROJECT MANAGEMENT
PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE
## WATER SUPPLY HYDRANT RANGE

| | | | | |
|---|---|---|---|---|
| PROPOSAL CHECKED : | CAD CHECKED : | PROPOSAL APPROVED : | CLIENT APPROVED : | ENGINEER APPROVED : |
| DRAWN BY : KP | A1 DWG SCALE : 1:200 | PROJ / DWG / SHEET : J23215 / 620 | REVISION : 0 | |

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# Appendix C Stormwater Calculations

***99A Stanley Road***

Site areas

| | Surface areas | | c | cA values | |
|---|---|---|---|---|---|
| | Pre-development | Post development | | Pre-development | Post development |
| | *$m^2$* | *$m^2$* | | *$m^2$* | *$m^2$* |
| Roofs | 368 | 521 | 1.00 | 368 | 521 |
| Sealed | 270 | 970 | 0.80 | 216 | 776 |
| Pervious | 953 | 99 | 0.25 | 238 | 25 |
| Total | 1590.0 | 1590.0 | | 822 | 1322 |

Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

| ARI | AEP | 10m | 20m | 30m | 1h | 2h | 6h |
|---|---|---|---|---|---|---|---|
| Minutes | | 10 | 20 | 30 | 60 | 120 | 360 |
| 1.58 | 0.633 | 48.4 | 34.3 | 28.3 | 20.6 | 14.8 | 8.45 |
| 2 | 0.5 | 54.6 | 38.6 | 31.8 | 23.1 | 16.7 | 9.45 |
| 5 | 0.2 | 77.1 | 54.2 | 44.5 | 32.1 | 23 | 12.9 |
| **10** | **0.1** | **95.3** | **66.7** | **54.7** | **39.3** | **28** | **15.7** |
| 20 | 0.05 | 115 | 80.4 | 65.7 | 47 | 33.4 | 18.6 |
| 30 | 0.033 | 128 | 89 | 72.7 | 51.9 | 36.8 | 20.4 |
| 40 | 0.025 | 137 | 95.3 | 77.8 | 55.4 | 39.2 | 21.7 |
| 50 | 0.02 | 145 | 101 | 82 | 58.4 | 41.2 | 22.8 |
| 60 | 0.017 | 151 | 105 | 85.4 | 60.7 | 42.8 | 23.7 |
| 80 | 0.013 | 162 | 112 | 91.1 | 64.7 | 45.5 | 25 |
| **100** | **0.01** | **170** | **117** | **95.5** | **67.7** | **47.6** | **26.2** |
| 250 | 0.004 | 206 | 141 | 115 | 80.9 | 56.6 | 30.9 |

**Allowable**

Pre-development time of concentration 10 minutes

10% AEP Pre- and post development runoff rates

| | cA values | | | Runoff rates | |
|---|---|---|---|---|---|
| | Pre-development | Post development | i | Pre-development | Post development |
| | *$m^2$* | *$m^2$* | mm/hr | *L/s* | *L/s* |
| Roofs | 368 | 521 | 95.3 | 9.7 | 13.8 |
| Sealed | 216 | 776 | 95.3 | 5.7 | 20.6 |
| Pervious | 238 | 25 | 95.3 | 6.3 | 0.7 |
| Total | 822 | 1322 | | **21.7** | **35.0** |
| C EFFECTIVE | 0.52 | 0.83 | | | |

1% AEP Pre- and post development runoff rates

| | cA values | | | Runoff rates | |
|---|---|---|---|---|---|
| | Pre-development | Post development | i | Pre-development | Post development |
| | *$m^2$* | *$m^2$* | mm/hr | *L/s* | *L/s* |
| Roofs | 368 | 521 | 170 | 17.4 | 24.6 |
| Sealed | 216 | 776 | 170 | 10.2 | 36.7 |
| Pervious | 238 | 25 | 170 | 11.2 | 1.2 |
| Total | 822 | 1322 | | **38.8** | **62.4** |

Proposed discharge for 10% AEP Event

| | | |
|---|---|---|
| Discharge from Underground storage | 14.3 | L/s |
| Discharge from roof storage tanks | 2.9 | L/s |
| **Total** | **17.2** | **L/s** |

Roof attenuation tank storage requirements

10% AEP

| Time | *minutes* | 10 | 20 | 30 | 60 | 120 | 360 |
|---|---|---|---|---|---|---|---|
| i | *mm/hr* | 95.3 | 66.7 | 54.7 | 39.3 | 28 | 15.7 |
| cA roofs | *$m^2$* | 521 | 521 | 521 | 521 | 521 | 521 |
| Runoff | *L/s* | 13.8 | 9.7 | 7.9 | 5.7 | 4.1 | 2.3 |
| Discharge | L/s | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 |
| Attenuation | *L/s* | 10.9 | 6.8 | 5.0 | 2.8 | 1.2 | -0.6 |
| Attenuation | *$m^3$* | 6.5 | 8.1 | 9.0 | 10.0 | 8.3 | -13.6 |
| Actual discharge | *L/s* | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.3 |

1% AEP

| Time | *minutes* | 10 | 20 | 30 | 60 | 120 | 360 |
|---|---|---|---|---|---|---|---|
| i | *mm/hr* | 170 | 117 | 95.5 | 67.7 | 47.6 | 26.2 |
| cA roofs | $m^2$ | 521 | 521 | 521 | 521 | 521 | 521 |
| Runoff | *L/s* | 24.6 | 16.9 | 13.8 | 9.8 | 6.9 | 3.8 |
| Runoff | $m^3$ | 14.8 | 20.3 | 24.9 | 35.3 | 49.6 | 81.9 |
| Throttled discharge rate | *L/s* | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| Throttled discharge | $m^3$ | 1.7 | 3.5 | 5.2 | 10.4 | 20.9 | 62.6 |
| Required storage | $m^3$ | 13.0 | 16.8 | 19.7 | 24.8 | 28.7 | 19.2 |
| Available storage | $m^3$ | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Overflow discharge | $m^3$ | 3.0 | 6.8 | 9.6 | 14.8 | 18.7 | 9.2 |
| Total discharge from tanks | $m^3$ | 4.7 | 10.3 | 14.8 | 25.2 | 39.6 | 71.9 |
| Average discharge rate from tanks | *L/s* | 7.88 | 8.57 | 8.25 | 7.01 | 5.49 | 3.33 |
| Throttling effect | *L/s* | 16.7 | 8.4 | 5.6 | 2.8 | 1.4 | 0.5 |

Underground  storage requirements

cA sealed and grass areas attenuated 801

10% AEP

| Time | *minutes* | 10 | 20 | 30 | 60 | 120 | 360 |
|---|---|---|---|---|---|---|---|
| i | *mm/hr* | 95.3 | 66.7 | 54.7 | 39.3 | 28 | 15.7 |
| cA sealed and grass area | $m^2$ | 801 | 801 | 801 | 801 | 801 | 801 |
| Runoff | *L/s* | 21.2 | 14.8 | 12.2 | 8.7 | 6.2 | 3.5 |
| Discharge | L/s | 14.3 | 14.3 | 14.3 | 14.3 | 14.3 | 14.3 |
| Attenuation | *L/s* | 6.9 | 0.6 | -2.1 | -5.5 | -8.1 | -10.8 |
| Attenuation | $m^3$ | 4.1 | 0.7 | -3.8 | -20.0 | -58.0 | -233.2 |
| Actual discharge | *L/s* | 14.3 | 14.3 | 12.2 | 8.7 | 6.2 | 3.5 |

1% AEP

| Time | *minutes* | 10 | 20 | 30 | 60 | 120 | 360 |
|---|---|---|---|---|---|---|---|
| i | *mm/hr* | 170 | 117 | 95.5 | 67.7 | 47.6 | 26.2 |
| cA sealed and grass area | $m^2$ | 801 | 801 | 801 | 801 | 801 | 801 |
| Runoff | *L/s* | 37.8 | 26.0 | 21.2 | 15.1 | 10.6 | 5.8 |
| Runoff | $m^3$ | 22.7 | 31.2 | 38.2 | 54.2 | 76.3 | 125.9 |
| Throttled discharge rate | *L/s* | 14.3 | 14.3 | 14.3 | 14.3 | 14.3 | 14.3 |
| Throttled discharge | $m^3$ | 8.6 | 17.1 | 25.7 | 51.4 | 102.9 | 308.7 |
| Required storage | $m^3$ | 14.1 | 14.1 | 12.5 | 2.8 | -26.6 | -182.7 |
| Available storage | $m^3$ | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 |
| Overflow discharge | $m^3$ | 10.0 | 9.9 | 8.4 | 0.0 | 0.0 | 0.0 |
| Total discharge from Surface storage | $m^3$ | 18.5 | 27.1 | 34.1 | 51.4 | 102.9 | 308.7 |
| Average discharge rate from Surface storage | *L/s* | 30.9 | 22.6 | 18.9 | 14.3 | 14.3 | 14.3 |
| Throttling effect | *L/s* | 6.9 | 3.5 | 2.3 | 0.8 | -3.7 | -8.5 |

| Total discharge from site with overflows of devices from site | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10% AEP | *L/s* | **17.2** | **17.2** | **15.1** | **11.6** | **9.1** | **5.8** |
| 1% AEP | *L/s* | **38.8** | **31.1** | **27.2** | **21.3** | **19.8** | **17.6** |

1% AEP

| | | |
|---|---|---|
| Attenuated discharge from roof tanks | L/s | 2.9 |
| Attenuated discharge frrom surface storage | L/s | 14.3 |
| | | |
| Total discharge rate | L/s | 17.2 |

***Rainwater tanks 2000 litres 2Nos***

| | | |
|---|---|---|
| Orifice Diameter (mm) | 16.82 | mm |
| Orifice Diameter (m) | 0.01682 | m |
| Orifice Area ($m^2$) | 0.0002 | $m^2$ |
| Orifice Area (mm2) | 222 | $mm^2$ |
| Average depth: $h_{hy} = d_{(det)} / 2$ (m) = | 0.90 | m |
| μ = discharge coefficient = | 0.62 | |
| g = | 9.81 | $m^2/s$ |
| $Q_{(proposed)}$ | 0.000578901 | $m^3/s$ |
| $Q_{(proposed)}$ | 0.58 | L/s |
| Total discharge from 2 tanks of 2000L capacity | *1.16* | L/s |

***Rainwater tanks 1000 litres 6Nos***

| | | |
|---|---|---|
| Orifice Diameter (mm) | 12.7 | mm |
| Orifice Diameter (m) | 0.0127 | m |
| Orifice Area ($m^2$) | 0.0001 | $m^2$ |
| Orifice Area (mm2) | 126.6769 | $mm^2$ |
| Average depth: $h_{hy} = d_{(det)} / 2$ (m) = | 0.70 | m |
| μ = discharge coefficient = | 0.62 | |
| g = | 9.81 | $m^2/s$ |
| $Q_{(proposed)}$ | 0.000291063 | $m^3/s$ |
| $Q_{(proposed)}$ | 0.29 | L/s |
| Total discharge from 6 tanks of 1000L capacity | *1.75* | L/s |
| **Total discharge from rainwater tanks** | ***2.90*** | **L/s** |

***Surface Storage***

| | | |
|---|---|---|
| Orifice Diameter (mm) | 112.3 | mm |
| Orifice Diameter (m) | 0.11226 | m |
| Orifice Area ($m^2$) | 0.00990 | $m^2$ |
| Orifice Area (mm2) | 9,897.83 | $mm^2$ |
| Average depth: $h_{hy} = d_{(det)} / 2$ (m) = | 0.40 | m |
| μ = discharge coefficient = | 0.62 | |
| g = | 9.81 | $m^2/s$ |
| $Q_{(proposed)}$ | 0.0172 | $m^3/s$ |
| $Q_{(proposed)}$ | ***17.19*** | ***L/s*** |

***Therefore for in ground storage provide an orifice of 112 mm diameter to have a discharge of 14.29 L/s from surface storage and***

***2.90 L/s from 6 lots connected to the kerb and 2 lots connected to sump***

***i.e., total 17.19 L/s***

***For 2000 litres tanks provide an orifice of 16.8 mm diameter***

***For 1000 litres tanks provide an orifice of 12.7 mm diameter***

99a Stanley Road

| | | |
|---|---|---|
| Households | 8 | |
| Persons per household | 3.2 | persons |
| Demand | 330 | L/p/d |
| Daily demand | 8448 | L |
| Average daily demand | 0.098 | L/s |
| Peak hour (PF = 10) | 0.978 | L/s |

| | | |
|---|---|---|
| Pipe ID | 50 | mm |
| Surface area | 0.001963495 | m2 |
| Flow velocity | 0.50 | m/s |

Mannings equation

| | | |
|---|---|---|
| D | 0.05 | m |
| Rh | 0.0125 | |
| Rh ^ 2/3 | 0.053860867 | |
| S | 0.010343303 | m/m |
| S ^ 0.5 | 0.101702029 | |
| n | 0.011 | |
| v | 0.497978133 | m/s |
| L | 54 | m |
| hf | 0.558538342 | m |

Reynolds number

| | | |
|---|---|---|
| Kinematic Viscosity of water at 20$^{o}$C | 1.00E-06 | m/s |
| Flow speed | 0.50 | m/s |
| Charecteristic length, Lc | 0.05 | m |
| Reynolds number, $R_e$ | 25,000.00 | > 4000 |

Colebrook-White Equation

$$\frac{1}{\sqrt{\lambda}} = -2\log\left(\frac{k}{3.7D} + \frac{2.51}{\mathrm{Re}\sqrt{\lambda}}\right)$$

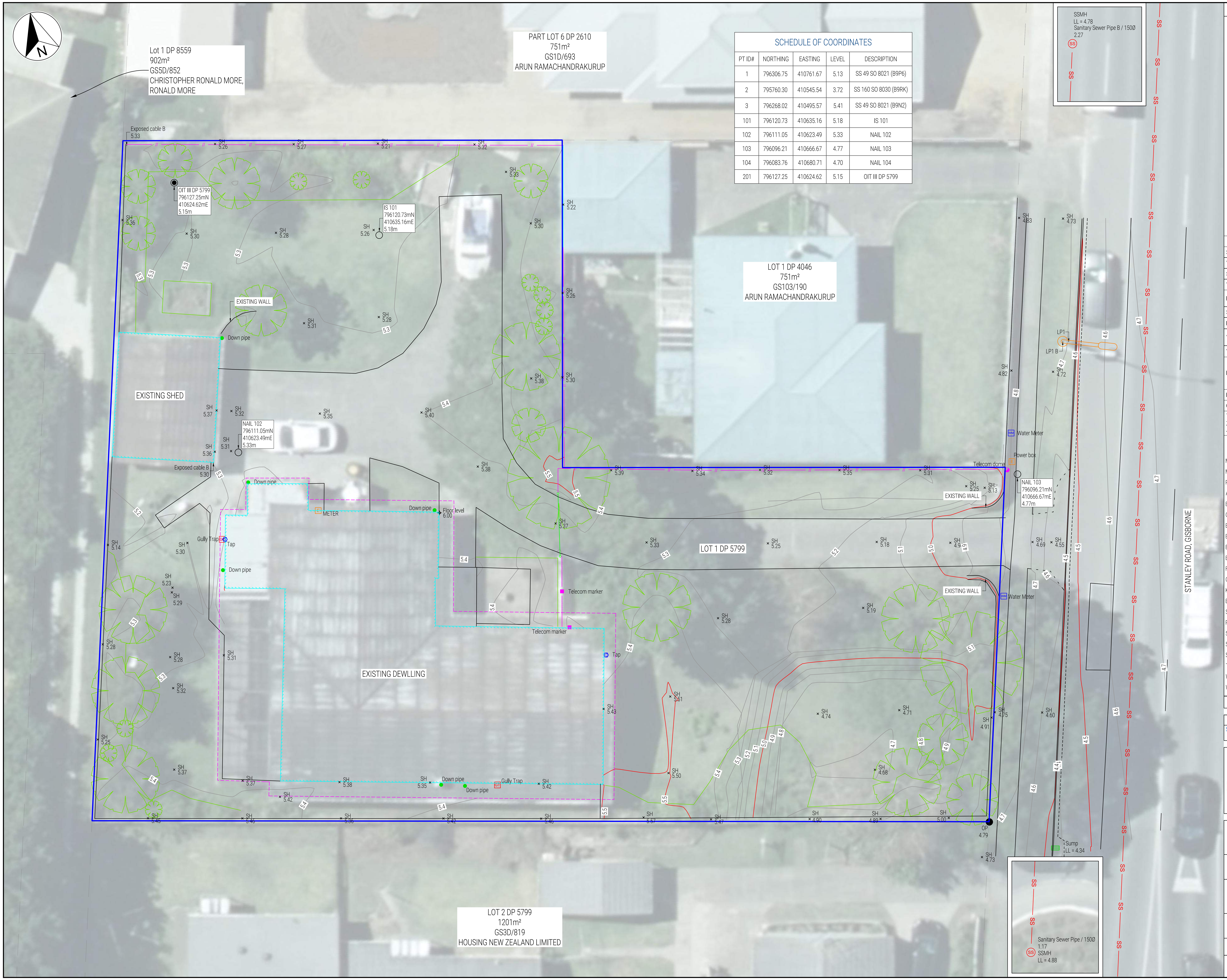
| | | |
|---|---|---|
| Lambda | | 0.035172 |
| Diameter | m | 0.05 |
| Colebrook roughness,k | m | 0.0003 |
| Velocity | m/s | 0.5 |
| Kinematic viscosity | m2/s | 1.00E-06 |
| Reynolds number | | 25000 |
| | | |
| 1/(Lamda)^0.5 | | 5.332 |
| | | |
| k/3.7D | | 0.0016216 |
| 2.51/(R(Lambda)^0.5) | | 0.0005353 |
| -2log(A13+A14) | | 5.332 |
| | | |
| Delta | | 0.00 |

Darcy weisbach equation

$$\Delta h_f = f \frac{L}{D} \frac{V^2}{2g}$$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| By Darcy-weisbach equation, hf= | | 0.484 | m | | | 4.75 | kPa |
| From, Mannings equation, hf | | 0.559 | m | | | 5.48 | kPa |
| Adopt | | | | | | 4.75 | kPa |
| | | | | | | | |
| Minor Friction loss | k value | velocity | | | | | |
| For 1 nos Tee | 0.2 | 0.5 | m/s | 0.003 | m | 0.03 | kPa |
| For 5 nos 90$^{o}$ Elbow | 0.3 | 0.5 | m/s | 0.019 | m | 0.19 | kPa |
| For 7 nos reduced tee | 2 | 1.59 | m/s | 1.807 | m | 17.73 | kPa |
| Head loss by Backflow prevention unit | | | | | | 80.00 | kPa |
| | | | | | | | |
| Total head loss | | | | | | 102.69 | kPa |
| | | | | | | | |
| Conservative pressure in GDC network | 450-500 Kpa | | | Assuming min | | 450 | kPa |
| | | | | | | | |
| Balance available pressure | | | | | | **347.31** | **kPa** |

# Appendix D Topographic Survey



## SCHEDULE OF COORDINATES

| PT ID# | NORTHING | EASTING | LEVEL | DESCRIPTION |
|---|---|---|---|---|
| 1 | 796306.75 | 410761.67 | 5.13 | SS 49 SO 8021 (B9P6) |
| 2 | 795760.30 | 410545.54 | 3.72 | SS 160 SO 8030 (B9RK) |
| 3 | 796268.02 | 410495.57 | 5.41 | SS 49 SO 8021 (B9N2) |
| 101 | 796120.73 | 410635.16 | 5.18 | IS 101 |
| 102 | 796111.05 | 410623.49 | 5.33 | NAIL 102 |
| 103 | 796096.21 | 410666.67 | 4.77 | NAIL 103 |
| 104 | 796083.76 | 410680.71 | 4.70 | NAIL 104 |
| 201 | 796127.25 | 410624.62 | 5.15 | OIT III DP 5799 |

## NOTES:

1. THE PURPOSE OF THIS SCHEME PLAN IS TO SUPPORT A RESOURCE CONSENT APPLICATION ONLY. IF APPLICABLE THIS PLAN SHOULD BE READ IN CONJUNCTION WITH SUPPORTING ARCHITECTURAL AND ENGINEERING PLANS/INFORMATION.
2. PROPOSED BOUNDARIES, DIMENSIONS AND AREAS ARE SUBJECT TO LAND TRANSFER SURVEY.
3. FOR EXISTING BUILDINGS - EXTERIOR FACE OF CLADDING/WEATHERPROOFING HAS BEEN SURVEYED.
4. SERVICES, UTILITIES, AND DRAINAGE SHOWN ON THIS PLAN ARE LIMITED TO WHAT WAS 'VISIBLE' AND 'ACCESSIBLE' ON THE DAY OF SURVEY.
5. UNDERLYING BOUNDARIES ON THIS PLAN HAVE BEEN ADOPTED FROM THE MOST RELEVANT UNDERLYING PLANS.
6. NOT ALL LEGAL INSTRUMENTS, DRAINAGE, OR OTHER INTERESTS PERTAINING TO THIS SITE ARE NECESSARILY SHOWN ON THIS PLAN.
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8. THE COPYRIGHT AND INTELLECTUAL PROPERTY RIGHTS FOR THE INFORMATION SHOWN ON THIS PLAN REMAIN THE PROPERTY OF DEFINITION SURVEYING LTD.
9. FOR PROPOSED DEVELOPMENTS, WHERE HEIGHT IN RELATION TO BOUNDARY BECOMES CRITICAL, ADDITIONAL GROUND LEVELS MAY BE REQUIRED ADJACENT TO THE CRITICAL POSITION. LEVELS SHOWN ON THIS PLAN SHOULD BE CROSS-CHECKED AGAINST COUNCILS 'DEFINITIONS' BEFORE BEING USED FOR DESIGN PURPOSES.
10. SOME DRAINAGE FEATURES INCLUDE PUMPS AND ASSOCIATED PIPES. PLEASE REFER TO SITE PHOTOS FOR DETAILS.
11. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S, SERVICE ENGINEER'S DRAWINGS AND SPECIFICATIONS.

## SURVEY DETAILS

| | |
|---|---|
| SURVEYOR | A. TUKAKI |
| VERIFIED BY | A. TUKAKI |
| SURVEY DATE: | 11/09/2023 |
| VERIFIED DATE: | 14/09/2023 |
| HORIZONTAL DATUM | EPSG:2107: NZGD2000 / Poverty Bay 2000 |
| SCALE FACTOR | 1.0000000 |
| HORIZONTAL ORIGIN | SS 49 SO 8021 (B9P6) |
| VERTICAL DATUM | EPSG:1169 / New Zealand Vertical Datum 2016 |
| VERTICAL ORIGIN | SS 49 SO 8021 (B9P6) |
| EQUIPMENT USED | TRIMBLE R12I BASE AND ROVER<br>TRIMBLE S7 ROBOTIC TOTAL STATION |
| BOUNDARY ACCURACY | SUBJECT TO CADASTRAL SURVEY |

COMMENTS:

THIS WORK INCLUDES DATA WHICH IS LICENSED BY LAND INFORMATION NEW ZEALAND (LINZ) FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

## LEGEND

MAJOR CONTOUR
MINOR CONTOUR
PROPERTY BOUNDARY
ABUTTING BOUNDARIES
BUILDING
CENTRELINE
EAVE
EDGE OF CONCRETE
EX FENCE
EDGE OF SEAL
FOOTPATH
GATE
KERB
EX HEDGE
SANITARY SEWER PIPE
POWER UTILITIES
SANITARY SEWER UTILITIES
SIGN
STORMWATER UTILITIES
TELECOM UTILITIES
WATER UTILITIES
WALL

| REV: | DESCRIPTION: | BY: | DATE: |
|---|---|---|---|
| A | ISSUED FOR INFORMATION | DM | 14/09/2023 |

STATUS: STATUS

DEFINITION SURVEYING LTD.
BAY OF PLENTY | HAWKES' BAY | CANTERBURY
WWW.DEFINITION.NZ

CLIENT: TW GROUP OF COMPANIES

SURVEYOR:
DEFINITION SURVEYING LTD
BAY OF PLENTY

SITE:
LOT 1 DP 5799
99A STANLEY ROAD, TE HAPARA, GISBORNE

TITLE:
TOPOGRAPHICAL PLAN

| SCALE AT A1: | DATE: | DRAWN: | CHECKED: |
|---|---|---|---|
| 1:100 | 14/09/2023 | KN | DM |

| PROJECT NO: | DRAWING NO: | REVISION: |
|---|---|---|
| N230007.14 | V100 | A |

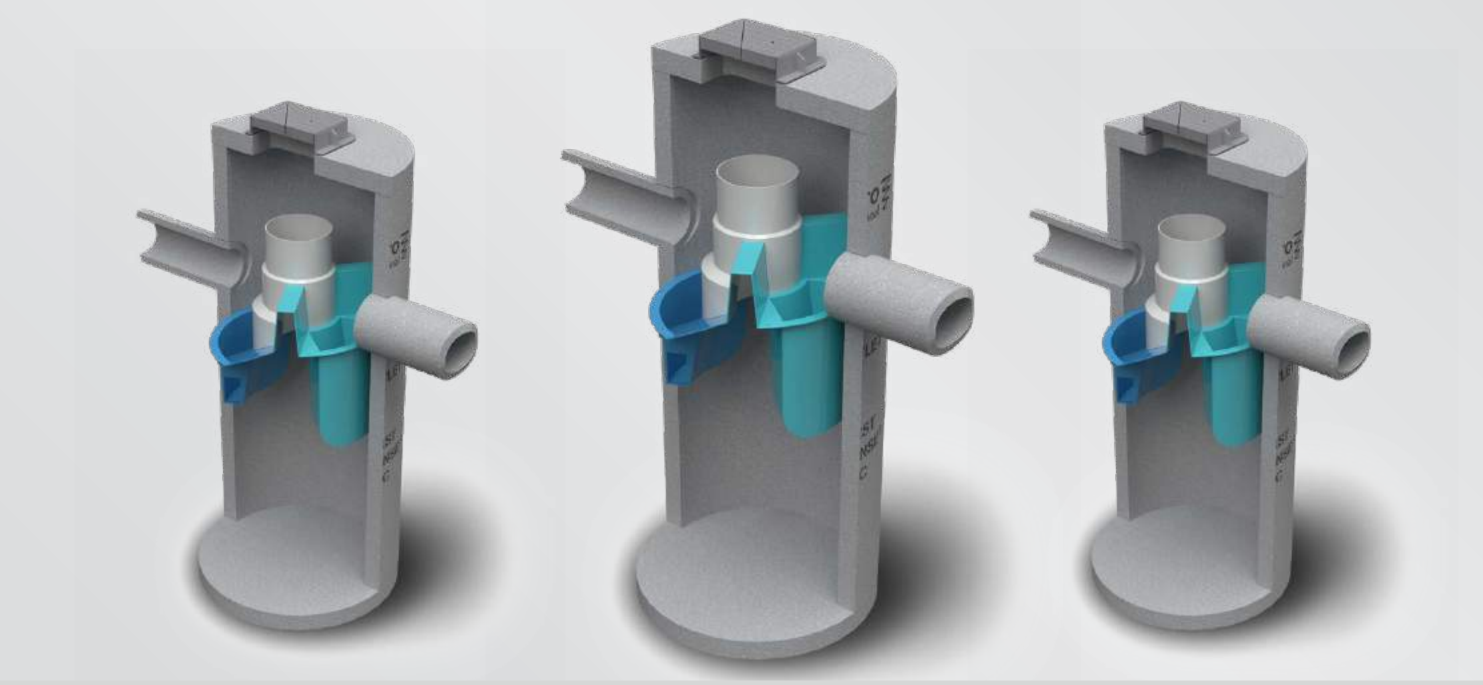
# Appendix E SW20 First Defence High-Capacity Brochure

# First Defense®
# High Capacity

(Stormwater Treatment)

Technical Guide SW 20

A simple solution for your trickiest sites



### Applications

- Roads, carparks, commercial properties
- Ports, airports, construction sites
- Industrial and commercial facilities
- Offline and online treatment of existing stormwater reticulation

### Product Attributes

- Removal efficiencies exceeding 80% on particulate contaminants down to 75 micron
- Low head requirements at treatment flow rate
- Easy to maintain

### Approvals/Standards

- NJCAT
- NZS3109, Concrete Construction

### Quality

- ISO 9001:2008 Quality Management Standard

***We are the supply partner of choice for New Zealand's stormwater management and treatment solutions.***

HYNDS STORMWATER

# The First Defense® High Capacity is an enhanced vortex separator that combines an effective stormwater treatment chamber with an integral peak flow bypass. It efficiently removes sediment, total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants.

The First Defense® High Capacity is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

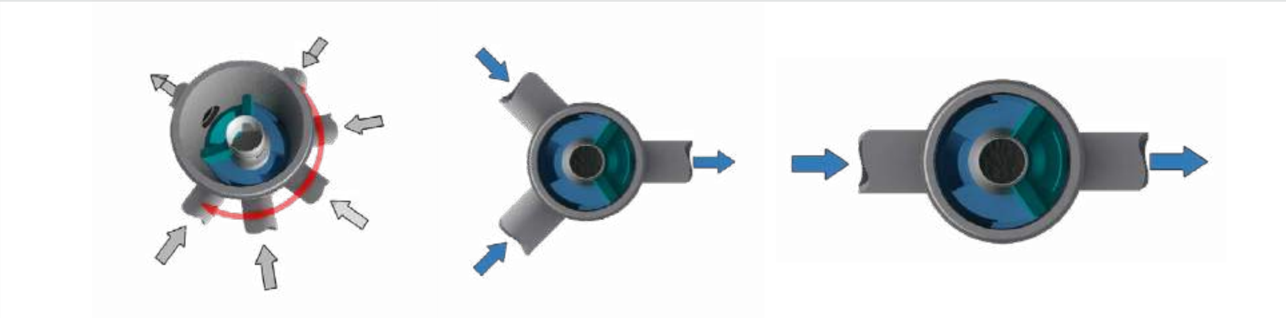


**FIG. 1** The First Defense® High Capacity can have one or many inlets

## Design and Sizing

This adaptable online treatment system works easily with large pipes, multiple inlet pipes, inlet grates and now, contains a high capacity bypass for the conveyance of large peak flows. Designed with site flexibility in mind, the First Defense® High Capacity allows engineers to maximize available site space without compromising treatment level.

**TABLE 1** **Design & sizing**

| **Model Diameter** (m) | **Typical Treatment Flow Rate** (L/s) | **Maximum online Flow Rate** (L/s) | **Emergency Spill Containment** (L) | **Sediment Storage** (m3) |
|---|---|---|---|---|
| 0.9 | 23.7 | 424 | 473 | 0.3 |
| 1.2 | 42.4 | 510 | 723 | 0.5 |
| 1.8 | 95.7 | 906 | 1878 | 1.2 |
| 2.5 | 169.9 | 1415 | 4239 | 2.1 |

*Please note that FDHC0900 is only available in South Island*

## How it works

The First Defense® High Capacity has internal components designed to remove and retain gross debris, total suspended solids (TSS) and hydrocarbons. Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow. Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An internal bypass conveys infrequent peak flows directly to the outlet eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

## Applications

Stormwater treatment at the point of entry into the drainage line.

Sites constrained by space, topography or drainage profiles with limited slope and depth of cover.

Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line.

Pretreatment for filters, infiltration and storage.

**TABLE 2** **First Defense® High Capacity dimensions**

| **Product** | **Chamber size** (mm) | **Lid Openings** | **Lid Thickness** (mm) | **Dimension** (mm) | | | | | **Mass Total (T)** | **Shipped from** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **A** | **B** | **C** | **D** | **E** | | |
| First Defense High Capacity 900 | 900 | 1 | 200 | 1329 | 1199 | 933 | 1199 | 933 | 2.2 | Chch |
| First Defense High Capacity 1200 | 1200 | 1 | 200 | 1647 | 1701 | 1049 | 1701 | 1049 | 4.3 | Auck / Chch |
| First Defense High Capacity 1800 | 1800 | 1 | 200 | 2307 | 2004 | 1346 | 2004 | 1346 | 9.0 | Auck / Chch |
| First Defense High Capacity 2550 | 2550 | 1 | 225 | 3150 | 2569 | 1686 | 2569 | 1686 | 24.0 | Auck / Chch |

*Please note that FDHC0900 is only available in South Island*

## Advantages

- Inlet options include surface grate or multiple inlet pipes.
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes.
- Proven to prevent pollutant washout at up to 450% of its treatment flow.
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling.
- Delivered to site pre-assembled and ready for installation.

## Operation

The First Defense® operates on simple fluid hydraulics. It is selfactivating, has no moving parts, no external power requirement and the internals are fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space entry are avoided.

## Pollutant Capture and Retention

The internal components of the First Defense® High Capacity have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume. The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® High Capacity retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events. Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

## Maintenance

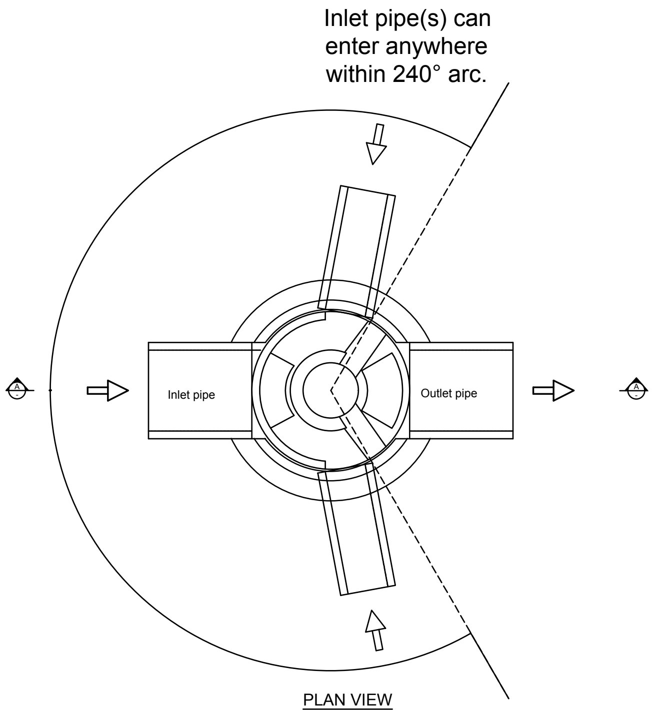
Maintenance of the First Defense® High Capacity is simple, safe and cost-effective. Maintenance is carried out from the surface using a standard vacuum tanker and personnel are not required to enter the device.

**FIG. 2** The First Defense® High Capacity internals

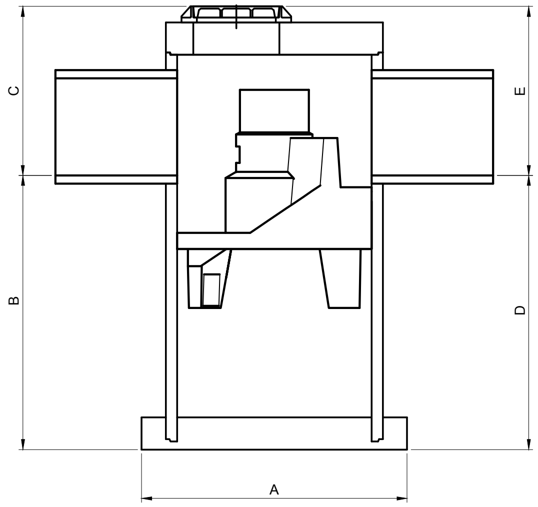
**TABLE 3** **MAINTENANCE / SERVICING**

The Frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge can be used to determine the level of accumulated solids stored in the sump.

| **Activity** | Indicative frequency for mid level catchment area |
|---|---|
| **Inspection** | Regularly during the first year of installation.<br>Every 6 months after the first year of installation |
| **Oil and Floatables Removal** | Once per year, with sediment removal<br>Following a spill in the drainage area |
| **Sediment Removal** | Once per year or as needed<br>Following a spill in the drainage area |



PLAN VIEW



SECTION VIEW

**FIG. 3** General arrangement drawing

## Lifting and Handling

All First Defense® High Capacity incorporate Swiftlift lifting anchors for safe lifting and must be used with the correct lifting clutch.

Hynds Pipe Systems has designed and manufactured First Defense® High Capacity with a minimum dynamic factor of 1.2. This dynamic factor requires that all the following conditions are observed when lifting, moving or placing the units:

1. Lifting with mobile plant *(such as an excavator or similar)* where equipment is specifically exempt from the requirements of the PECPR Regulations 1999, subject to the conditions outlined in the New Zealand Gazette, No. 104, September 2015 and
2. Lifting, travelling and placing over rough or uneven ground where anchor failure is not anticipated to cause harm or injury, by adopting procedures such as:
    a. Transporting the element as close as practical to ground level (300mm recommended)
    b. Establishing and maintaining exclusion zones
    c. Transporting only precast concrete elements that are unlikely to topple if they were to hit the ground
    d. Inspecting lifting anchors both after transportation and before final lifting into place

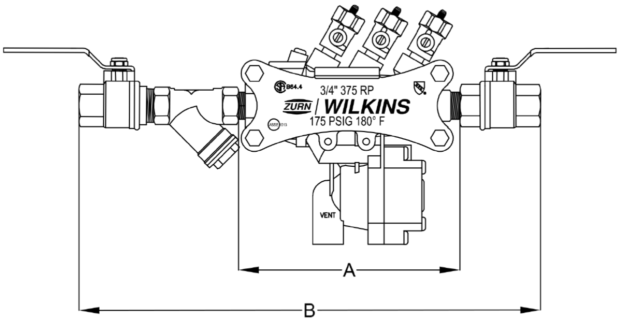
Refer to "Safe work with precast concrete - Handling, transportation and erection of precast concrete elements" published by Worksafe New Zealand (October 2018)

Shock loads resulting from travelling with suspended First Defense® High Capacity over rough terrain and uneven ground may exceed design, dynamic and safety factors of the lifting systems. It is essential that care is taken during lifting and transporting as additional stresses could result in anchor failure.

# Appendix F Reduced Pressure Zone Device Brochure

# 375 (SMALL)
# REDUCED PRESSURE PRINCIPAL ASSEMBLY 20MM - 50MM

**WILKINS**



## ENGINEERING SPECIFICATION

- Designed for installation on potable water lines.
- Protects against both backsiphonage and backpressure of contaminated water into the water supply.
- Assembly provides protection where a potential health hazard exists (High Hazard).
- The Reduced Pressure Principle Backflow Preventer is Australian Watermark Approved (AZ/NZS 2845.1).
- The Reduced Pressure Principle Assembly is rated to 82°C.
- The Reduced Pressure Principle Assembly is supplied with male pipe thread tailpieces.
- The main body is Nylon and the seat disc elastomers are silicone.
- Unless otherwise specified, the assembly should be mounted at a minimum of 300mm and maximum of 762mm above adequate drains with sufficient side clearance for testing and maintenance.

## PRODUCT INFORMATION

### MODEL 375 FEATURES

| | |
|---|---|
| Max. Working Water Pressure | 1600kPa |
| Max. Working Temperature | 82°C |
| Hydrostatic Test Pressure | 2400kPa |
| End Connections | Threaded |

### MODEL 375 MATERIALS

| | |
|---|---|
| Main Valve Body | Reinforced Nylon (FDA approved) |
| Housing | Brass (DZR) |
| Fastner | Stainless Steel 300 Series |
| Elastomers | Silicone & Buna Nitrile (FDA approved) |
| Internals | Delrin & Nylon (NSF listed) |
| Springs | Stainless Steel 300 Series |
| Tailpiece | Cast Bronze ASTM B 584 |
| Struts | Forged Brass ASTM B 124 |

| CODE | VALVE SIZE mm | A mm | B mm |
|---|---|---|---|
| W19375L | 19 | 168 | 330 |
| W25375L | 25 | 178 | 375 |
| W32375L | 32 | 367 | 610 |
| W40375L | 40 | 367 | 635 |
| W50375L | 50 | 367 | 700 |

## STANDARDS COMPLIANCE

- Australian Watermark (AS/NZS 2845.1) Approved Lic. 1379
- Type Tested AS/NZS 4020 Lic. 20111

## MODELS

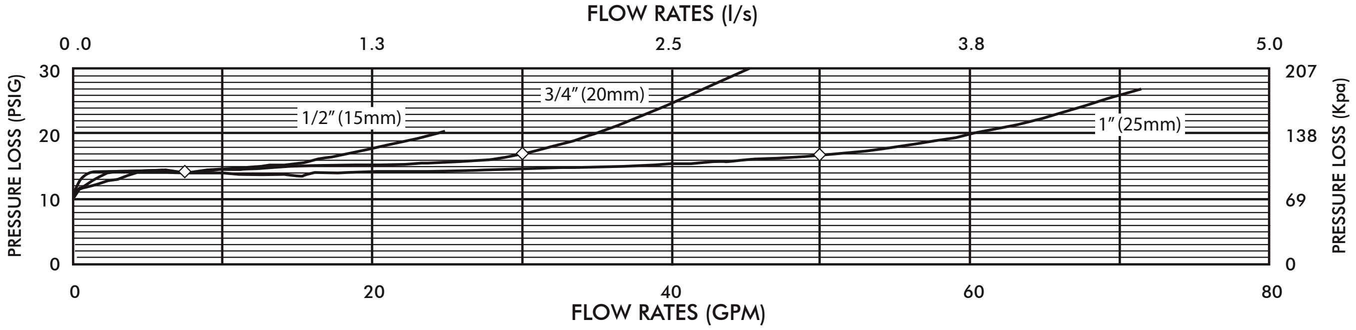
### RPZ COMES WITH 2 X BALL VALVES Y-STRAINER

**W19375S** - 19mm Reduced Pressure Zone Device
**W25375S** - 25mm Reduced Pressure Zone Device
**W32375S** - 32mm Reduced Pressure Zone Device
**W40375S** - 40mm Reduced Pressure Zone Device
**W50375S** - 50mm Reduced Pressure Zone Device

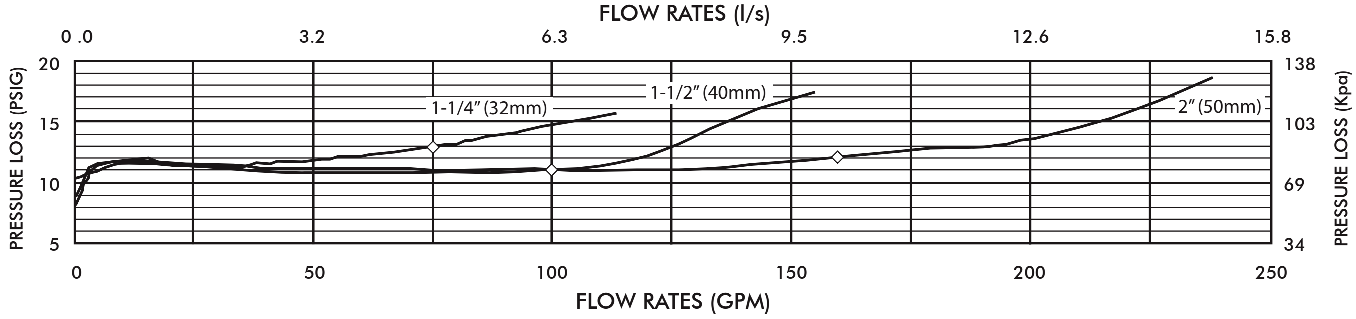
WaterMark
AS/NZS 2845.1
LIC. 1379

# FLOW CHARACTERISTICS

MODEL 375, 375XL 1/2", 3/4" & 1" (STANDARD & METRIC)



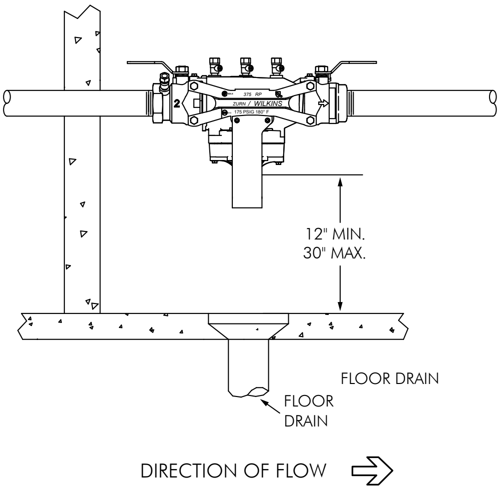
MODEL 375, 375XL 1-1/4"-2" (STANDARD & METRIC)



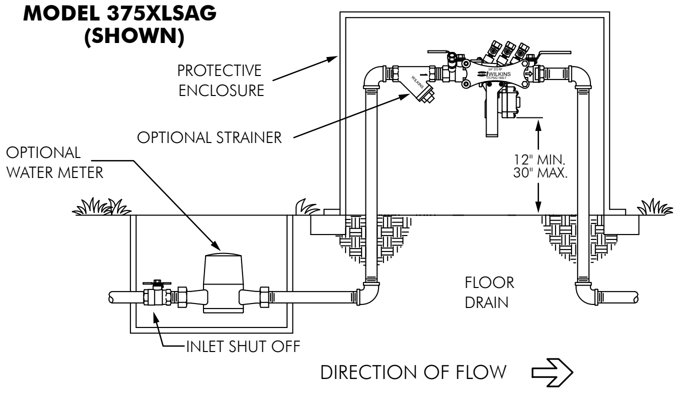
◇ Rated flow (Established by approval agencies)

## TYPICAL INSTALLATION

Local codes shall govern installation requirements. To be installed in accordance with the manufacturers instructions and the latest edition of the Uniform Plumbing Code. Unless otherwise specified, the assembly shall be mounted at a minimum of 12" (305mm) and a maximum of 30˚ (762mm) above adequate drains with sufficient side clearance for testing and maintenance. The installation shall be made so that no part of the unit can be submerged.



INDOOR INSTALLATION



OUTDOOR INSTALLATION

**MACDONALD**
**INDUSTRIES LIMITED**

**Auckland (Head Office)**
20 Carr Rd, Three Kings
Auckland 1041
**P:** 09 624 1115
**F:** 09 624 1110
**E:** sales@macdonaldindustries.co.nz

**Wellington**
**P:** 04 569 8033
**F:** 04 569 8066

**Christchurch**
**P:** 03 348 2356
**F:** 03 348 2376

www.macdonaldindustries.co.nz

# Appendix 5

## Detailed Site Investigation

# DETAILED SITE INVESTIGATION

## 99a STANLEY ROAD
## GISBORNE

PROJECT NO. EAM2422-01

PREPARED FOR
TW GROUP

PREPARED BY
KAREN TOULMIN
SEPTEMBER 2023

**EAM NZ LTD – ENVIRONMENTAL CONSULTANTS**
**PO Box 1154, Napier 4110**
**Mobile 027 440 5990 Email info@eam.co.nz**

Report prepared by:

**Karen Toulmin (BSc)**
Senior Environmental Scientist
EAM NZ Limited

Report reviewed by:

**Jason Strong (MSc)**
Principal Environmental Scientist
EAM NZ Limited

EAM
ENVIRONMENTAL
CONSULTANTS

# TABLE OF CONTENTS

# 1 INTRODUCTION

EAM NZ Limited (EAM) has been engaged by TW GROUP to undertake a Detailed Site Investigation (DSI), at 99a Stanley Road, Gisborne (hereon in referred to as the Site). It is our understanding that the site is proposed for residential re-development.

This DSI has been undertaken to provide a contamination assessment of the Site and to evaluate human health risks at the Site. A phased approach has been adopted for this investigation with an initial investigation, assembling background information to identify potential sources of contamination from past and present activities. This information is then used to develop a conceptual Site model and investigation strategy.

This report provides the following information:

- Background information.
- Site history.
- A conceptual Site model.
- Site visit and sampling
- Laboratory results.
- Conclusions and recommendations.

This investigation has been carried out in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES).

## 1.1 SUITABLY QUALIFIED ENVIRONMENTAL PRACTITIONERS

EAM are Suitably Qualified and Experienced Practitioners (SQEP) in the field of contaminated sites. We offer 20+ years' experience in the contaminated site and environmental science fields. EAM routinely carry out contaminated land assessments in both the North and South Islands over many different Council jurisdictions.

Jason Strong (Principle Environmental Scientist - MSc Environmental Science1st Class)

Jason has undertaken literally hundreds of contaminated site assessments and remediation over the past 15 years. He has an MSc in Environmental Science where his thesis was based around trace metal contamination of soils/sediment.

Karen Toulmin (Senior Environmental Scientist – BSc Environmental Science)

Karen has 8 years' experience in contaminated land assessments and remediation, in both Australia and New Zealand.

## 1.2 SCOPE

The following scope of work was completed:

- Review of available information from Gisborne District Council, namely, the Listed Land Use Register (LLUR), historical aerial photographs, and available environmental reports.
- Review of the environmental setting of the site.
- Collection of surface soil samples across the site.
- Analysis of soil samples at an accredited laboratory for:
    - Heavy metals
- Preparation of a DSI report, including presentation and interpretation of results in accordance with the requirements of the NESCS and with the current 2021 edition of the MfE Contaminated Land Management Guidelines No. 1 and No. 5.

## 1.3 LIMITATIONS

This report: has been prepared by EAM for TW GROUP and may only be used and relied on by Gisborne District Council for the purpose agreed between EAM and TW GROUP as set out in section 1.1 of this report. EAM otherwise disclaims responsibility to any person other than TW GROUP arising in connection with this report. EAM also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by EAM in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. EAM has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by EAM described in this report (refer section(s) 1.3 of this report). EAM disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the site conditions, such as the location of buildings, services, and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. EAM does not accept responsibility arising from, or in connection with, any change to the site conditions. EAM is also not responsible for updating this report if the site conditions change.

EAM has prepared this report based on information provided TW GROUP and others who provided information to EAM (including Government authorities), which EAM has not independently verified or checked beyond the agreed scope of work. EAM does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Notwithstanding the Report Limitations, we confirm that Gisborne District Council can rely on this report for the purposes of determining compliance with the NES guidelines with respect to the development identified in this assessment.

### 1.4 ASSUMPTIONS

EAM has made the following assumptions during the preparation of this report:

- Information obtained from third parties and TW GROUP is complete and accurate.
- The observed and inferred conditions are representative of the actual conditions associated with HAIL sites and / or other sites not directly assessed.
- That the future land use of the site will remain residential.

## 2 SITE DETAILS

### 2.1 SITE DESCRIPTION

The Site is located at 99a Stanley Road, Gisborne. The legal descriptions are presented here.

TABLE 1. SITE DETAILS

| | |
|---|---|
| Address | 99a Stanley Road, Te Hapara |
| Valuation Number | 853065500 |
| Legal Descriptions | Lot 1 DP 5799 |
| Land area | 0.159 ha |
| Land Use | Residential |

Figure 1 and 2 of Appendix A details the current site boundaries and the proposed development scheme plan.

## 3 ENVIRONMENTAL SETTING

### 3.1 TOPOGRAPHY

The site is in a residential zoned area. The topography of the site is low gradient flat land.

### 3.2 SOIL

Soils at the site are described by Manaaki Whenua[1] (2019) as well drained recent soils. Recent soils are weakly developed with a distinct topsoil, but a weak or absent B horizon. They typically occur on alluvial floodplains and young land surfaces. These soils are typical of low-lying areas.

The Manaaki Whenua, Landcare Research S map portal describes the soil at the sites as Fere_40 (100) %, which is a deep, well drained loam over sand.

---

[1] Manaaki Whenua- Landcare Research 2019. S-map - New Zealand's national digital soil map. 10.7931/L1WC7

### 3.3 HYDROGEOLOGY

Groundwater in the area is sourced from the Te Hapara Sands Aquifer, a shallow sand aquifer that can be encountered just below the topsoil. The aquifer extends up to 20 metres thick in places and forms an unconfined to confined shallow water table aquifer. This aquifer extends inland for approximately 5 km from the coast. The Sands aquifer becomes confined by river silts inland, with sands interfinger with Waipaoa gravels and shallow fluvial deposits. The permeability of the aquifer decreases to the southwest, with the silt content of the sand increasing towards the Waipaoa Channel. Water takes within the aquifer range from 45- 1850m3/day, with variable water quality. Seasonal water level fluctuations tend to be within 0.5-1 metres; therefore, surface pumps are usually sufficient to extract water.

### 3.4 SURFACE WATER

The nearest surface waterways are the Waikanae Creek and the Taruheru River.

The Waikanae Creek is located approximately 500m south of the site at its closest point. The Waikanae Creek drains easterly, taking surface water from Matawhero, Makaraka and Awapuni areas before eventuating in the Turanganui River, approximately 3km east of the site.

The Taruheru River is located north and north-east of the site, approximately 2km north-east of the site at its closest point. It commences in the hills of Waihirere and drains surface water to the east where it joins the Waimata River and flows into the Pacific Ocean.

## 4 PROPERTY HISTORY

A desktop study was undertaken to gain an understanding of the history of the site. The review looks to determine potential contaminants which may be present at the site because of past and present land uses. The following information was sourced to establish the history of the site:

- Gisborne District Council Property Search
- Historical Aerial Photographs
- HAIL review
- Site Visit

### 4.1 GISBORNE DISTRICT COUNCIL PROPERTY SEARCH

A review of Gisborne District Council Property records found the following documents on file:

| BUILDING CONSENT | | |
|---|---|---|
| DATE | CONSENT/PERMIT | DESCRIPTION |
| 1973 | F12078 | Erect a dwelling. |
| 1973 | 6157 | Application for plumbing and drainage work. |

No files referring to potentially contaminating activities were found for this site.

### 4.2 HISTORICAL AERIAL PHOTOGRAPHS

Historical aerial photographs of the site, from 1942 through to 2023, were sourced from Retrolens, Google earth, Google maps and Gisborne District Council. Aerial photographs for the years 1942, 1948, 1951, 1966, 1977, 1988, 2007, 2011, 2017 and 2023 942,1951, 1962, 1976, 1988, 2013 and 2022 are presented in Appendix C.

The earliest available imagery is from 1942, sourced from Retrolens and shows the site as a residential section, containing a very large dwelling, likely two stories high, based on multiple roof peaks. A garage is located on the north-west boundary. At this time, the neighbouring properties to the south and north of the site are part of the property.

The site remains in this configuration until a time between 1951 and 1966, when it appears that the north-eastern garden is subdivided from the site, forming 99 Stanley Road. A small square shaped dwelling, and two sheds occupy the neighbouring property at 99 Stanley Rd.

Imagery from 1977 shows significant changes to the site, with the large dwelling replaced with another dwelling and shed. This new dwelling is much smaller in size, L-shaped and appears single story. A shed is present on the north-western boundary.

Imagery from 1988 shows the southern area of the original site subdivided, and developed into a block of units, becoming 497 Childers Road.

No significant changes are noted to the site through to the present day.

## 4.3 HAZARDOUS ACTIVITIES AND INDUSTRIES LIST

In accordance with Appendix C: Hazardous Activities and Industries List (HAIL) of the MfE NES for Assessing and Managing Contaminants in Soil to Protect Human Health, the site is considered HAIL under:

*Section I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.*

A large double story dwelling was present on this site from at least 1942, before being replaced with a new, single-story dwelling in 1973 (see property files). The original dwelling, located on the site from at least 1942 was most likely painted with lead-based paints. The second, and existing dwelling on the site was constructed in 1973. White lead was banned in paint in NZ from 1965 suggesting the unlikely use of lead-based paint on the existing dwelling.

Lead based paint contributes to soil contamination through weathering, sanding, and redecoration.

## 4.4 SITE VISIT

A site visit was completed on 5th September 2023. The following observations were made:

- The site is a residential section comprising a single dwelling, and garage.
- The dwelling is of painted weatherboard construction with a tiled roof. It has aluminium windows. Some asbestos is present in the eaves, and as exterior cladding on the north facing porch.
- A garage is located on the central, western boundary adjacent to the dwelling. It is constructed of blockwork with a tiled roof.
- Sealed driveway extends from Stanley Road to the dwelling and garage.
- Grassed and garden areas are present along the eastern entranceway from Stanley Road, on the northern side of the dwelling, and a small area on the western boundary.

No visual or olfactory evidence of contamination or contaminating activities were observed during the site visit. Site photographs are presented in Appendix C.

# 5 CONCEPTUAL SITE MODEL

## 5.1 RATIONALE

The overall rationale for the site investigation was to determine whether historical activities on the Site may have caused soil contamination that would affect the proposed residential land use. The following is an analysis of potential contaminants, receptors, and pathways between potentially contaminated soils, and the proposed residential land use.

### 5.1.1 HAZARDOUS SUBSTANCES AND POTENTIAL CONTAMINANTS OF CONCERN

For the purposes of this investigation, the following contaminants were considered.

- Metals

Metals occur naturally in the soil environment from the process of weathering of parent materials. Soils may become contaminated by the accumulation of metals and through leaded paints, land application of fertilisers, animal manures, sewage, pesticides, leaching from treated timber and wastewater irrigation. Most metals do not undergo microbial or chemical degradation hence, their total concentration in soils persists forever. Metals are associated with human illness, particularly nervous system damage from long term exposure in humans.

The main source of metal contamination within residential sections is lead based paint. The domestic paints available today contain only very small quantities of lead and are unlikely to be a hazard. However, the lead content of paints used in the past was generally much higher. When lead-based paint is sanded or power blasted during redecoration, high concentrations of lead dust become widely dissipated. Dust particles are deposited on surrounding surfaces, and in the soil, and may affect those exposed to dust and fragments long after the work is completed.

### 5.1.2 POTENTIALLY RELEVANT SENSITIVE HUMAN AND ECOLOGICAL RECEPTORS

The site is proposed for residential land use (10% produce), which is considered one of the most sensitive of land uses. The MFEs National Environmental Standard (NESCS) for soil contaminants, considers that residential landowners may use the land for activities such as vegetable gardening or fruit trees. These activities pose a risk to the consumer/landowner's where contaminated soils are involved in an exposure pathway.

The following potential receptors were identified as being relevant to the Site:

- Earthworks, construction, maintenance, and excavation contractors who may encounter potentially contaminated soil during the proposed works via inhalation (dusts).
- Future residents at the Site via inhalation (dusts) and/or ingestion of contaminated soil.

### 5.1.3 EXPOSURE PATHWAYS

A human health risk can only occur when there is a direct link between contaminant source and receptor. Potential complete pathways for this Site may include:

- Dermal (skin) contact with soil, for gardening, construction.
- Direct contact and inhalation of dusts and soil during construction and site works.
- Consumption of foods grown in contaminated soils.
- Consumption of soils, particularly by small children.

# 6 FIELD INVESTIGATION

## 6.1 RATIONALE OF SAMPLE COLLECTION

Sampling locations across the Site were established using reference to the "Contaminated Land Guidelines No. 5" (MfE 2021). These guidelines set out (in Table B1; p91), indicate the *"number of samples required to detect hotspot with 95 percent confidence"*.

Eight samples were taken systematically across the site, with the locations presented in Figure 3, Appendix A.

Samples were collected using a 150mm soil augur and collected from the 0-150mm depth interval. One duplicate sample was collected during sampling for statistical accuracy and precision of results.

Samples were collected directly into laboratory supplied containers and were placed in a chilly bin with ice packs for transport. Samples were couriered to an IANZ accredited laboratory (Hills Laboratories) under standard chain of custody procedures.

## 6.2 SITE LITHOLOGY

Site soils were observed to be consistent across the site as consisting of dark brown topsoil.

### 6.2.1 FIELD QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Quality Assurance and Quality Control procedures undertaken during sampling included the following:

- Changing of disposable gloves after each sample.
- Decontamination and rinsing of augur between each sample.
- Collection of soil samples in new, clean, appropriately labelled sample bags and jars.
- 10% Duplicate analysis (collection of one duplicate).
- Use of chain of custody procedures and forms.
- Use of IANZ accredited laboratories with in-house QA/QC procedures for the analyses requested.

# 7 ASSESSMENT CRITERIA

The following soil assessment criteria have been selected for the site.

## 7.1 THE NATIONAL ENVIRONMENTAL STANDARD FOR ASSESSING AND MANAGING CONTAMINANTS IN SOIL TO PROTECT HUMAN HEALTH (NESCS)

The NESCS sets national standards for contaminants in soil to protect human health. It contains a national set of soil contaminant standards (SCS) for 12 priority contaminants for five standard land use scenarios. The land use category selected for this investigation was Residential (10% Produce) as described in the NES CS User Guide.

## 7.2 THE NATIONAL ENVIRONMENTAL PROTECTION MEASURE

In the absence of New Zealand specific risk-based human health criteria for beryllium, nickel and zinc, the Australian National Environment Protection Measure 2013 (NEPM) guidelines have been adopted for this investigation. The intention of the NEPM is to enable safe use of contaminated land to ensure that contaminated land is appropriately assessed prior to development. The NEPM covers a range of land uses. For the purposes of this assessment, the NEPM Health-based Investigation Level A (Residential land use) have been selected based on the land use and Site attributes.

### 7.3 BACKGROUND CONCENTRATIONS OF HEAVY METALS

In the absence of available published data for uncontaminated background soils in the Gisborne region, a control sample was collected. The control sample was collected from the Gisborne A & P Showgrounds. The sample was collected from an undisturbed and undeveloped area of grass. If concentrations of contaminants are found to be at or less than typical background concentrations, then the NES CS does not apply.

### 7.4 ECOLOGICAL SOIL GUIDELINE VALUES

To assess potential risk to environmental receptors, the criteria for Residential / Recreational area developed for protection of ecological receptors from the updated, Development of soil guideline values for the protection of ecological receptors (Eco-SGVs): Technical Document (Manaaki Whenua Landcare Research, 2019) were used. Criteria were selected assuming a typical soil, aged contamination source, and a residential land use.

## 8 ANALYTICAL RESULTS

The following sections discusses the analytical results by analyte and compares against the adopted human health guideline criteria. In this case, the most appropriate SCS is likely to be those for the NES land use scenario of Residential (10% Produce). The NES description of this land use is as follows:

*“Standard residential Lot, for single dwelling sites with gardens, including homegrown produce consumption (10 percent)”.*

The analytical results are summarised in Table 1 in Appendix D, along with the laboratory reports. The results of analysis have been compared directly against appropriate (where available) Soil Contaminant Standards (SCS) from the NES Priority contaminants list (MfE, 2012).

### 8.1 BACKGROUND SOIL CONCENTRATIONS

Soils at the site were compared with the background soil concentrations of a control sample, collected from parkland within the A & P Showgrounds in Gisborne by EAM. The soil here is considered unlikely to have been exposed to potentially contaminating activities.

The control sample shows very low concentrations of all metals. The sample results which were found to be “at or about the value” of the concentrations of the control sample were considered background.

All samples collected at the site exceed the Gisborne control sample value of 38mg/kg for lead. Concentrations range from 60mg/kg to 500mg/kg.

Zinc concentrations exceed the Gisborne control sample value of 56mg/kg in all sample locations, ranging from 71mg/kg to 480 mg/kg.

Mild chromium, copper, cadmium, and nickel exceedance were reported in sample locations #6, #7 and #8, although these could be considered background in value.

## 8.2 METALS/METALLOIDS

Soil metal analysis was compared with the NES standards for Residential land use (10% produce). Sample locations #2 and #3, #4, #7 and #8 reported exceedance of the NES residential standards of 210 mg/kg for lead, reporting concentrations of 300mg/kg, 300mg/kg, 290mg/kg, 500mg/kg, and 250 mg/kg, respectively.

All other samples reported concentrations of metals within the NES standards.

## 8.3 ECOLOGICAL SOIL GUIDELINE VALUES

Sample location #7 exceeds the Landcare Updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco-SGVs) for Zinc (300mg/kg), reporting a concentration of 480 mg/kg.

## 8.4 QUALITY ASSURANCE AND QUALITY CONTROL

### 8.4.1 FIELD DUPLICATES

Duplicate analysis was completed as a means for determining uncertainty, accuracy, and precision of laboratory analysis. One duplicate sample was collected during sampling at the same sample location and depth interval as Sample #1 and labelled as #1a.

The RPD between samples was calculated according to the following formula:

$$RPD = \frac{(Result\ No.1 - Result\ No.2)\ x\ 100}{(Mean\ of\ result\ No.1 + result\ No.2)}$$

The typical data quality objective is for an RPD to be within 30 – 50% (MfE, 2021). The RPD results were reported within the data quality objective. Mean RPD was reported as 9.6%. RPD calculations are presented in Appendix D.

## 8.5 RISK ASSESSMENT

A hazard – pathway – receptor pollution linkage is considered to aid assessment of risk associated with results of the site investigation.

For contaminated soils to pose a risk to a receptor, a complete pathway must exist between the contamination source and the identified receptor(s). If there is an incomplete pathway, then there is no risk. In this instance, there is a risk to human health across the site to lead exposure.

# 9 CONCLUSIONS AND RECOMMENDATIONS

EAM was engaged to undertake a Detailed Site Investigation of 99a Stanley Road, Gisborne. The objectives of the investigation were to evaluate:

1. The type, extent, and level of contamination, if any, within the proposed subdivision sites.
2. Whether contaminants of concern identified present an unacceptable risk to human health or identified environmental receptors.
3. Whether the soils remaining on-site are suitable for the proposed end use.

A detailed site history was undertaken to review the historical land use at the site. The site has been a residential section since at least 1942.

This investigation identified one potential site activities included on the HAIL (Ministry for the Environment, 2011):

- Section I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment – This was considered based on the potential for lead-based paint which was likely used on the buildings to contaminate site soils.

Due to the potential HAIL activities at the site, eight soil samples were collected systematically across the site and analysed for heavy metals.

Laboratory analysis results and comparison with relevant NZ guidelines indicate that:

- Lead and zinc concentrations were reported well above regional background concentrations for the Gisborne area, when compared with a control sample.
- Sample locations #2 and #3, #4, #7 and #8 reported exceedance of the NES residential standards of 210 mg/kg for lead, reporting concentrations of 300mg/kg, 300mg/kg, 290mg/kg, 500mg/kg, and 250 mg/kg, respectively.
- Sample location #7 exceeds the Landcare Updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco-SGVs) for Zinc (300mg/kg), reporting a concentration of 480 mg/kg.
- The RPD results were reported within the data quality objective.

Elevated metals of lead are above NES residential standards, thus there is a human health risk unless addressed through remediation. While further investigation is required, we would expect remediation to be possible and for the site to be redeveloped for residential purposes. We consider it appropriate for a condition of consent to be imposed to require the preparation of a Remedial Action Plan, including validation procedures, to be implemented prior to site works.

Based on the exceedance of background soil concentrations, and ecological soil guideline values, off-site disposal options, should they be required as part of development will require planning, consideration, and possible resource consent approval.

Any soils exceeding uncontaminated background values, have a degree of anthropogenic contamination. Should offsite disposal be required, this can only be through resource consent for an alternative land use; or disposed to appropriate landfill facility. Soils may be required to go to a licenced A Class landfill facility.

The best option is for excavated soils to be retained on site, in either noise bund, or garden areas, however we appreciate that due to the density of development, this option is unlikely. Options to enable soils to remain on site would be to pile foundations for the new buildings rather than excavate for concrete rafts. Alternatively, topsoil could be geotechnically engineered to create structurally compliant building platforms.

This investigation confirms that the site is highly likely to pose a risk to human health, and remediation will be required to ensure its suitability for the proposed development.

# 10 REFERENCES

MfE 2021 Contaminated Land Management Guidelines No.1 Reporting on Contaminated Sites in New Zealand. Ministry for the Environment.

MfE 2012 Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Ministry for the Environment.

MfE 2021 Contaminated Land Management Guidelines No.5; Site Investigation and Analysis of Soil. Ministry for the Environment.

Hawkes Bay Region: Background Soil Concentrations for Managing Soil Quality, Landcare Research, 2014.

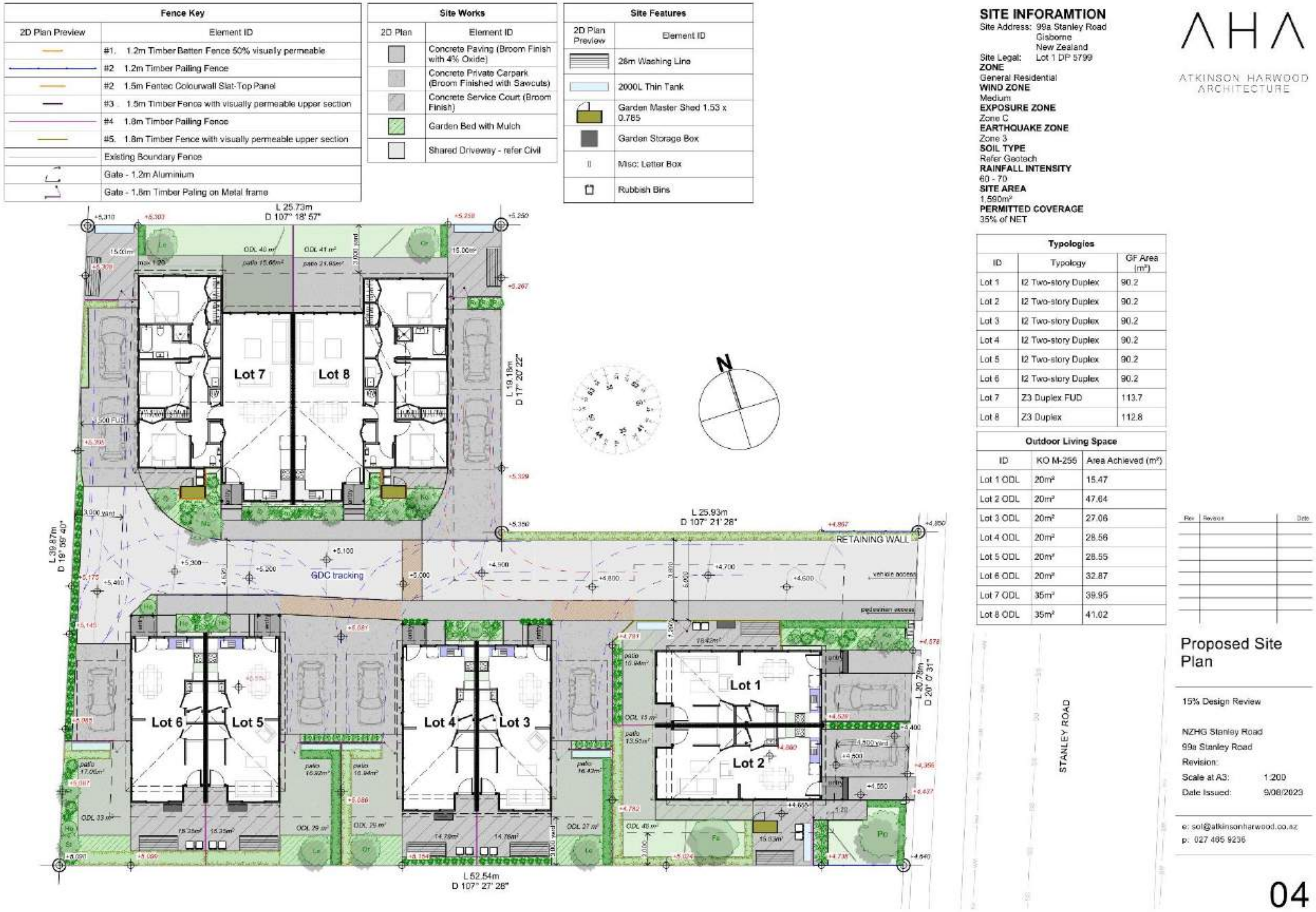
https://soils-maps.landcareresearch.co.nz (2020)

NZGS. (2005). New Zealand Geotechnical Society December 2005 - Guidelines for the classification and description of soil and rock for engineering purposes.

# APPENDIX A-FIGURES

FIGURE 1. SITE LAY OUT PLAN FOR 99a STANLEY ROAD, GISBORNE

FIGURE 2. DRAFT SCHEME PLAN FOR DEVELOPMENT



| Fence Key | |
|---|---|
| 2D Plan Preview | Element ID |
| — | #1. 1.2m Timber Batten Fence 50% visually permeable |
| — | #2 1.2m Timber Pailing Fence |
| — | #2 1.5m Fentec Colourwall Slat-Top Panel |
| — | #3 . 1.5m Timber Fence with visually permeable upper section |
| — | #4 1.8m Timber Pailing Fence |
| — | #5. 1.8m Timber Fence with visually permeable upper section |
| — | Existing Boundary Fence |
| | Gate - 1.2m Aluminium |
| | Gate - 1.8m Timber Paling on Metal frame |

| Site Works | |
|---|---|
| 2D Plan | Element ID |
| ▨ | Concrete Paving (Broom Finish with 4% Oxide) |
| ▨ | Concrete Private Carpark (Broom Finished with Sawcuts) |
| ▨ | Concrete Service Court (Broom Finish) |
| 🟩 | Garden Bed with Mulch |
| ☐ | Shared Driveway - refer Civil |

| Site Features | |
|---|---|
| 2D Plan Preview | Element ID |
| ▤ | 28m Washing Line |
| ▭ | 2000L Thin Tank |
| ▬ | Garden Master Shed 1.53 x 0.765 |
| ■ | Garden Storage Box |
| ▯ | Misc: Letter Box |
| ▯ | Rubbish Bins |

**SITE INFORAMTION**
Site Address: 99a Stanley Road
Gisborne
New Zealand
Site Legal: Lot 1 DP 5799
**ZONE**
General Residential
**WIND ZONE**
Medium
**EXPOSURE ZONE**
Zone C
**EARTHQUAKE ZONE**
Zone 3
**SOIL TYPE**
Refer Geotech
**RAINFALL INTENSITY**
60 - 70
**SITE AREA**
1,590m²
**PERMITTED COVERAGE**
35% of NET

| Typologies | | |
|---|---|---|
| ID | Typology | GF Area (m²) |
| Lot 1 | I2 Two-story Duplex | 90.2 |
| Lot 2 | I2 Two-story Duplex | 90.2 |
| Lot 3 | I2 Two-story Duplex | 90.2 |
| Lot 4 | I2 Two-story Duplex | 90.2 |
| Lot 5 | I2 Two-story Duplex | 90.2 |
| Lot 6 | I2 Two-story Duplex | 90.2 |
| Lot 7 | Z3 Duplex FUD | 113.7 |
| Lot 8 | Z3 Duplex | 112.8 |

| Outdoor Living Space | | |
|---|---|---|
| ID | KO M-256 | Area Achieved (m²) |
| Lot 1 ODL | 20m² | 15.47 |
| Lot 2 ODL | 20m² | 47.64 |
| Lot 3 ODL | 20m² | 27.06 |
| Lot 4 ODL | 20m² | 28.56 |
| Lot 5 ODL | 20m² | 28.55 |
| Lot 6 ODL | 20m² | 32.87 |
| Lot 7 ODL | 35m² | 39.95 |
| Lot 8 ODL | 35m² | 41.02 |

AHA
ATKINSON HARWOOD
ARCHITECTURE

| Rev | Revision | Date |
|---|---|---|

Proposed Site Plan

15% Design Review

NZHG Stanley Road
99a Stanley Road
Revision:
Scale at A3: 1:200
Date Issued: 9/08/2023

e: sol@atkinsonharwood.co.nz
p: 027 485 9236

04

FIGURE 3. SAMPLE LOCATIONS SHOWING NES EXCEEDANCE IN RED

# APPENDIX B- AERIAL PHOTOGRAPHY

1942- Source, Retrolens

1948- Source, Retrolens

1951- Source, Retrolens

1966- Source, Retrolens

1977- Source, Retrolens

1988- Source, Retrolens

2007- Source, Google Earth

2011- Source, Google Earth

2022- Source, GDC

# APPENDIX C- SITE PHOTOGRAPHS

**Top.** Front yard and eastern facing side of dwelling**. Middle.** Southern boundary**. Bottom.** Western boundary of site behind dwelling.

**Top.** Asbestos construction on porch **Middle.** Northern side of property. **Bottom.** North facing side of house.

# APPENDIX D- LABORATORY ANALYSIS AND REPORTS

## TABLE 1. SOIL METAL RESULTS (mg/kg)

| Sample Name: | Arsenic mg/kg | Cadmium mg/kg | Chromium mg/kg | Copper mg/kg | Lead mg/kg | Nickel mg/kg | Zinc mg/kg |
|---|---|---|---|---|---|---|---|
| 99a Stanley #1 05-Sep-2023 | 6 | 0.14 | 6 | 6 | 63 | 6 | 57 |
| 99a Stanley #1a 05-Sep-2023 | 6 | 0.15 | 7 | 8 | 60 | 6 | 71 |
| 99a Stanley #2 05-Sep-2023 | 7 | 0.16 | 9 | 8 | 300 | 9 | 146 |
| 99a Stanley #3 05-Sep-2023 | 9 | 0.2 | 9 | 12 | 300 | 9 | 270 |
| 99a Stanley #4 05-Sep-2023 | 9 | 0.27 | 8 | 10 | 290 | 9 | 300 |
| 99a Stanley #5 05-Sep-2023 | 6 | 0.1 | 5 | 8 | 120 | 5 | 107 |
| 99a Stanley #6 05-Sep-2023 | 8 | 0.2 | 7 | 23 | 210 | 8 | 280 |
| 99a Stanley #7 05-Sep-2023 | 9 | 0.63 | 14 | 47 | 500 | 11 | 480 |
| 99a Stanley #8 05-Sep-2023 | 8 | 0.38 | 14 | 20 | 250 | 15 | 210 |
| isborne Uncontaminated Background Soil [1] | 4 | 0.21 | 8 | 9 | 38 | 7 | 56 |
| NES Residential [2] | 20 | 3 | 460 | >10,000 | 210 | | |
| NEPM Residential [3] | | | | | | 400 | 7400 |
| Landcare Eco SGV's [4] | 60 | 12 | 390 | 240 | 900 | NGV | 300 |

🟦 Exceeds Gisborne Uncontaminated Background Soil, Control sample collected Gisborne A & P Showgrounds.

123 Exceeds Ecological SGV’s

RED Exceeds NES Residential

[1]-Gisborne Control sample. Collected from Gisborne A & P showgrounds in an undeveloped area.

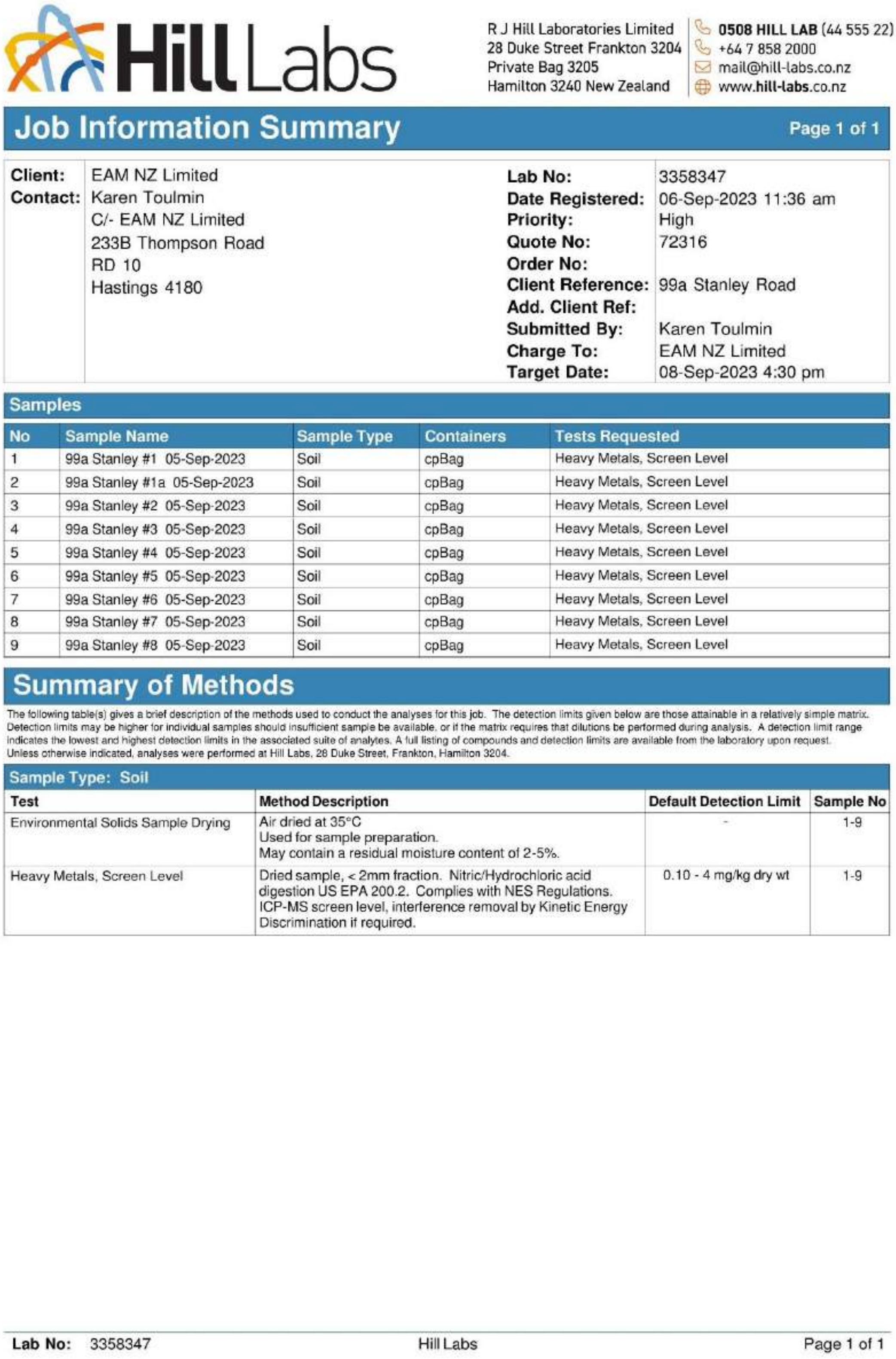
[2] -MfE, June 2011. Resource Management (National Environmental Standard for Assessing and managing contaminants in Soil to Protect Human Health) Regulations 2011

[3]-National Environmental Protection (Assessment of Site Contamination) Measure, 1999.

[4] Landcare updated Development of Soil Guideline Values for Protection of Ecological Receptors (Eco SGVs). Assumes residential/recreational area, aged source, typical soil

## TABLE 2. RELATIVE PERCENTILE DIFFERENCES

| Sample Name: | Arsenic mg/kg | Cadmium mg/kg | Chromium mg/kg | Copper mg/kg | Lead mg/kg | Nickel mg/kg | Zinc mg/kg |
|---|---|---|---|---|---|---|---|
| 99a Stanley #1 05-Sep-2023 | 6 | 0.14 | 6 | 6 | 63 | 6 | 57 |
| 99a Stanley #1a 05-Sep-2023 | 6 | 0.15 | 7 | 8 | 60 | 6 | 71 |
| Mean | 6 | 0 | 7 | 7 | 62 | 6 | 64 |
| RPD (%) | 0 | -7 | -15 | -29 | 5 | 0 | -22 |



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Private Bag 3205
Hamilton 3240 New Zealand

**0508 HILL LAB** (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.**hill-labs**.co.nz

## Job Information Summary

Page 1 of 1

| | | | |
|---|---|---|---|
| **Client:** | EAM NZ Limited | **Lab No:** | 3358347 |
| **Contact:** | Karen Toulmin | **Date Registered:** | 06-Sep-2023 11:36 am |
| | C/- EAM NZ Limited | **Priority:** | High |
| | 233B Thompson Road | **Quote No:** | 72316 |
| | RD 10 | **Order No:** | |
| | Hastings 4180 | **Client Reference:** | 99a Stanley Road |
| | | **Add. Client Ref:** | |
| | | **Submitted By:** | Karen Toulmin |
| | | **Charge To:** | EAM NZ Limited |
| | | **Target Date:** | 08-Sep-2023 4:30 pm |

### Samples

| No | Sample Name | Sample Type | Containers | Tests Requested |
|---|---|---|---|---|
| 1 | 99a Stanley #1 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 2 | 99a Stanley #1a 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 3 | 99a Stanley #2 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 4 | 99a Stanley #3 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 5 | 99a Stanley #4 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 6 | 99a Stanley #5 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 7 | 99a Stanley #6 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 8 | 99a Stanley #7 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |
| 9 | 99a Stanley #8 05-Sep-2023 | Soil | cpBag | Heavy Metals, Screen Level |

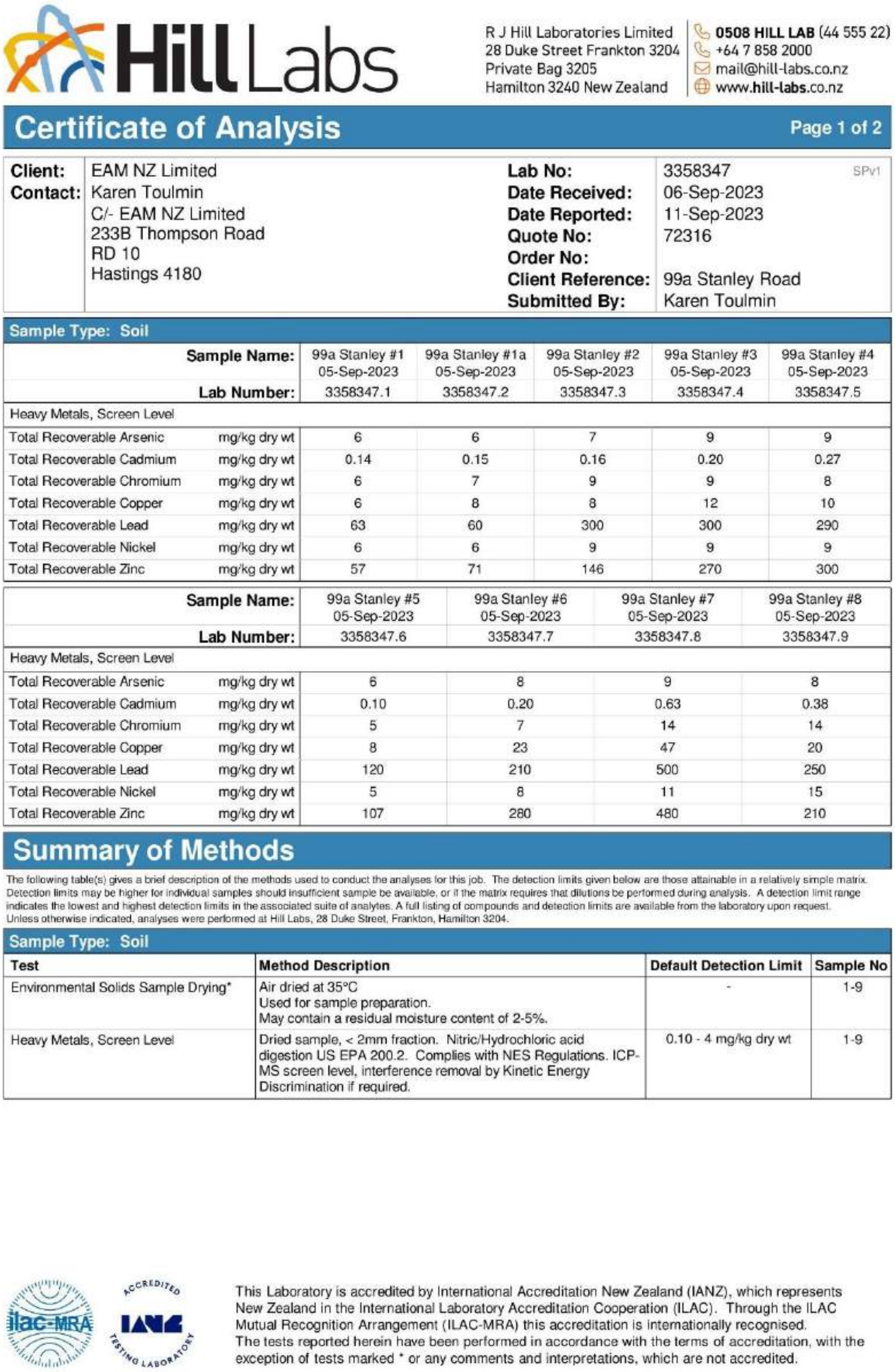
## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

### Sample Type: Soil

| Test | Method Description | Default Detection Limit | Sample No |
|---|---|---|---|
| Environmental Solids Sample Drying | Air dried at 35°C<br>Used for sample preparation.<br>May contain a residual moisture content of 2-5%. | - | 1-9 |
| Heavy Metals, Screen Level | Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. | 0.10 - 4 mg/kg dry wt | 1-9 |

**Lab No:** 3358347 Hill Labs Page 1 of 1



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www.hill-labs.co.nz

# Certificate of Analysis

Page 1 of 2

| | | | |
|---|---|---|---|
| **Client:** | EAM NZ Limited | **Lab No:** | 3358347 SPv1 |
| **Contact:** | Karen Toulmin<br>C/- EAM NZ Limited<br>233B Thompson Road<br>RD 10<br>Hastings 4180 | **Date Received:** | 06-Sep-2023 |
| | | **Date Reported:** | 11-Sep-2023 |
| | | **Quote No:** | 72316 |
| | | **Order No:** | |
| | | **Client Reference:** | 99a Stanley Road |
| | | **Submitted By:** | Karen Toulmin |

**Sample Type: Soil**

| | **Sample Name:** | 99a Stanley #1 05-Sep-2023 | 99a Stanley #1a 05-Sep-2023 | 99a Stanley #2 05-Sep-2023 | 99a Stanley #3 05-Sep-2023 | 99a Stanley #4 05-Sep-2023 |
|---|---|---|---|---|---|---|
| | **Lab Number:** | 3358347.1 | 3358347.2 | 3358347.3 | 3358347.4 | 3358347.5 |
| Heavy Metals, Screen Level | | | | | | |
| Total Recoverable Arsenic | mg/kg dry wt | 6 | 6 | 7 | 9 | 9 |
| Total Recoverable Cadmium | mg/kg dry wt | 0.14 | 0.15 | 0.16 | 0.20 | 0.27 |
| Total Recoverable Chromium | mg/kg dry wt | 6 | 7 | 9 | 9 | 8 |
| Total Recoverable Copper | mg/kg dry wt | 6 | 8 | 8 | 12 | 10 |
| Total Recoverable Lead | mg/kg dry wt | 63 | 60 | 300 | 300 | 290 |
| Total Recoverable Nickel | mg/kg dry wt | 6 | 6 | 9 | 9 | 9 |
| Total Recoverable Zinc | mg/kg dry wt | 57 | 71 | 146 | 270 | 300 |

| | **Sample Name:** | 99a Stanley #5 05-Sep-2023 | 99a Stanley #6 05-Sep-2023 | 99a Stanley #7 05-Sep-2023 | 99a Stanley #8 05-Sep-2023 |
|---|---|---|---|---|---|
| | **Lab Number:** | 3358347.6 | 3358347.7 | 3358347.8 | 3358347.9 |
| Heavy Metals, Screen Level | | | | | |
| Total Recoverable Arsenic | mg/kg dry wt | 6 | 8 | 9 | 8 |
| Total Recoverable Cadmium | mg/kg dry wt | 0.10 | 0.20 | 0.63 | 0.38 |
| Total Recoverable Chromium | mg/kg dry wt | 5 | 7 | 14 | 14 |
| Total Recoverable Copper | mg/kg dry wt | 8 | 23 | 47 | 20 |
| Total Recoverable Lead | mg/kg dry wt | 120 | 210 | 500 | 250 |
| Total Recoverable Nickel | mg/kg dry wt | 5 | 8 | 11 | 15 |
| Total Recoverable Zinc | mg/kg dry wt | 107 | 280 | 480 | 210 |

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

**Sample Type: Soil**

| Test | Method Description | Default Detection Limit | Sample No |
|---|---|---|---|
| Environmental Solids Sample Drying* | Air dried at 35°C<br>Used for sample preparation.<br>May contain a residual moisture content of 2-5%. | - | 1-9 |
| Heavy Metals, Screen Level | Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. | 0.10 - 4 mg/kg dry wt | 1-9 |

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 06-Sep-2023 and 11-Sep-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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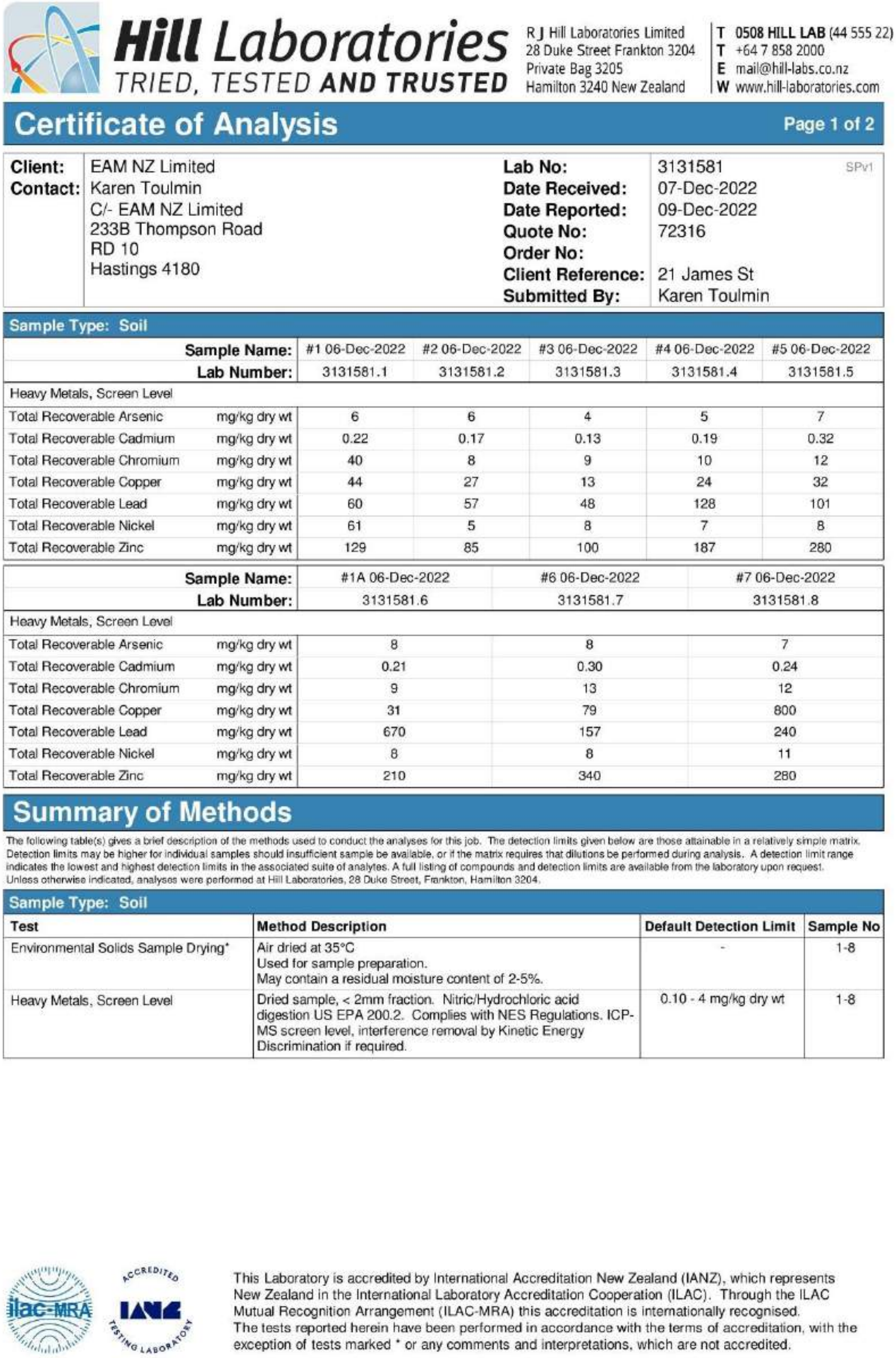
K Harrison

Kim Harrison MSc
Client Services Manager - Environmental



**Hill Laboratories**
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## Certificate of Analysis

Page 1 of 2

SPv1

| | | | |
|---|---|---|---|
| **Client:** | EAM NZ Limited | **Lab No:** | 3131581 |
| **Contact:** | Karen Toulmin<br>C/- EAM NZ Limited<br>233B Thompson Road<br>RD 10<br>Hastings 4180 | **Date Received:** | 07-Dec-2022 |
| | | **Date Reported:** | 09-Dec-2022 |
| | | **Quote No:** | 72316 |
| | | **Order No:** | |
| | | **Client Reference:** | 21 James St |
| | | **Submitted By:** | Karen Toulmin |

**Sample Type: Soil**

| **Sample Name:** | | #1 06-Dec-2022 | #2 06-Dec-2022 | #3 06-Dec-2022 | #4 06-Dec-2022 | #5 06-Dec-2022 |
|---|---|---|---|---|---|---|
| **Lab Number:** | | 3131581.1 | 3131581.2 | 3131581.3 | 3131581.4 | 3131581.5 |
| Heavy Metals, Screen Level | | | | | | |
| Total Recoverable Arsenic | mg/kg dry wt | 6 | 6 | 4 | 5 | 7 |
| Total Recoverable Cadmium | mg/kg dry wt | 0.22 | 0.17 | 0.13 | 0.19 | 0.32 |
| Total Recoverable Chromium | mg/kg dry wt | 40 | 8 | 9 | 10 | 12 |
| Total Recoverable Copper | mg/kg dry wt | 44 | 27 | 13 | 24 | 32 |
| Total Recoverable Lead | mg/kg dry wt | 60 | 57 | 48 | 128 | 101 |
| Total Recoverable Nickel | mg/kg dry wt | 61 | 5 | 8 | 7 | 8 |
| Total Recoverable Zinc | mg/kg dry wt | 129 | 85 | 100 | 187 | 280 |

| **Sample Name:** | | #1A 06-Dec-2022 | #6 06-Dec-2022 | #7 06-Dec-2022 |
|---|---|---|---|---|
| **Lab Number:** | | 3131581.6 | 3131581.7 | 3131581.8 |
| Heavy Metals, Screen Level | | | | |
| Total Recoverable Arsenic | mg/kg dry wt | 8 | 8 | 7 |
| Total Recoverable Cadmium | mg/kg dry wt | 0.21 | 0.30 | 0.24 |
| Total Recoverable Chromium | mg/kg dry wt | 9 | 13 | 12 |
| Total Recoverable Copper | mg/kg dry wt | 31 | 79 | 800 |
| Total Recoverable Lead | mg/kg dry wt | 670 | 157 | 240 |
| Total Recoverable Nickel | mg/kg dry wt | 8 | 8 | 11 |
| Total Recoverable Zinc | mg/kg dry wt | 210 | 340 | 280 |

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

**Sample Type: Soil**

| Test | Method Description | Default Detection Limit | Sample No |
|---|---|---|---|
| Environmental Solids Sample Drying* | Air dried at 35°C<br>Used for sample preparation.<br>May contain a residual moisture content of 2-5%. | - | 1-8 |
| Heavy Metals, Screen Level | Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. | 0.10 - 4 mg/kg dry wt | 1-8 |

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 09-Dec-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc
Client Services Manager - Environmental

# APPENDIX E- REMEDIAL ACTION PLAN

# REMEDIAL ACTION PLAN

## REMEDIAL AREAS

Based on the observations and results of the DSI, lead contamination was identified in sample location #2, #3, #4, #7, and #8 reporting concentrations of 300mg/kg, 300mg/kg, 290mg/kg, 500mg/kg, and 250 mg/kg, respectively.

EAM recommend a XRF investigation is completed to delineate the boundaries of soil contamination across the site. XRF is a handheld X-Ray Fluorescence (XRF) analyser used to measure metal concentrations within the soil. XRF provides fast, accurate, and non-destructive alloy identification and elemental analysis. It is considered highly accurate in relation with laboratory analysis.

XRF should be utilised to assess both the depth and lateral extent of contamination.

Establishment of depth and lateral contamination will provide approximate volumes of soil requiring remediation, and volumes of soil above uncontaminated background values.

## REMEDIATION OPTIONS ASSESSMENT

Options which may be considered feasible are as follows, although again, may be dependent on the volume of contaminated soil established.

1. In-situ vertical mixing of impacted material with underlying clean soil, and re-use.
2. Excavation for disposal to landfill.
3. A combination of 3 and 4.

As a rule of thumb, soil mixing is only considered feasible providing soil concentrations are within 2-3 times the acceptable concentrations set out by the NES. Based on the present findings, soil lead concentrations do not exceed 500 mg/kg and therefore may be acceptable to achieve sufficient dilution.

Excavation and disposal of contaminated material to landfill is the least preferred option due to cost and environmental impacts from haulage and use of landfill space, however where concentrations of lead contamination present are too high for mixing, then this is likely to be the only practical option.

## REMEDIAL CRITERIA

The proposed remedial assessment criteria for arsenic in a residential (10% produce) land use are shown in Table 1.

Table 1. Summary of Remedial Criteria

| CONTAMINANT | NES (mg/kg) |
|---|---|
| Lead | 210 |

## REMEDIAL ACTION PLAN

Prior to any remedial activities commencing, the SQEP will screen the surface soils at the site with a hand-held Olympus Vanta X-Ray Fluorescence spectrometer at the site to delineate the lateral extent of contamination. Depth analysis will be completed across the site by excavating augur holes to access deeper soils for screening. Boundaries will be marked. Approximate volumes of contaminated soil will be estimated, and recordings of lead concentrations will be taken to establish the best method of remedial action.

The following methodologies are proposed to remediate the site to National Environmental standards for Residential land use. The remedial works will be supervised by a Suitably Qualified Environmental Practitioner (SQEP) and will be completed in accordance with the earthwork's procedures and unexpected discovery of contamination protocols as discussed in this plan.

### *In situ vertical mixing of contaminated soil*

Should the XRF investigation find depth and concentrations of the contaminated material suitable for soil mixing, then the following procedures will be followed:

1. The SQEP will mark out the remedial area on the ground surface.
2. Soils will be blended during dry conditions, and not after recent heavy rain.
3. Soils in the remedial area will be blended using either a tractor towing a disc plough, or an excavator with a bucket large enough to achieve a cutting depth of at least 0.3 m bgl. The tractor or excavator will mix the soil in multiple directions until site soils are thoroughly mixed.
4. The SQEP will regularly check the mixed soils using the XRF. Mixing will continue until all soils achieve NES.
5. Upon completion of mixing, the SQEP will validate the remediated area on an approximate 2m x 2m grid using the XRF.
6. The SQEP will collect 10% validation samples for laboratory analysis.

### *Excavation and removal of contaminated soil to landfill.*

1. The SQEP will mark out the remedial areas on the ground surface
2. Machinery / vehicles will not enter the remedial zones.
3. The remedial areas will be excavated to their target depth as instructed by the SQEP. The SQEP will continually screen the base and sides of the excavation to ensure that remaining concentrations meet NES. Further excavation will be completed as required.
4. Material will be loaded directly into trucks, which will be covered for transportation to landfill.
5. Upon completion of excavation, the SQEP will map and record lead concentrations using XRF in a 2m x 2m grid pattern across the excavated area.
6. The SQEP will collect 10% validation samples for laboratory validation analysis.

## REMEDIAL PLAN-GENERAL

### *EARTHWORKS MANAGEMENT*

To ensure the site is effectively remediated, removed/ and tracked, a detailed earthworks management plan has been developed.

### *WASTE MANAGEMENT*

Contaminated soil excavated from the site and disposed of to an appropriate landfill facility, will be subject to leachate testing.

## *VALIDATION*

Sampling at the base and edges of the stripped areas is required to confirm that soil contamination has been removed, and that any remaining contamination levels are below the Soil contamination standards for Residential land use.

A detailed report will be prepared after contaminated soils have been removed/mixed and laboratory analysis has verified that validation samples across the site are within the acceptable standards. This Site Validation Report will confirm the adherence to the Site Remedial Action Plan. The report will detail the remedial actions and processes carried out, present photographs documenting site activities, soil sample locations and will include laboratory results.

## *HEALTH AND SAFETY*

This section relates only to those occupational health and safety issues resulting from the elevated levels of lead associated with site soils and does not cover general site working requirements. The following key Health and Safety precautions should be implemented:

1. All workers at the site should be made aware of the presence of elevated concentrations of metals.
2. A consideration of the elevated lead levels is the potential for the site works to generate dust. Dust generation increases the likelihood of direct skin contact, and ingestion through inhalation. Therefore, adherence to the following site working precautions is essential. Dust minimisation measures are required, including, but not limited to:
    - Ensuring earthworks are undertaken only during low wind conditions.
    - Installation of high mesh fencing around the perimeter of the site to prevent dust drift into neighbouring residential properties.
    - Use of appropriate dust filters in excavation machinery and closed in cab.
3. Personal Protective Equipment (PPE) is required, the minimum being:
    - Safety Vest and Safety boots
    - Gloves for soil handling
    - High quality ventilation mask
    - Goggles or safety glasses
    - First aid and eye wash kits should be available on site.
4. Good hygiene should always be observed:
    - Follow measures to avoid skin contact, inhalation, and ingestion
    - No eating, drinking of smoking during site remedial works
    - Thorough hand washing before eating, drinking, or smoking, prior to leaving site.
    - Changing of clothing on completion of daily site works prior to leaving the site.
5. Silt/Mud controls. To ensure mud is not spread onto public roads from vehicles and machinery, (including around the source site to avoid transfer of contamination), earthworks will only occur in dry weather.

## *UNEXPECTED DISCOVERY OF CONTAMINATION PROTOCOL*

Should unexpected contamination be encountered during site remedial works all site work must immediately stop, and the potential hazards must be assessed. Report the discovery to the SQEP or manager on site. Contamination may present as:

- Staining and/or discolouration of soil
- Refuse and/or debris such as brick, glass, rubble, timber, domestic waste
- Drums or underground storage tanks
- Odour, such as hydrocarbons, sewage or rotting material.

- Presence of discoloured surface water or leachate
- Oils, grease, oily substances
- Asbestos

Should asbestos be observed or suspected during the excavation works, all work shall cease and Guidelines for the Management and Removal of Asbestos (revised 1999) for the Department of Labour, and the Health & Safety in Employment (Asbestos) Regulations (1998) will be followed. Works can recommence once all asbestos has been removed safely. Any such asbestos works (assessment, delineation, removal, and verification) would be undertaken by a specialist asbestos contractor.

A first response protocol for unexpected contamination is as follows:

1. Stop work immediately. Assess the potential immediate hazards. • If the discovery is assessed as presenting an imminent hazard or danger, notify emergency services dialling 111. If unsafe, move away, secure the area, and notify workers in the nearby area.

2. Advise SQEP, site manager or client representative

3. Work will not resume or commence until the SQEP has provided clearance.

## SITE VALIDATION REPORT

A SVR will be produced and provided to council, summarising the works completed and confirming that the remediated areas are suitable for residential (10% produce) land use. The SVR will include a plan showing final extent of remedial areas and validation sample locations, validation sample results, unexpected discovery of contamination and how it was managed (if any), copies of receipts for waste disposal and information about imported material.

# Appendix 6

## Geotechnical Assessment

NZHG Gisborne Limited

# SITE SPECIFIC GEOTECHNICAL REPORT FOR PROPOSED RESIDENTIAL DWELLING, LOT 1 AND 2

99A Stanley Road, Gisborne

**Project Reference: 24729**
**October 13, 2023**

# DOCUMENT CONTROL

| Version | Date | Comments |
|---|---|---|
| 01 | 13/10/2023 | Issued for Resource Consent. Plan review required prior to submission for Building Consent. |

| Version | Issued For | Date | Prepared By | Reviewed & Authorised By |
|---|---|---|---|---|
| 01 | Issued for Resource Consent | 13/10/2023 | Sahil Sathwara<br>*B.Tech (Civil), MEngNZ*<br>Geotechnical Engineer | Dan Bond<br>*CMEngNZ, PEngGeol.*<br>*Associate Engineering Geologist* |

# CONTENTS

# 1 INTRODUCTION

Land Development & Engineering Ltd (LDE) was engaged by NZHG Gisborne Limited to undertake geotechnical investigations of a site located at 99A Stanley Street, Te Hapara, Gisborne (Figure 1), with legal description Lot 1 DP 5799. The 1,590m$^2$ site is proposed to be subdivided into 8 Lots for residential development (Figure 1). This geotechnical report pertains to proposed **Lot 1 and 2**, 99A Stanley Road, Gisborne.

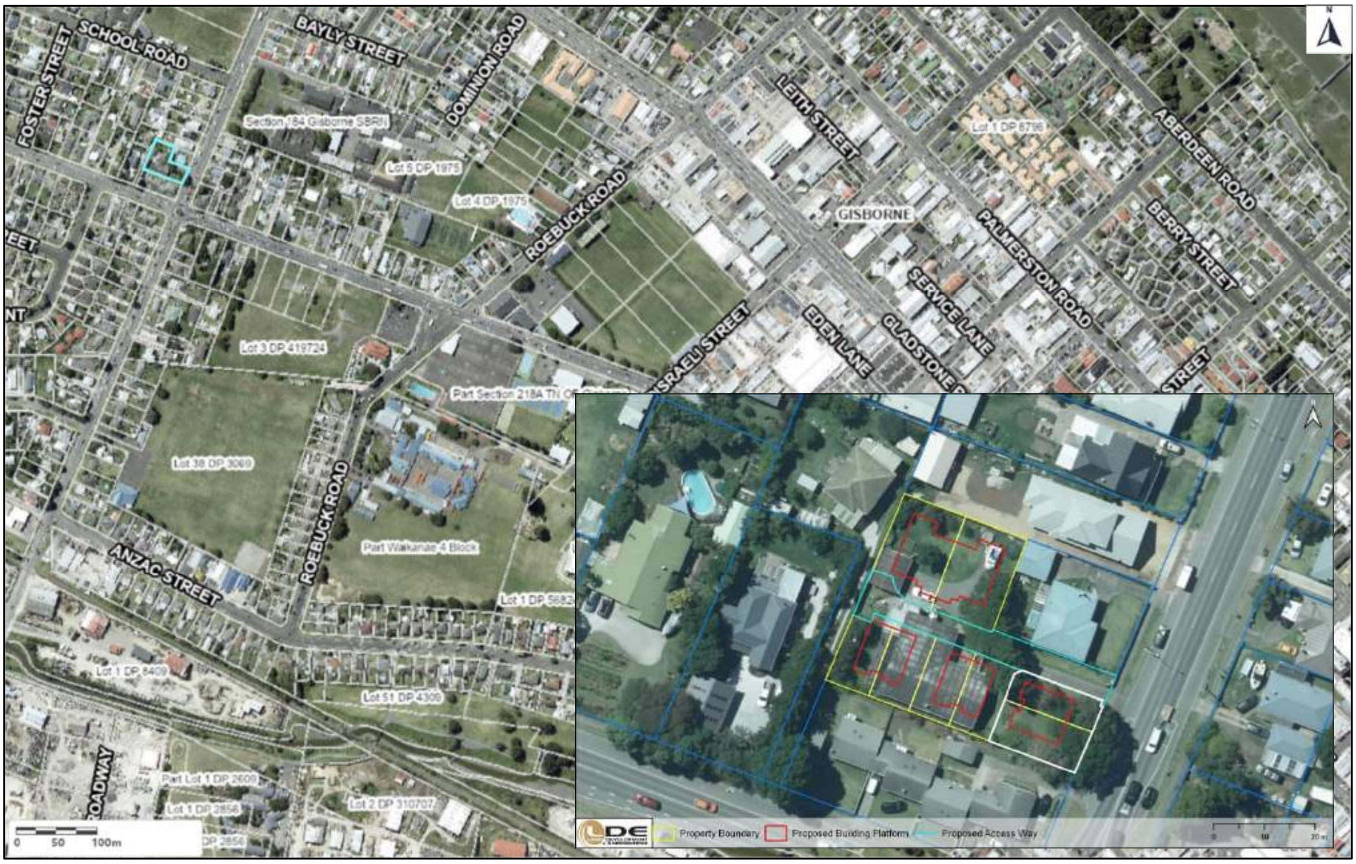


Figure 1: Site location outlined in blue, with the proposed subdivision outlined in yellow, Lot 1 and 2 highlighted in white. Image source: Tairāwhiti Maps (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2023) Accessed: September 2023.

The purpose of this investigation was to determine and assess the nature of the ground beneath the building site to inform our geotechnical recommendations for site development and design of the building's foundations. The investigation was completed to satisfy the Gisborne District Council (2022) for Resource and Building Consent.

# 2 PROPOSED DEVELOPMENT

An 8-lot subdivision is proposed at 99A Stanley Road. Demolition and removal of existing structures is proposed, with the development consists of 4 structures formed of three double-storey duplex buildings and one single-storey duplex building (Figure 1).

The proposed driveway is located centrally in the site to provide access to the lots from Stanley Road. Proposed access and building platform locations are shown in Figure 1 and Appendix A.

A 93.6m$^2$ double storey building is proposed across Lot 1 and 2 (Figure 2), with timber framing in accordance with NZS3604 (2011), with weatherboard and sheet wall cladding, profiled metal roofing and either concrete floor or suspended timber floor, which has yet to be determined.

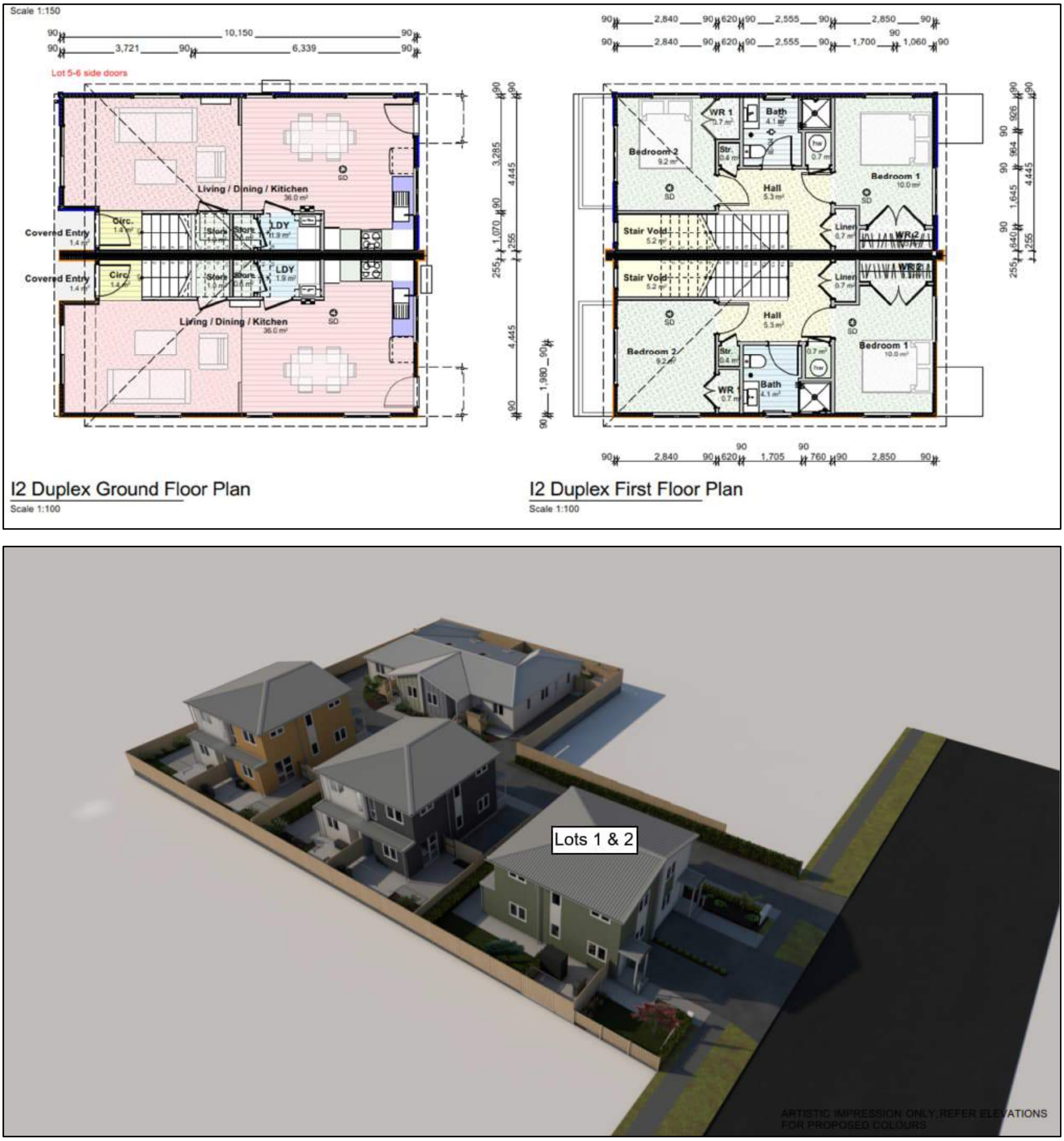


Figure 2: (From top to bottom): Floor plan for proposed duplex building across Lot 1 and 2, alongside the architect's drawing (Lot 1 and 2 are labelled) Image source: Client supplied.

# 3 SITE STUDY

## 3.1 Description

The site is located within the established suburb of Te Hapara, Gisborne, approximately 1.7km northwest of the Gisborne CBD. The site is generally flat and is elevated approximately 5m (New Zealand Vertical Datum (NZVD) 2016).

The site is within a General Residential zoning based on the Tairāwhiti Resource Manage Plan (2023) and recent aerials show the site to be developed has an existing dwelling and ancillary structure. The site does not contain any open drainage pathways or watercourses and we did not identify any significant geomorphological features nearby.

## 3.2 Published Geology

The 1:250,000 geological map of the region (Mazengarb & Speden, 2000) indicates the site is underlain by Holocene aged beach deposits which consist predominantly of sand.

## 3.3 Geotechnical Risks

Our review of Gisborne District Council's (GDC) GIS viewer, Tairāwhiti Maps (Gisborne District Council, 2022), and GNS Science's Active Faults Database (GNS Science, 2022) revealed following:

- The site is mapped as being within an area of moderate liquefaction risk.
- The nearest active fault is the Repongaere Fault, located approximately 16km north-west of the property.
- The site is mapped as yellow tsunami evacuation zone.

## 3.4 Historic Site Imagery

Historical aerial imagery was also reviewed as part of the investigation using Retrolens and Google Earth aerial photography, which revealed the following:

- Early images indicate that the site was developed prior to 1942, with a dwelling placed over the southwestern corner of Lot 1 DP 5799, occupying the corner of Stanley Road and Childers Road. These images also indicate the site to be within relic dune forms.
- The historic dwelling on the corner of Stanley Road and Childers Road was demolished between 1966 and 1972.
- The current, existing dwelling and a carport first appear in 1977 imagery.
- The surrounding developments on Childers Road are constructed by 1986.

After which the site appears to remain largely unchanged through to the present day.

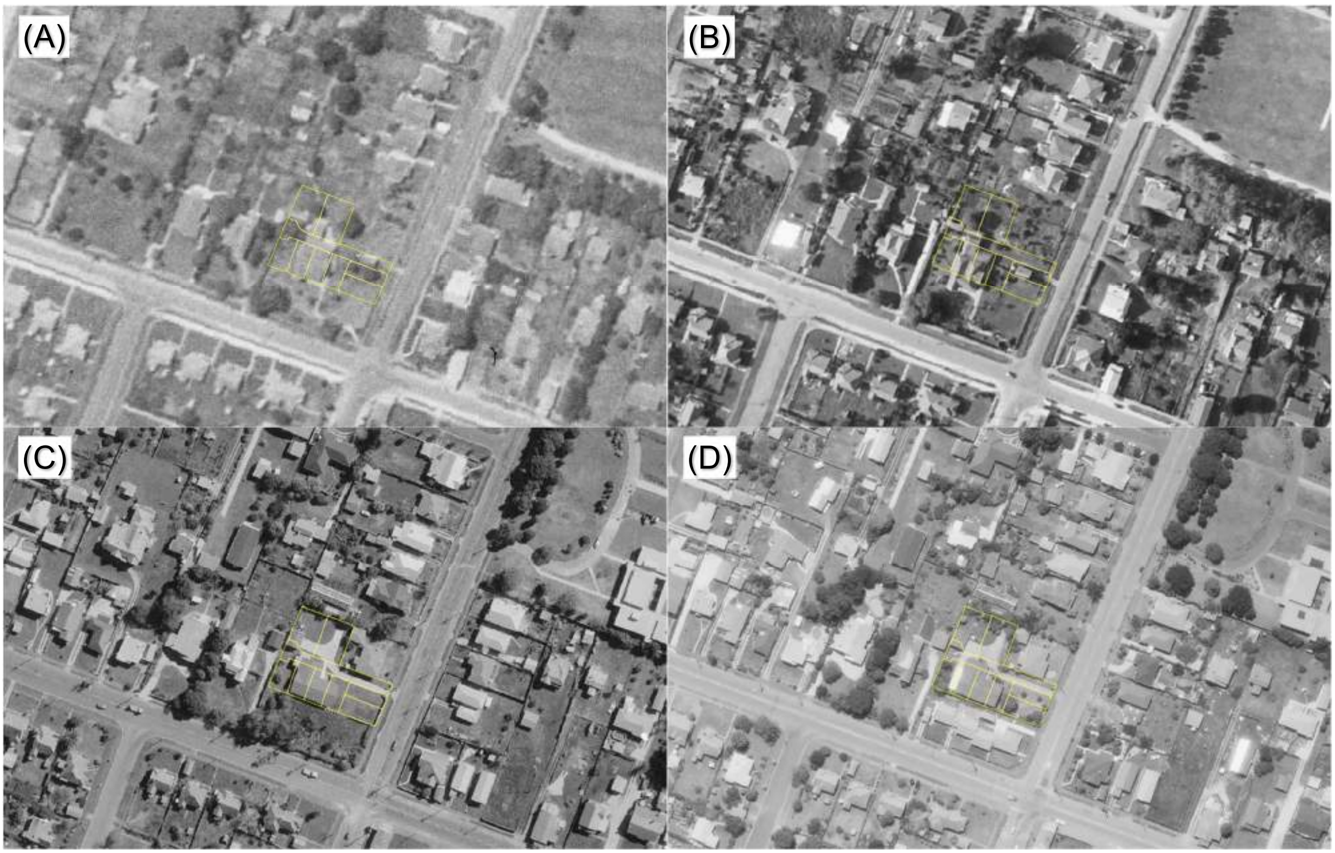


Figure 3: Historical aerial imagery of the Stanley Road subdivision (Source: (Retrolens.co.nz)), with the location of the individual lots marked in yellow. (a) Aerial imagery from 1942, (b) 1951, (c) 1977, (d) 1986.

# 4 GEOTECHNICAL INVESTIGATION

## 4.1 Development wide Investigation Scope

Our investigation of the entire site included the following scope of work:

- A walkover assessment of the site and immediate surrounding area to assess its geomorphology and identify any features which may influence our engineering recommendations, or the long-term performance of the ground.
- Twelve, 50mm diameter, hand auger boreholes to refusal or 2.5m target depth at the proposed building locations and associated Dynamic Cone Penetrometer (DCP) tests to the 2.5m target depth.
- Two cone penetrometer tests (CPTs) driven to between 17.9m and 20.15m depths, at either end of the proposed site.

## 4.2 Lot 1 and Lot 2 Investigation Scope

The investigation of the site, completed on 14 September 2023, included the following work:

- A walkover assessment of the site and immediate surrounding area to identify its geomorphology and features which may influence our engineering recommendations or the long-term performance of the ground.
- One cone penetrometer test (CPT02) to the target depth of 20.15m.
- Three, 50mm diameter, hand-auger boreholes (HA01, HA02 and HA03), which refused at 2.0m, 1.6m and 2.2m below ground level (bgl), respectively. Associated DCP tests were carried out at each test location to the 2.5m target depth.

The test locations are shown on the Geotechnical Investigation Plan (Figure 4) and is included as Appendix A. Logs with details of the relevant testing completed are presented as Appendices B and C.

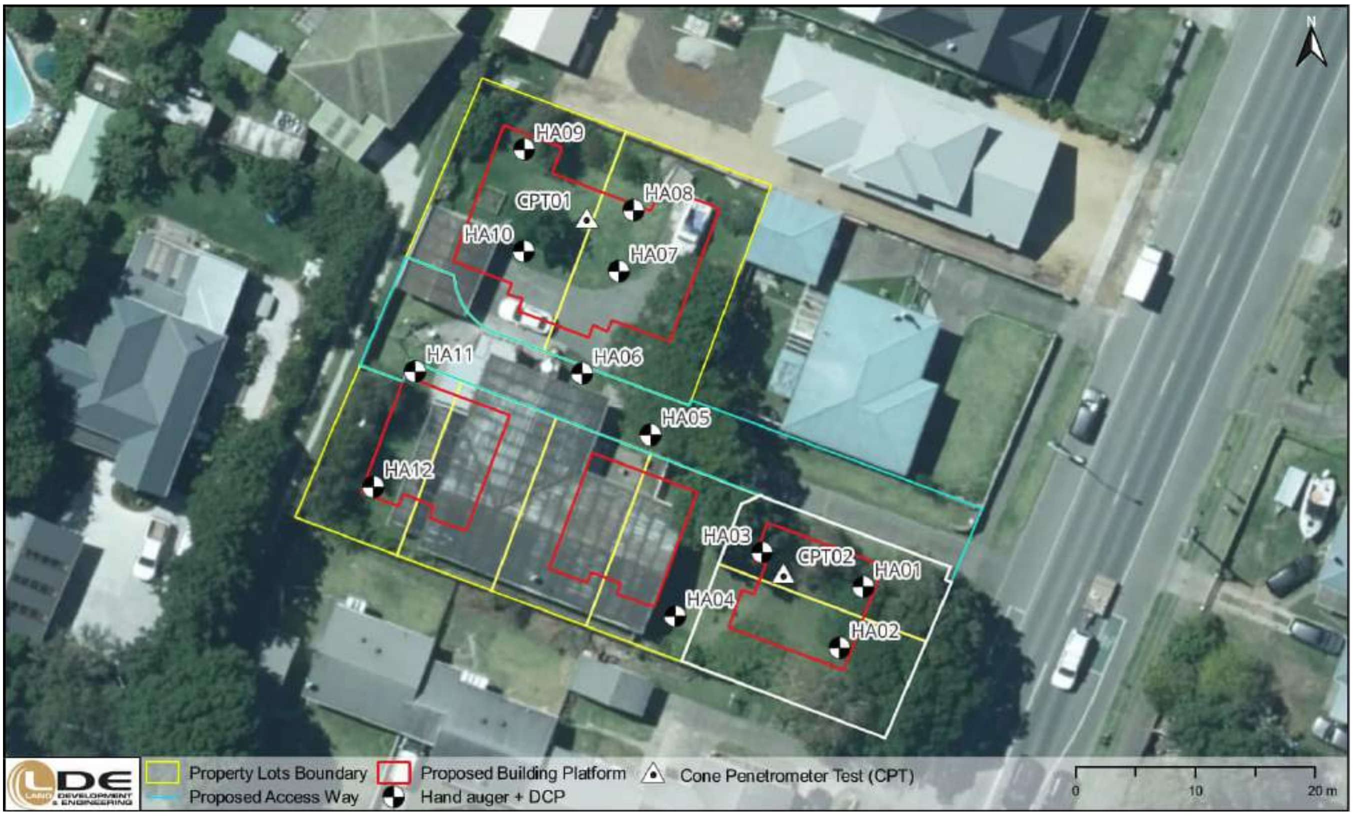


Figure 4: Geotechnical Investigation Plan for proposed development, Lot 1 and 2 highlighted in white.

## 5 GROUND CONDITIONS

This section addresses the ground conditions encountered during our investigations.

## 5.1 Site Stratigraphy

### 5.1.1 Development Wide

Ground conditions are reasonably consistent across the site. Typically, the property is underlain by topsoil and/or fill to a depth between 0.25m and 0.7m below ground level (bgl), which overlies sand/ silt mixtures to a depth of 1.0m. Underlying this, medium dense to dense sand was encountered to around 8.5m to 9.0m.

Deposits of firm clay were encountered from around 8.5m to 9.0m to 13m depth followed by interbedded stiff silt/clay mixtures and silty sand, sandy silt extending to at least 20m depth.

### 5.1.2 Lot 1 & Lot 2 Site Specific

Topsoil was encountered in each hand auger borehole from the existing ground surface to depths of 0.7m, 0.25m and 0.4m in HA01, HA02 and HA03 respectively.

This was underlain by Holocene Beach Deposits, comprising a layer of very loose to very dense sand to the refusal depths between 1.6m to 2.2m bgl, due to saturated sand flowing into the borehole.

Dynamic penetrometer testing in within the sand subgrade ranged between 1 and 15 blows per 50mm, between underside of topsoil and 2.5m depth.

## 5.2 Groundwater

The groundwater was encountered at depths of between 1.3m and 1.8m in hand auger boreholes across the site. The groundwater was not measured in CPTs due to hole collapse but is inferred to be a short way beneath the depths of hole collapse.

A groundwater level of 1.3m bgl was adopted in our assessments. Given that testing was completed in the wettest year on record for Gisborne, the groundwater level adopted is considered significantly elevated from typical levels and no further allowance has been applied for seasonal variations.

# 6 NATURAL HAZARDS

## 6.1 Definition & Legislation

This section summarises our assessment of the natural hazards that might affect the site including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding, that might affect the property, as generally defined in Section 106 of the Resource Management Act., including erosion (including coastal erosion, bank erosion, and sheet erosion), falling debris (including soil, rock, snow and ice), subsidence, inundation (including flooding, overland flow, storm surge, tidal effects and ponding), and slippage.

## 6.2 Seismic Hazard

### 6.2.1 Surface Fault Rupture

The GNS NZ Geology Web-map and Active Faults Database (GNS Science, 2020) do not show any faults passing beneath the subject site. There also does not appear to be any surface expressions which would indicate the presence of an active fault beneath or within close proximity to the site. We therefore consider the surface fault rupture risk to be low.

### 6.2.2 Site Subsoil Class

Based on the published geological information for the region discussed in Section 3.2 and obtained CPTs data, we consider that the site classification of D- "Deep or Soft Soil" Site is appropriate as defined by NZS 1170.5 (2004).

### 6.2.3 Seismic Actions

In accordance with the NZ Building Code and NZS 1170.5 (2004):

- The structure proposed is considered Importance Level 2 (IL2) with a design working life of 50 years, and therefore;
- The Serviceability Limit State (SLS) design earthquake has an annual exceedance probability of 1/25, and;
- The Ultimate Limit State (ULS) design earthquake has an annual exceedance probability of 1/500.
- Furthermore, an intermediate state event (ILS) has been considered in accordance with Module 1 recommendations (2021) for an annual exceedance probability of 1/100.

The modules of the Earthquake Geotechnical Engineering Practice series jointly published by Ministry of Business Innovation and Employment (MBIE) and the New Zealand Geotechnical Society (NZGS) (2021) provides guidance under Section 175 of the Building Act (2004), to assist with ensuring compliance with the Act. We have adopted the ground motions published within Module 1 (2021) for geotechnical design which are summarised in Table 1 below.

Table 1 Summary of adopted seismic parameters.

| Seismic Parameters | SLS | ILS | ULS |
|---|---|---|---|
| **Horizontal Peak Ground Accelerations (PGA), g** | 0.12 | 0.28 | 0.65 |
| **Effective magnitude, Mw** | 6.3 | 6.8 | 7.5 |

## 6.3 Liquefaction and Cyclic Softening Assessments

### 6.3.1 Liquefaction

Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground, and structure settlement, and in lateral (spreading) displacement of the ground.

The liquefaction potential was assessed with site-specific CPT data using specialist geotechnical software (CLiq Ver.3.3.1.13) in general accordance with NZGS/ MBIE Module 3 Guidance (2021).

Liquefaction triggering was assessed using the method proposed by Boulanger and Idriss (2014).

Liquefaction-induced, free-field, vertical, volumetric strains were estimated using the method proposed by Zhang et al (2002).

A groundwater level of 1.3m bgl was adopted as discussed in Section 5.2.

### 6.3.2 Cyclic-Softening

Cyclic softening is a phenomenon that occurs when the strength and stiffness of a soil decreases due to repeated cyclic loading such as that resulting from strong seismic shaking. Relatively soft clay soils are commonly susceptible to this phenomenon, which can be accentuated where these soils are sensitive i.e., there is a significant difference between the soil's peak and residual shear strength.

Due to the presence of the clay rich estuarine soils at this site, we have undertaken a cyclic softening analysis for the ULS design case. The Gisborne 2007 earthquake was of comparable magnitude and PGA to the ILS design case. No liquefaction or induced settlements were identified within the proximity of the subject site because of this earthquake. Accordingly, cyclic softening has been assessed for the ULS design case only.

Our assessments assumed:

- An $N_{kt}$ value of 14 for the clay-like soils, based on previous work undertaken proximally by LDE within the estuarine deposits.
- An estimate of the maximum, post-liquefaction, volumetric strain based on the work by Robertson and Cabal (Robertson & Cabal, 2014) which recommends a default value of 0.5% for clay-like soils.

### 6.3.3 Liquefaction and Cyclic Softening Results

The results of the analysis are summarised below in Table 2 and detailed outputs are provided as Appendix D.

The Liquefaction Potential Index (LPI) and Liquefaction Severity Number (LSN) are indices used to assess the general performance level of liquefied deposits in accordance with the NZGS/MBIE Module 3 Guidance (2021).

Table 2 Summary of Seismic Site Performance

| Limit State / Return Period | CPT ID | LPI | LSN | Estimated Seismic Volumetric Settlements (mm) [Limited to 10m] (3) | | | Effects of Liquefaction |
|---|---|---|---|---|---|---|---|
| | | | | Liquefaction | Cyclic Softening | Total Seismic Settlement | |
| **SLS 1/25 year** | CPT-01 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | **L0** |
| | CPT-02 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | |
| **ILS 1/100 year** | CPT-01 | 4 | 6 | ~45 [~45] | - | **~45 [~45]** | **L2** |
| | CPT-02 | 5 | 7 | ~50 [~50] | - | **~50 [~50]** | |
| **ULS 1/500 year** | CPT-01 | 17 | 15 | ~80 [~75] | ~30 | **~110 [~75]** | **L3** |
| | CPT-02 | 18 | 17 | ~85 [~80] | ~35 | **~120 [~80]** | |
| **Effects of liquefaction Key** | | **L0: Insignificant** | **L1: Mild** | **L2 Moderate** | **L3: High** | **L4 Severe** | **L5: Very Severe** |

**Notes:**

- Liquefaction triggering Boulanger and Idriss (2014) methodology limited to upper 15m. Limited to 10m of soil profile shown in [brackets].
- Settlements are free-field estimated settlements and do not include any building induced settlements.
- Effects of Liquefaction based on NZGS Module 3 (New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE), 2021)

Our analyses indicate that liquefaction-induced settlements are likely to be negligible (<5mm) in a design SLS seismic event.

Under the ILS design case, liquefaction-induced settlements are estimated to be between 45mm and 50mm. As discussed in Section 6.3.2 , no liquefaction, or liquefaction-induced settlements were identified within the proximity of the subject site as a result of the Gisborne 2007 earthquake, which had almost identical ground motions. Accordingly, we consider it unlikely that liquefaction would be realised under ILS seismic shaking and conclude that the software is likely to be over-estimating liquefaction potential.

Under design ULS seismic shaking, 110mm to 120mm of settlement is estimated. However, given the rationalisation to the Gisborne 2007 earthquake, discussed above, we consider that total, free-field, seismic settlements are likely to less than 100mm.

## 6.4 Lateral Spreading

The site is generally level and the nearest free face is associated with an unnamed tributary to the Waikanae Creek, approximately 700m south of the proposed building area. Given that there are no significant slopes within influencing distance of the proposed dwelling, and grades on site are very low, we consider the risk of lateral spreading in the event of a significant earthquake to be low.

## 6.5 Liquefied Bearing

Liquefaction may lead to foundation bearing failure, by either ‘punch through’ failure or a reduction in bearing capacity when liquefaction occurs within the zone of influence of load bearing foundations.

A preferred foundation option has not been identified for the proposed structures at the time of writing and we have completed liquefied bearing assessments for both raft-type surface structures and piled foundations.

A unit weight of 17kN/m$^3$ was adopted for both the non-liquefied and liquefied soil layers. An angle of internal friction of 34 degrees was adopted for the non-liquefied material.

The tau/sigma ratio for these assessments was based on site-specific CPT data and taken as 0.075 for the liquefied material within the zone of influence of the foundations.

Groundwater level was taken as 1.3m, as discussed in Section 5.2.

A reduction factor of 0.75 was applied to the ultimate capacities calculated for the proposed, two-storey, duplex buildings, in accordance with MBIE Module 5 (2021) for moderately loaded structures.

### 6.5.1 Pile Foundation Assessment

Our assessment of pile foundations assumed:

- Ordinary piles embedded to a minimum depth of 0.7m at 0.3m diameter (including concrete cover),
- Anchor piles embedded to a minimum depth of 0.9m at 0.4m diameter (including concrete cover), and
- A 100kPa design load.

Both projected area and ‘punch-through’ failure mechanisms were assessed.

#### 6.5.1.1 Results

The design load exceeded capacity in both design cases with the ‘punch-through’ failure mechanism governing. Maximum design loads were calculated as follows:

Ordinary piles

75kPa for the single-storey structures and 55kPa for the two-storey duplex buildings.

Anchor Piles

45kPa for the single-storey structures and 30kPa for the two-storey duplex buildings.

### 6.5.2 Raft type Surface Structure Foundation Assessment

For the raft-type surface structures assessments were completed for the single-storey and two-storey buildings assuming:

- Foundation widths as presented in the 15% architectural drawings, and
- An embedment depth of 0.2m.

#### 6.5.2.1 Results

Liquefied bearing capacities were calculated to be 14.5kPa for the proposed single-story buildings and 11kPa for the proposed two-storey duplex structures.

The values presented above are dependent on the assumptions listed. Should the foundation breadth, embedment depth or design loads change, the liquefied bearing capacities will need to be reassessed.

## 6.6 Equivalent MBIE Technical Category

Considering the rationalisation provided in Section 6.3, we consider that seismic ground performance at this site would be equivalent to a TC2 classification in accordance with Table 15.6 of the MBIE Guidance (2015).

## 6.7 Slope Stability

The site is generally flat-lying and there are no significant slopes within, or near the site. Therefore, we do not consider slope stability to be a geotechnical constraint.

## 6.8 Flood Hazard

The site is not located in a mapped flood hazard zone.

## 6.9 Tsunami

The Gisborne / East Cape coastline is classified as being at the highest risk in the country of being affected by tsunami. Modelling for the Gisborne region (GNS Science Te Pū Ao, 2016) indicates that the site is sufficiently elevated and is unlikely to be inundated in 1:100, 1:500, and 1:2500-year return period tsunami events, respectively. Civil defence tsunami inundation maps show that the site mapped as a yellow zone, which may be subject to tsunami hazard in the case of a severe (i.e. M8.9) local earthquake on the Hikurangi subduction margin (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2019) .

## 6.10 Expansive Soils

No laboratory testing of the soil properties was completed. Based on field tests, the surficial soils below the topsoil are granular in nature and therefore not subject to expansivity.

## 6.11 Natural Hazards Summary

From our assessment of the natural hazards and ground deformation risks presented to the proposed development we consider that the proposed structures can be safely located on the site, provided that the recommendations given in Section 7 are adopted.

# 7 ENGINEERING RECOMMENDATIONS

## 7.1 Site Contouring and Topsoiling

The finished ground level should be graded so that water cannot pond against, beneath or around the buildings for the economic life of structure. To achieve this, it will be important that the building platform beneath the topsoil grades away from the site. Contouring should avoid the potential for concentration and discharge of surface water over point locations which could result in soil erosion or instability.

## 7.2 Access Road Construction

Access is proposed from Stanley Road. No major/ significant earthworks are anticipated to form access to the proposed dwellings.

## 7.3 Foundation Recommendations

### 7.3.1 Foundation Type

Based on the site investigation and analysis, we consider that foundations comprising pile foundations or raft-type surface structures are suitable for the site conditions providing the recommendations and limitations presented within this section are addressed in design.

### 7.3.2 Design Considerations

Based on the scope of work completed, the following aspects need to be considered in detailed design:

- Site Class - Class D - Deep or soft soil
- Liquefaction-induced vertical settlements - TC2 equivalent
- Relatively high groundwater level

- Liquefied bearing capacity
- Potential for consolidation settlement

### 7.3.3 Bearing Capacity and Founding Depth

Foundations must extend beneath any topsoil, uncontrolled fill, organic and/ or otherwise unsuitable material.

For the Lot 1/2 duplex structure we anticipate that a static geotechnical ultimate bearing capacity (GUBC) of 210kPa will be available from 0.4m depth. Note that localised deepening of foundations is anticipated in the vicinity of HA01, where topsoil was encountered to 0.7m bgl. A reduction factor of 0.45 should be applied to the GUBC given above to give the design bearing strength ($q_{dbs}$).

A short-term, post-seismic (static), liquefied bearing capacity, equivalent to the values presented in Section 6.5, should be assessed in structural design. Note that these liquefied bearing capacities are contingent on the assumptions listed within Section 6.5. Should these assumptions change in design, the liquefied bearing capacities will need to be reassessed. This may require some iterative design between the geotechnical and structural engineers.

## 7.4 Surface Water

The site is proposed to be connected to the council stormwater system. On-site disposal is not proposed.

The stormwater system for the buildings should be operational as soon as the roof is in place. This is to ensure that the ground within the vicinity of the building is not compromised by the negative effects and potential consequences of soil saturation.

### 7.4.1 Service Pipes

All service pipes, stormwater structures should be designed and constructed to ensure adequate capacity, strength, and water tightness to prevent leakage into the platform through blockage, running under pressure, or structural failure.

All service pipes installed within any fill should be flexible, or flexibly joined, so that they may deflect without breaking if the ground settles.

A record should be kept of the position, type, and size of all subsoil drains, and in particular of their outlets.

## 7.5 Trees and Shrubs

There are multiple trees on the property, within the vicinity of the structure proposed dwellings. Trees can cause damage through heaving as a result of root growth and / or settlement resulting from soil shrinkage from the moisture uptake of the roots. Preliminary landscaping plans show that most of onsite trees and shrubs will be removed, we recommend one of the following options:

- The plant and its major root structure should be removed.
- A root barrier should be designed and installed between the offending plant and the structure.
- Foundations should be taken to a depth no less than 1.0m where damage from the roots of the plant is unlikely.

If new trees, shrubs or gardens are established, or the lemon tree relocated on site, care should be taken to ensure:

- The vegetation does not interfere with any subfloor ventilation or services to the structure.
- Over-watering of the vegetation does not saturate the ground near the foundations.
- Trees or shrubs with the potential to develop significant root systems should be planted a minimum distance equal to the mature height of the plant away from the foundations.

# 8 SUSTAINABILITY

Considering sustainability as early as possible in a project's development, could lead to significant project opportunities and wider positive outcomes. Geotechnical opportunities for increased sustainability for this project include:

- Striping and stocking topsoil for reuse (dependant on presence/ levels of contaminants).
- Designing for cut and fill balance where possible.
- Reuse of site won materials, or using materials won from other sites including use of recycled crushed concrete aggregate for hard fill.
- Contributing site investigation data to the New Zealand Geotechnical Database (NZGD) to help reduce the site investigations needed in the future.
- Using local consultants and contractors to reduce transport related emissions.

# 9 CONCLUSIONS

Following development of the site in accordance with our recommendations, we consider that:

a) The land in respect of which a consent is sought, or any structure on the land built in accordance with our recommendations, is unlikely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and

b) Any subsequent use that is likely to be made of the land is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; and

c) Sufficient provision has been made for physical access to each allotment to be created by the subdivision.

# 10 PLAN REVIEW

Prior to an application for Building Consent, it is important we are given the opportunity to review the final development drawings to ensure the recommendations contained within this report have been followed and interpreted correctly. Following successful review of the development drawings, we will update this report to support applications for Resource Consent and Building Consent.

# 11 VERIFICATION

Verification requirements will be provided once the form of the foundations has been determined.

# 12 LIMITATIONS

This report should be read and reproduced in its entirety including the limitations to understand the context of the opinions and recommendations given.

This report has been prepared exclusively for NZHG Gisborne Limited in accordance with the brief given to us or the agreed scope and they will be deemed the exclusive owner on full and final payment of the invoice. Information, opinions, and recommendations contained within this report can only be used for the purposes with which it was intended. LDE accepts no liability or responsibility whatsoever for any use or reliance on the report by any party other than the owner or parties working for or on behalf of the owner, such as local authorities, and for purposes beyond those for which it was intended.

This report was prepared in general accordance with current standards, codes and best practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods and subsurface investigations at discrete locations designed to the constraints of the project scope to provide the best assessment of the environment. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from those described in this report.

# 13 REFERENCES

Ambraseys, N., & Srbulov, M. (1995). Earthquake induced displacements of slopes. *Soil Dynamics and Earthquake Engineering*, 14(1), 59-71.

Boulanger, R., & Idriss, I. (2014). *CPT and SPT based liquefaction triggering proceedures.* Report No. UCD/CGM-14, 1.

Bray, J. D., & Travasarou, T. (2007). Simplified procedure for estimating earthquake-induced deviatoric slope displacement. *Journal of geotechnical and geoenvironmental engineering*, 133(4), 381-392.

Cetin, K., Bilge, H. T., Wu, J., Kammerer, A. M., & Seed, R. B. (2009). Probabilistic model for assessment of cyclically induced reconsolidation (volumetric) strains. *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, 387-398.

Chu, D. B., Stewart, J. P., Youd, T. L., & Chu, B. L. (2006). Liquefaction-Induced Lateral Spreading in Near-Fault Regions during 1999 Chi-Chi, Taiwan Earthquake. *Journal of Geotechnical & Geoenvironmental Engineering*, 1549-1565.

Gisborne District Council. (2022). Bearing Capacity and Geotechnical Investigation Requirements for Buildings.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2019). Tsunami inundation and evacuation maps.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2021). Minimum Requirements for Geotechnical Reports.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2023). Tairāwhiti Maps. Retrieved 2022, from https://maps.gdc.govt.nz/H5V2_12/

GNS Science. (2020). New Zealand Active Faults Database.

GNS Science. (2022, November 5). *New Zealand Active Faults Database*. Retrieved from https://data.gns.cri.nz/af/

GNS Science Te Pū Ao. (2016). *Probabilitistic Mapping of Tsunami Hazard and Risk for Gisborne City and Wainui Beach.* Wellington: GNS.

Jibson, R. W. (2007). Regression models for estimating coseismic landslide displacement. *Engineering geology*, 91(2-4), 209-218.

Mazengarb & Speden. (2000). Geology of the Raukumara area. *Institute of Geological and Nuclear Sciences 1:250,000 geological map 6*.

Ministry of Business Innovation and Employment Hīkina Whakatutuki. (2015). *Repairing and rebuilding houses affected by the Canterbury earthquakes - Part C Technical Guidance.* Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 1. Overview of the Guidelines, Rev 1. Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 3. Identfication, assessment and mitigation of liquefaction hazards Rev1. Wellington.

*Retrolens.co.nz*. (n.d.). Retrieved from retrolens.co.nz.

Robertson, P. K., & Cabal, K. L. (2014). *Guide to Cone Penetration Testing for Geotechnical Engineering. 6th Edition.* Gregg Drilling & Testing Inc.

Standards New Zealand Te Mana Tautikanga O Aotearoa. (2004). *NZS1170.5 Structural Design Actions: Part 5: Earthquake Actions- New Zealand.* Wellington: Standards New Zealand.

Tonkin & Taylor. (2015). *Liquefaction vulnerability and Geotechnical Assessment - Guidance for Gisborne District Council.*

Zhang, G., Robertson, P., & Brachman, R. (2002). Estimating liquefaction-induced groundsettlements from CPT for level ground. *Canadian Geotechnical Journal, 39*(5), 1168-1180.

Zhang, G., Robertson, P., & Brachman, R. (2004). Estimating liquefaction-induced lateral displacements using the standard penetration test or cone penetration test. *Journal of Geotechnical and Geoenvironmental Engineering, 130*(8), 861-871.

# 14 GLOSSARY

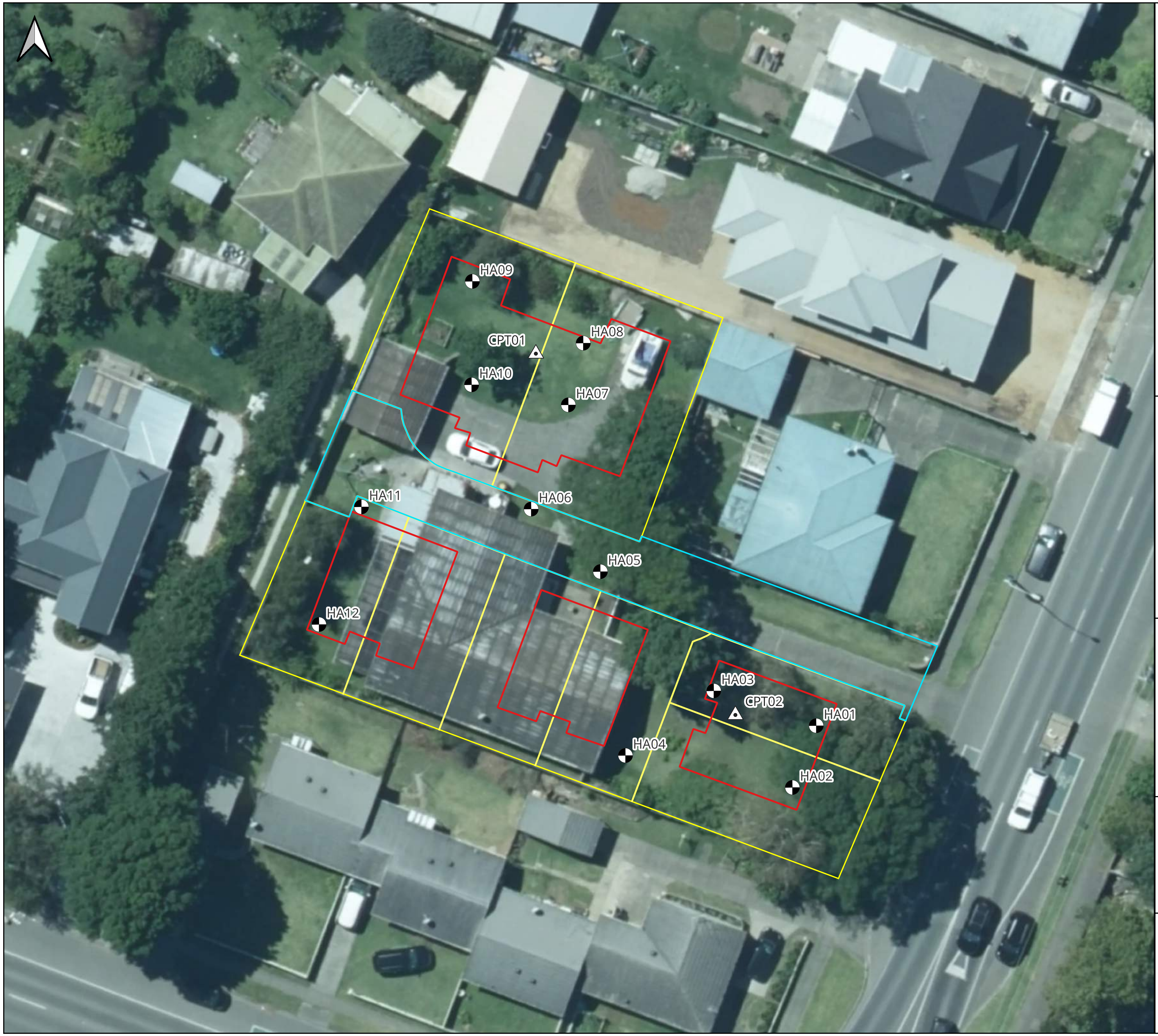
| | |
|---|---|
| **Compressible Soils:** | Compressible soils are those that will undergo a reduction in volume under an imposed load, such as the weight of fill or a structure. This occurs firstly as a result of the expulsion of air and water from the soil void spaces (primary settlement) and secondly due to a restructuring of the soil skeleton to take the load (secondary settlement). |
| **Cyclic Softening:** | Cyclic-softening is a related condition to liquefaction can also affect clay soils when subjected to cyclic-loading. Clay soils may significantly soften and led to bearing capacity failure, in addition to post-earthquake consolidation settlements may occur as a result of the earthquake shaking. |
| **Expansive Soils:** | Cohesive soils containing significant proportions of certain clay minerals can be subject to appreciable volume change caused by variations in soil moisture content, most notably between seasons or from the uptake of water through the root systems of trees and shrubs. This is also often referred to as soil reactivity or shrink-swell behaviour. |
| **Lateral Spread:** | Lateral spread of liquefied soils is the lateral displacement of blocks of land moving laterally towards a free edge (for example a riverbank) or within sloping ground. More lateral movement tends to occur closest to the edge with less movement further back. Lateral spreading may result in large permanent ground displacements including cracks, fissures, vertical offsets, and overall settlement of the ground. |
| **Lateral Stretch:** | Lateral stretch is the amount of differential extension that a portion of land may experience during an episode of lateral spreading. The lateral stretch across a foundation is a main factor in foundation damage due to liquefaction and lateral spreading because of a large earthquake. |
| **LiDAR** | Light Detection and Ranging (LiDAR) is a method of remote sensing topographical survey. |
| **Limit States:** | Seismic design criteria for performance-based design. SLS, SLS2 & ULS are prescribed in NZS1170.5 (Standards New Zealand Te Mana Tautikanga O Aotearoa, 2004)<br>• **Serviceability Limit State (SLS):** Functional requirements for the serviceability limit state are assumed to be met if the structure or part can continue to be used as originally intended without the need for repair (SLS1) or can remain operational or continue to be occupied as appropriate (SLS2). SLS earthquakes are considered highly likely to occur during the lifetime of the structure.<br>• **Ultimate Limit State (ULS):** Functional requirements for the ultimate limit state are assumed to be met if:<br>a) People within, and adjacent to the structure are not endangered by the structure or part. |

| | |
|---|---|
| | b) Displacements of the structure are such that there is no contact between any parts of a structure for which contact is not intended, or between separate structures on the same site, if such contact would damage the structures or parts to the extent that persons would be endangered, or detrimentally alter the response of the structure(s) or parts, or reduce the strength of structural elements below the required strength.<br>c) The structure does not deflect beyond a site boundary adjacent to which other structures can be built or collision between the structure and any adjacent existing structures cannot occur.<br>d) There is no loss of structural integrity in either the structure or part.<br>• **Intermediate Limit State (ILS):** ILS is an intermediate seismic event between SLS & ULS although is not a code requirement. The behaviour of soils and geotechnical systems under earthquake shaking may be highly non-linear and even exhibit a pronounced 'step change' in performance with increasing intensity of shaking. For such cases, only considering performance at the SLS and ULS levels of shaking would fail to identify potentially poor and unacceptable performance at intermediate return periods of shaking. |
| **Liquefaction:** | Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground and structure settlement, and in lateral (spreading) displacement of the ground. |
| **LPI** | Liquefaction potential index is a liquefaction damage index. LPI ranges between 0 and 100 and sites with an LPI of 5 indicate a high liquefaction risk and sites with LPI greater than 15 indicate very high risk (Iwasaki et al, 1982). Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. |
| **LSN** | Liquefaction Severity Number is a liquefaction damage index. LSN varies from 0 (representing no liquefaction vulnerability) to more than 100 (representing very high liquefaction vulnerability (van Ballegooy et al, 2013). LSN places greater importance (than LPI) on the thickness of the non-liquefied crust when the groundwater table is close to the ground surface. Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. LNS was developed based on the observations/ investigations from the Canterbury earthquake sequence |
| **PGA:** | Peak Ground Acceleration (PGA) is the maximum ground acceleration during an earthquake as a proportion of gravity. |
| **Punch Through Failure:** | Punch through failure occurs when a foundation punches through a crust of non-liquefiable material due to underlying liquefaction occurring and can lead to potential damage to foundations and/ or large settlements. |

| | |
|---|---|
| **Technical Category:** | Following the 2010 -2011 Canterbury earthquake sequence the Ministry of Business Innovation and Employment (MBIE) assigned three technical categories (TC1, TC2, TC3) across the residential 'green zone' for foundation investigation and design guidance focusing on one and two storey timber-framed dwellings. These categories are broadly defined as below:<br>• **TC1:** Liquefaction damage is unlikely in future large earthquakes. Standard residential foundation assessment and construction is appropriate.<br>• **TC2:** Liquefaction damage is possible in future large earthquakes. Standard enhanced foundation repair and rebuild options in accordance with MBIE guidance are suitable to mitigate against this possibility.<br>• **TC3:** Liquefaction damage is possible in future large earthquakes. Individual engineering assessment is required to select the appropriate foundation repair or rebuild option.<br>• **TC2/ TC3 Hybrid:** A site that straddles liquefaction settlement limits of TC2 and TC3 where the SLS settlements are assessed as being less than 50 mm but the ULS settlements are assessed at greater than 100mm.<br>Whilst this guidance is intended for residential buildings in the Canterbury region, they have been widely adopted to convey liquefaction vulnerability across New Zealand. |
| **The Modules:** | The New Zealand Geotechnical Society (NZGS) and MBIE jointly published a series of guidelines for Earthquake Geotechnical Engineering Practice. Revision 1 of the Modules was published in November 2021, and they provide guidance under section 175 of the Building Act 2004 to assist parties to comply with their obligations under the Building Act 2004. The following modules currently form the collection:<br>• **Module 1:** Overview of the guidelines<br>• **Module 2:** Geotechnical investigation for earthquake engineering<br>• **Module 3:** Identification, assessment, and mitigation of liquefaction hazards<br>• **Module 4:** Earthquake resistant foundation design<br>• **Module 5:** Ground improvement<br>• **Module 5A:** Specification of ground improvement for residential properties in the Canterbury region<br>• **Module 6:** Retaining walls |

# APPENDIX A

# SITE PLAN



## LEGEND

Project Data

🟨 Property Lots Boundary

🟥 Proposed Building Platform

— Proposed Access Way

◐ Hand Auger + DCP

△ Cone Penetrometer Test (CPT)

0 5 10 15 20 m

SCALE A3: 1:300

NOTES

1. Aerial basemap and property boundaries sourced from LINZ Data Service (CC-BY 4.0).
2. Investigation locations shown approximately only.

CLIENT

NZHG Gisborne Limited

PROJECT

Geotechnical Investigation for proposed subdivision
99A Stanley Road, Te Hapara
Gisborne

DRAWING TITLE

Geotechnical Investigation Plan

LDE LAND DEVELOPMENT & ENGINEERING

| PROJECT REF | DRAWING REF | REVISION |
|---|---|---|
| 24729 | GIP | A |
| DATE | PREPARED BY | CHECKED BY |
| 05/10/2023 | SS | RH |

FILE PATH

M-FILES\LDE - Project\76038-24729 Trans to 9602\Geo QGIS Zip Folder (ID 79084)\24729-QGIS Site Maps\24729- 99A Stanley Rd.qgz

# APPENDIX B

# HAND AUGER TEST LOGS

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA01** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

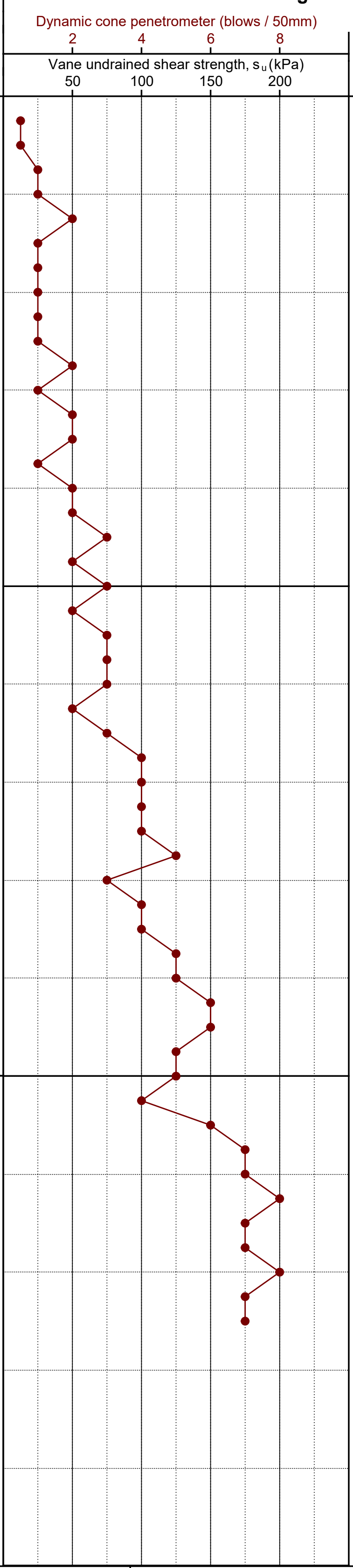
| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709080mN, 2035843mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.7 | Topsoil | SAND, with trace rootlets and silt; dark brown. Very loose; moist; sand, fine to medium.<br>0.40m: With trace rootlets; brown. | | |
| 0.7–2.0 | Holocene Beach Deposits | SAND; light brown. Medium dense; moist; sand, fine to coarse.<br>1.30m: Wet.<br>1.35m: Dense.<br>1.60m: Saturated.<br>1.80m: Poor recovery > 30%. | ▼ 1.60m | |

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**In-situ Testing**



**Values**

Vane ID: N/A

peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.00m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:38 pm

# Hand Auger Borehole Log

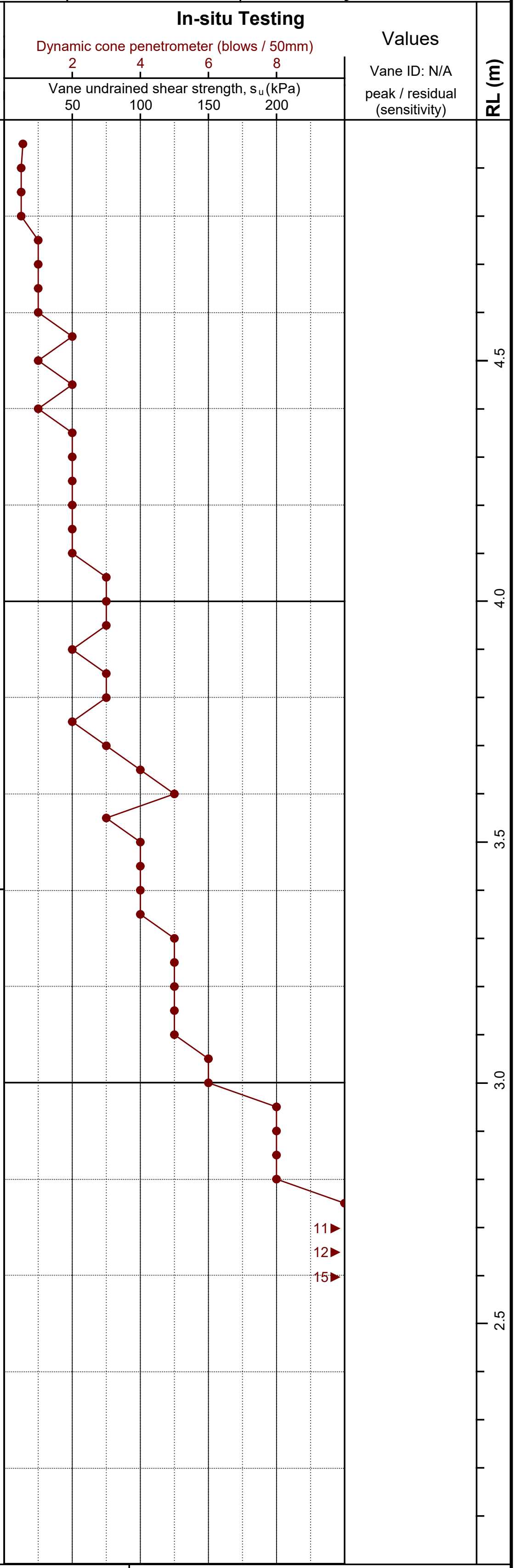
**Test ID:** HA02
**Project ID:** 24729
**Sheet:** 1 of 1

**Client:** NZHG
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne
**Test Site:** Refer to site plan

**Coordinates:** 5709075mN, 2035841mE
**System:** NZTM
**Elevation:** 5m (Presumably)
**Located By:** Site plan/map

**Test Date:** 14/09/2023
**Logged By:** SS
**Prepared By:** SS
**Checked By:** RH

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Very loose; moist; sand, fine.<br>0.10m: SAND. Sand, fine to medium. | |
| 0.5<br>1.0<br>1.5 | Holocene Beach Deposits | SAND; light brown. Loose; moist; sand, fine to coarse.<br>0.65m: Medium dense.<br>1.10m: Wet.<br>1.30m: Saturated.<br>1.50m: Dense; poor recovery > 30%. | ▼ |
| 2.0<br>2.5 | | | |



**Hole Depth:** 1.60m
**Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow
UTP = Unable to Penetrate

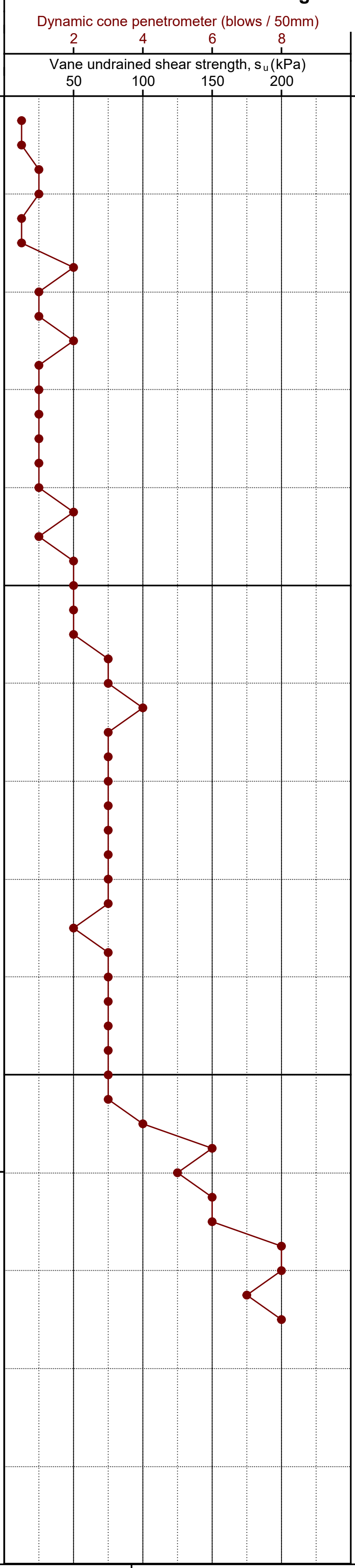
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA03** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709084mN, 2035835mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.40 | Topsoil | SAND, with minor silt, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium. | | |
| 0.40–2.20 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>0.95m: Medium dense.<br>1.10m: Light brown.<br>1.50m: Wet.<br>1.80m: Saturated.<br>2.10m: Dense; poor recovery > 50%. | ▼ (1.80) | |
| 0.5 | | | | 4.5 |
| 1.0 | | | | 4.0 |
| 1.5 | | | | 3.5 |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



Values
Vane ID: N/A
peak / residual
(sensitivity)

| | | |
|---|---|---|
| **Hole Depth:** 2.20m | **Termination:** HOLE COLLAPSE | |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

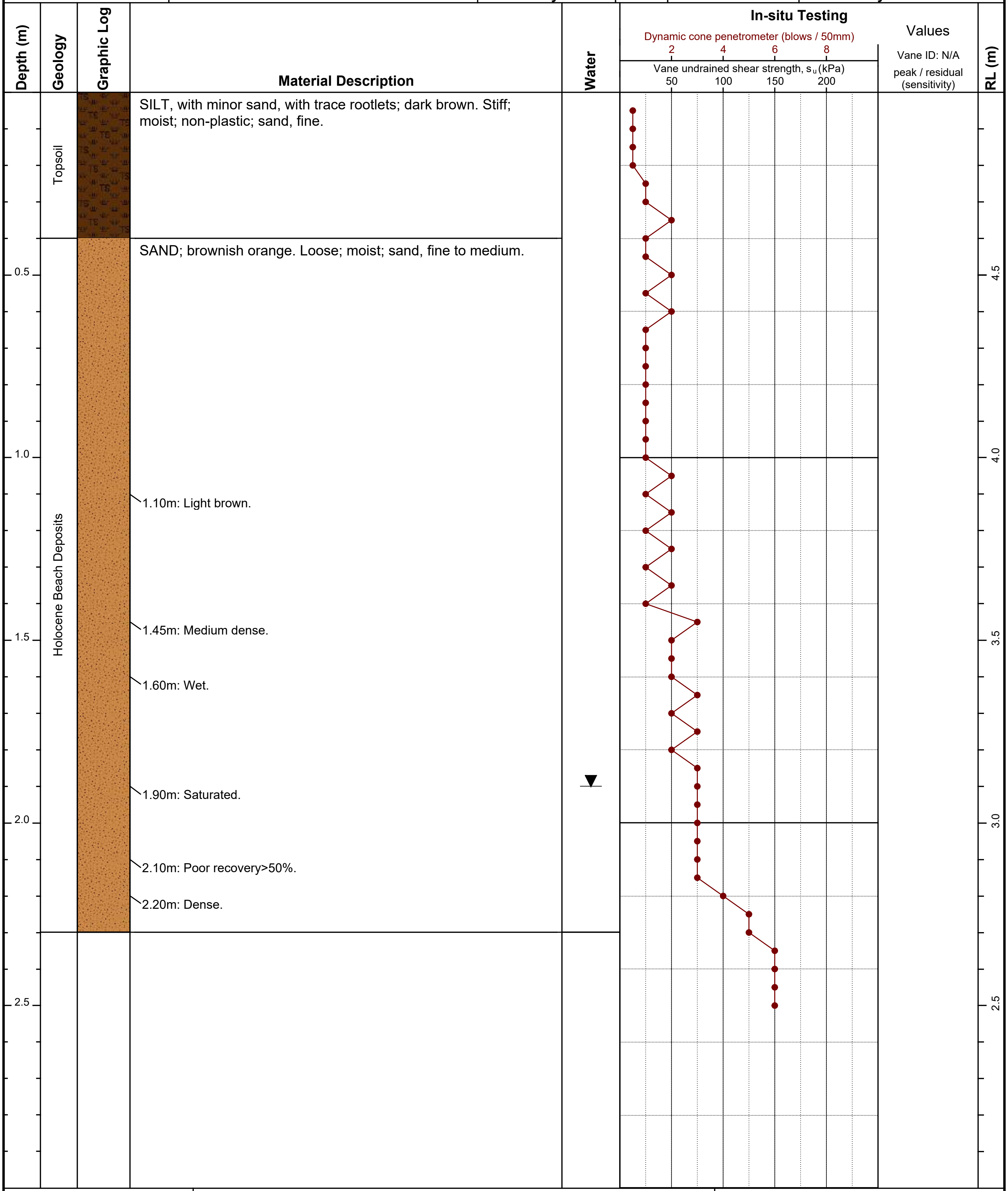
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:41 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA04** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709077mN, 2035830mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.0 | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | |
| 0.4 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | |
| 1.10 | | 1.10m: Light brown. | |
| 1.45 | | 1.45m: Medium dense. | |
| 1.60 | | 1.60m: Wet. | |
| 1.90 | | 1.90m: Saturated. | ▼ |
| 2.10 | | 2.10m: Poor recovery>50%. | |
| 2.20 | | 2.20m: Dense. | |



| | |
|---|---|
| **Hole Depth:** 2.30m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

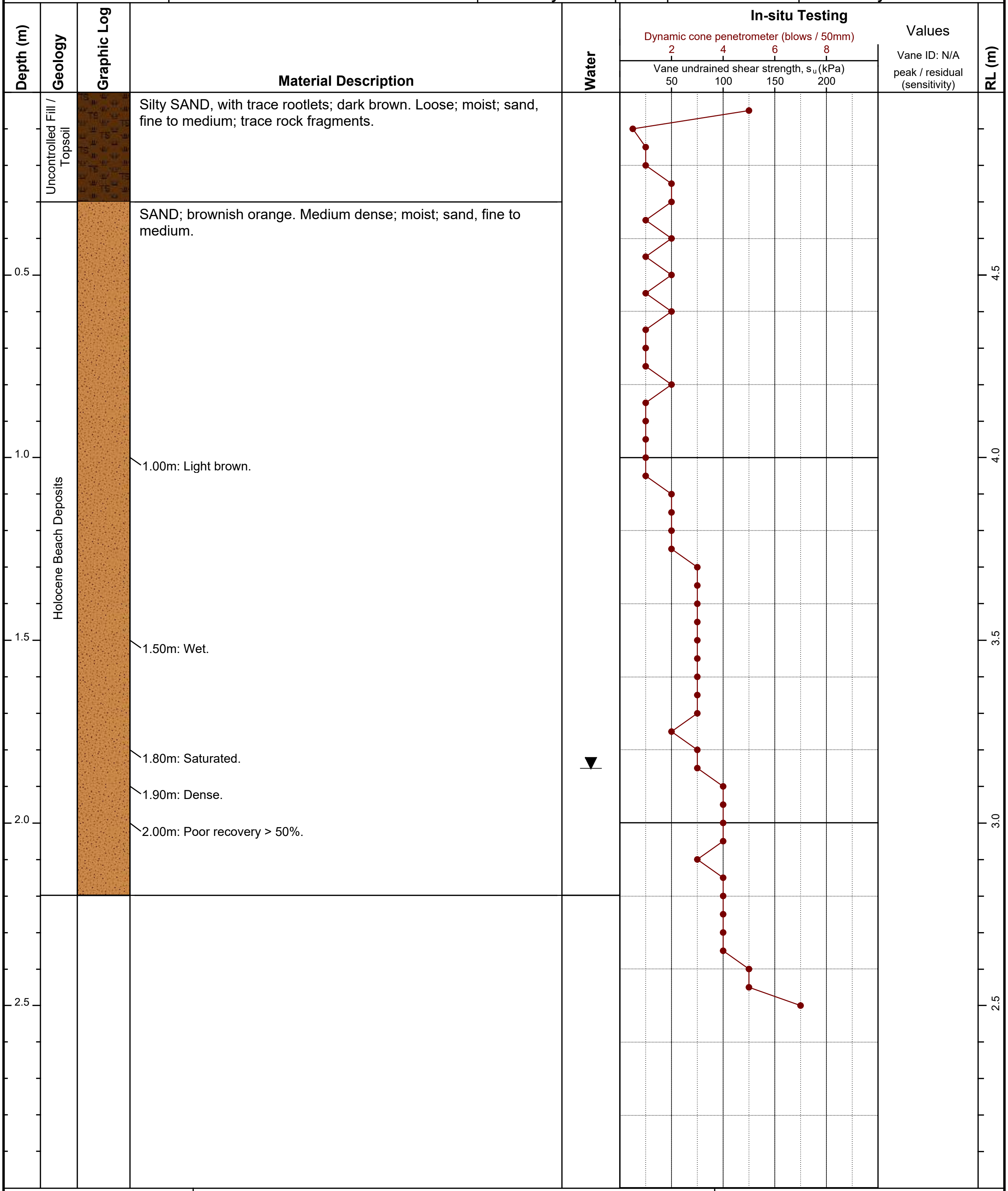
UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:42 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA05** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709093mN, 2035825mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium; trace rock fragments.

SAND; brownish orange. Medium dense; moist; sand, fine to medium.

1.00m: Light brown.

1.50m: Wet.

1.80m: Saturated.

1.90m: Dense.

2.00m: Poor recovery > 50%.

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

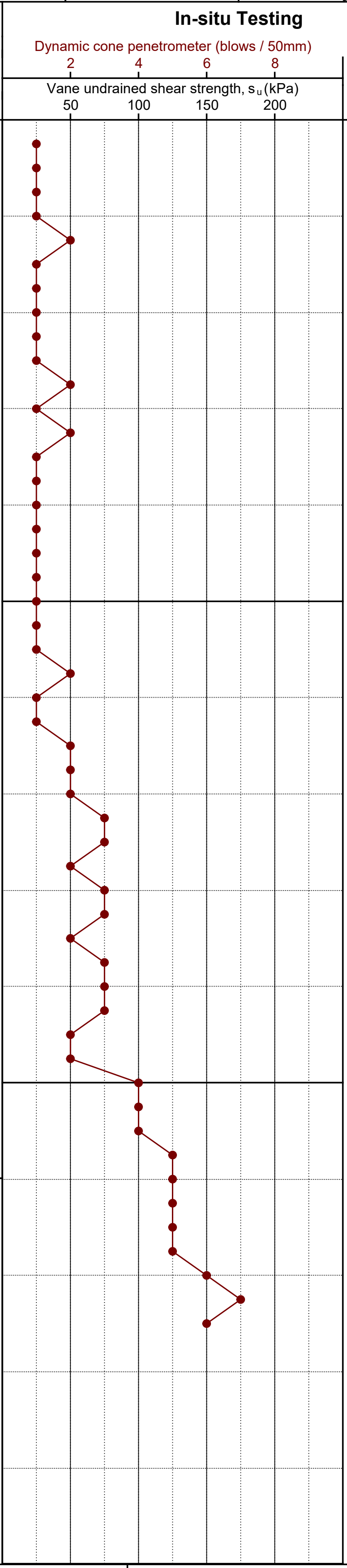
LDE LAND DEVELOPMENT & ENGINEERING

| | |
|---|---|
| **Test ID:** | **HA06** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035819mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water | RL (m) |
|---|---|---|---|---|---|
| 0.0–0.60 | Uncontrolled Fill / Topsoil | TS | SAND, with minor silt, with trace rootlets and gravel; dark brown. Loose; moist; sand, fine to medium; gravel, fine to medium, subangular.<br>0.40m: Brownish black. | | |
| 0.60–2.20 | Holocene Beach Deposits | | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.30m: Medium dense.<br>1.60m: Wet.<br>1.80m: Saturated.<br>2.00m: Dense.<br>2.10m: Poor recovery > 30%. | ▼ (approx. 1.90m) | |

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5; RL scale: 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:45 pm

# Hand Auger Borehole Log

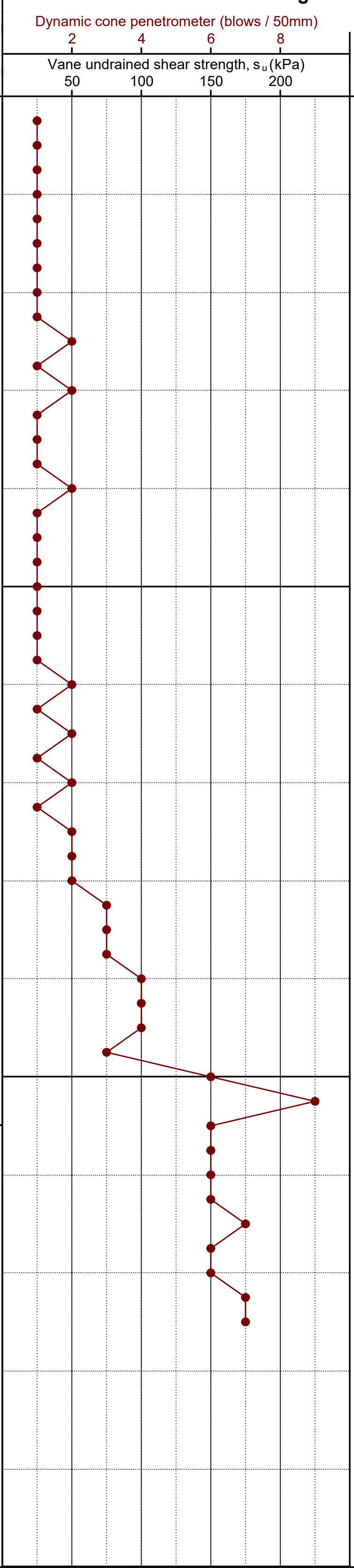
| | |
|---|---|
| **Test ID:** | **HA07** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | |
|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709106mN, 2035822mE |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map |

| | |
|---|---|
| **Test Date:** | 14/09/2023 |
| **Logged By:** | SS |
| **Prepared By:** | SS |
| **Checked By:** | RH |

| **Depth (m)** | **Geology** | **Material Description** | **Water** | **RL (m)** |
|---|---|---|---|---|
| | Topsoil | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium. | | |
| | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | | |
| 0.5 | | | | 4.5 |
| 1.0 | | | | 4.0 |
| | | 1.10m: Light brown. | | |
| | | 1.20m: Medium dense. | | |
| | | 1.30m: Wet. | | |
| 1.5 | | | | 3.5 |
| | | 1.60m: Saturated. | ▼ | |
| | | 1.80m: Dense; poor recovery > 50%. | | |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



**Values**

Vane ID: N/A

peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.10m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

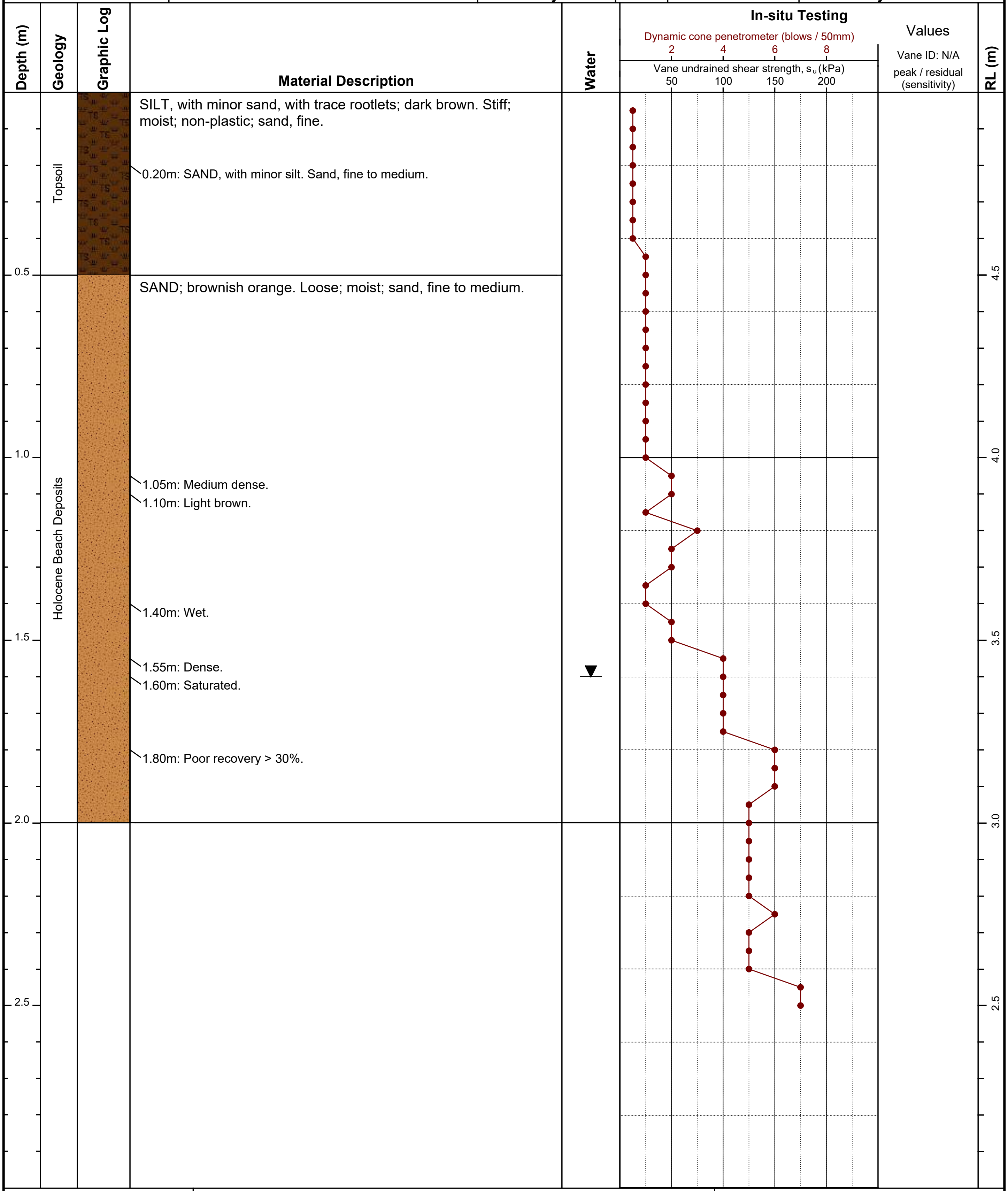
UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:46 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA08** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709111mN, 2035824mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine.

0.20m: SAND, with minor silt. Sand, fine to medium.

SAND; brownish orange. Loose; moist; sand, fine to medium.

1.05m: Medium dense.

1.10m: Light brown.

1.40m: Wet.

1.55m: Dense.

1.60m: Saturated.

1.80m: Poor recovery > 30%.

**Hole Depth:** 2.00m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:47 pm

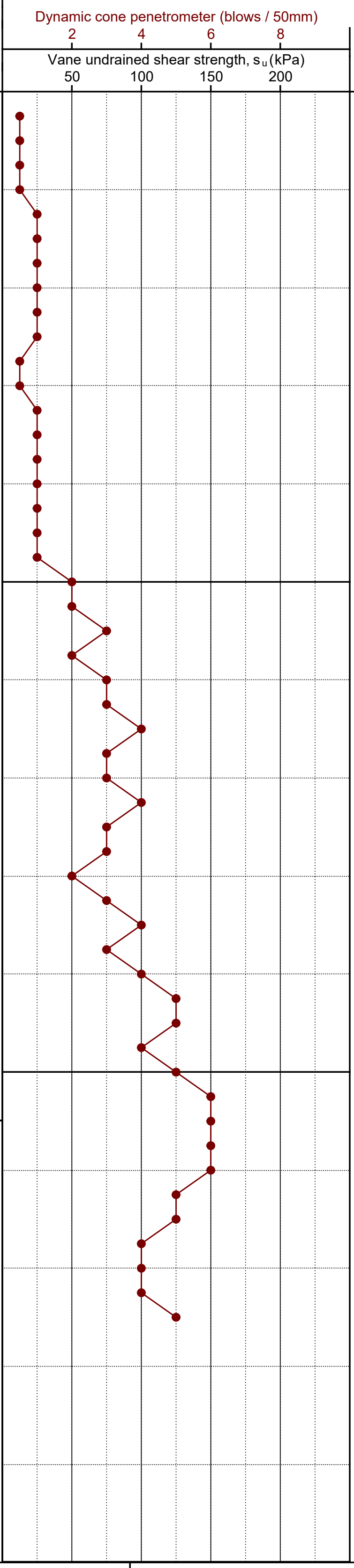
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | HA09 |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709117mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.40 | Uncontrolled Fill / Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine; trace glass fragments. | | |
| 0.40–2.10 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.00m: Medium dense.<br>1.10m: SAND; light brown. Sand, fine to coarse.<br>1.50m: Wet.<br>1.70m: Dense; saturated. | ▼ (1.70) | |
| 0.5 | | | | 4.5 |
| 1.0 | | | | 4.0 |
| 1.5 | | | | 3.5 |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

**Hole Depth:** 2.10m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow
UTP = Unable to Penetrate

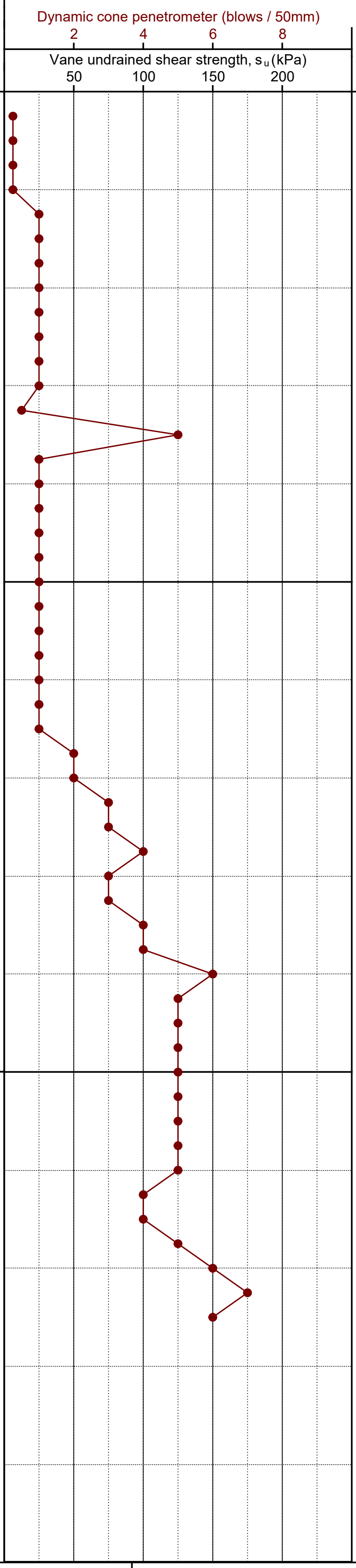
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA10** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709108mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| | Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | | |
| | Holocene Beach Deposits | SAND; light brown. Loose; moist; sand, fine to medium. | | |
| 0.5 | | | | 4.5 |
| 1.0 | | | | 4.0 |
| | | 1.20m: With minor silt. | | |
| | | 1.35m: Medium dense. | | |
| | | 1.40m: SAND. Sand, fine to coarse. | | |
| 1.5 | | 1.50m: Wet. | | 3.5 |
| | | 1.70m: Dense; saturated. | ▼ | |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

**Hole Depth:** 2.00m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

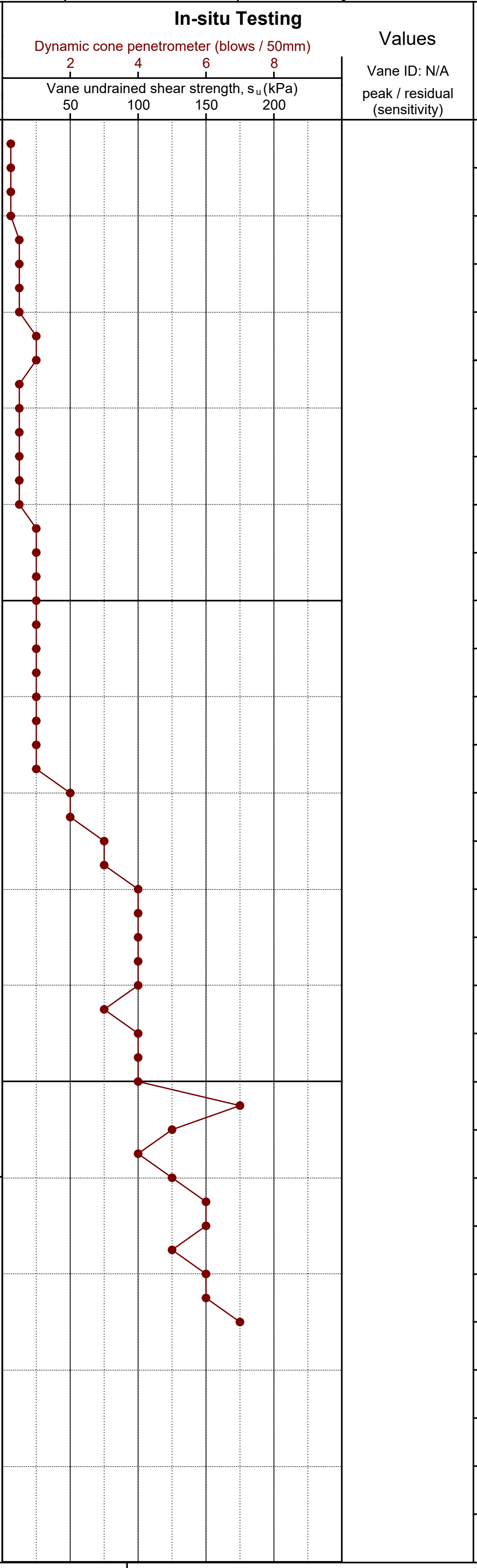
UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA11** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035805mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water | RL (m) |
|---|---|---|---|---|---|
| | Topsoil | | Silty SAND, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium. | | |
| | | | 0.20m: With trace silt. | | |
| 0.5 | | | 0.50m: Brownish black. | | 4.5 |
| | Holocene Beach Deposits | | SAND; brownish orange. Loose; moist; sand, fine to medium. | | |
| 1.0 | | | | | 4.0 |
| | | | 1.10m: Light brown. | | |
| | | | 1.40m: Medium dense. | | |
| 1.5 | | | 1.50m: Wet. | | 3.5 |
| | | | 1.60m: Dense. | | |
| | | | 1.80m: Saturated. | ▼ | |
| 2.0 | | | | | 3.0 |
| | | | 2.10m: Poor recovery > 30%. | | |
| 2.5 | | | | | 2.5 |



| | |
|---|---|
| **Hole Depth:** 2.20m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:51 pm

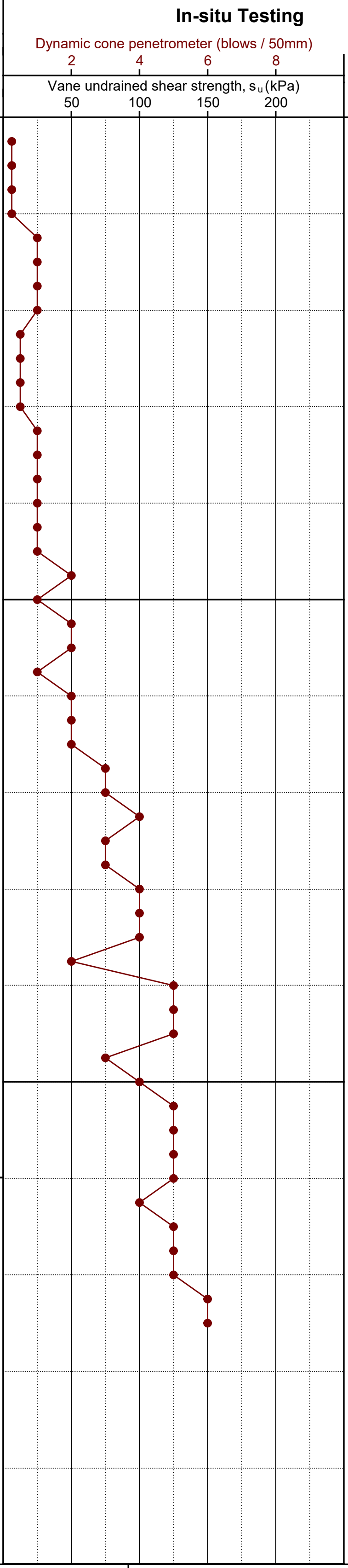
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA12** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709088mN, 2035801mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.0 – 0.6 | Topsoil | Silty SAND, with trace rootlets; brownish black. Very loose; moist; sand, fine to medium.<br>0.50m: Brownish grey. | |
| 0.6 – 2.2 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.20m: Medium dense.<br>1.50m: Wet.<br>1.80m: Saturated.<br>2.00m: Dense; poor recovery > 50%. | ▼ 1.80 |

**In-situ Testing**



**Values**

Vane ID: N/A

peak / residual (sensitivity)

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
▼ Standing water level
○ Vane residual
◁ Groundwater inflow
◆ Vane UTP
▷ Groundwater outflow

UTP = Unable to Penetrate

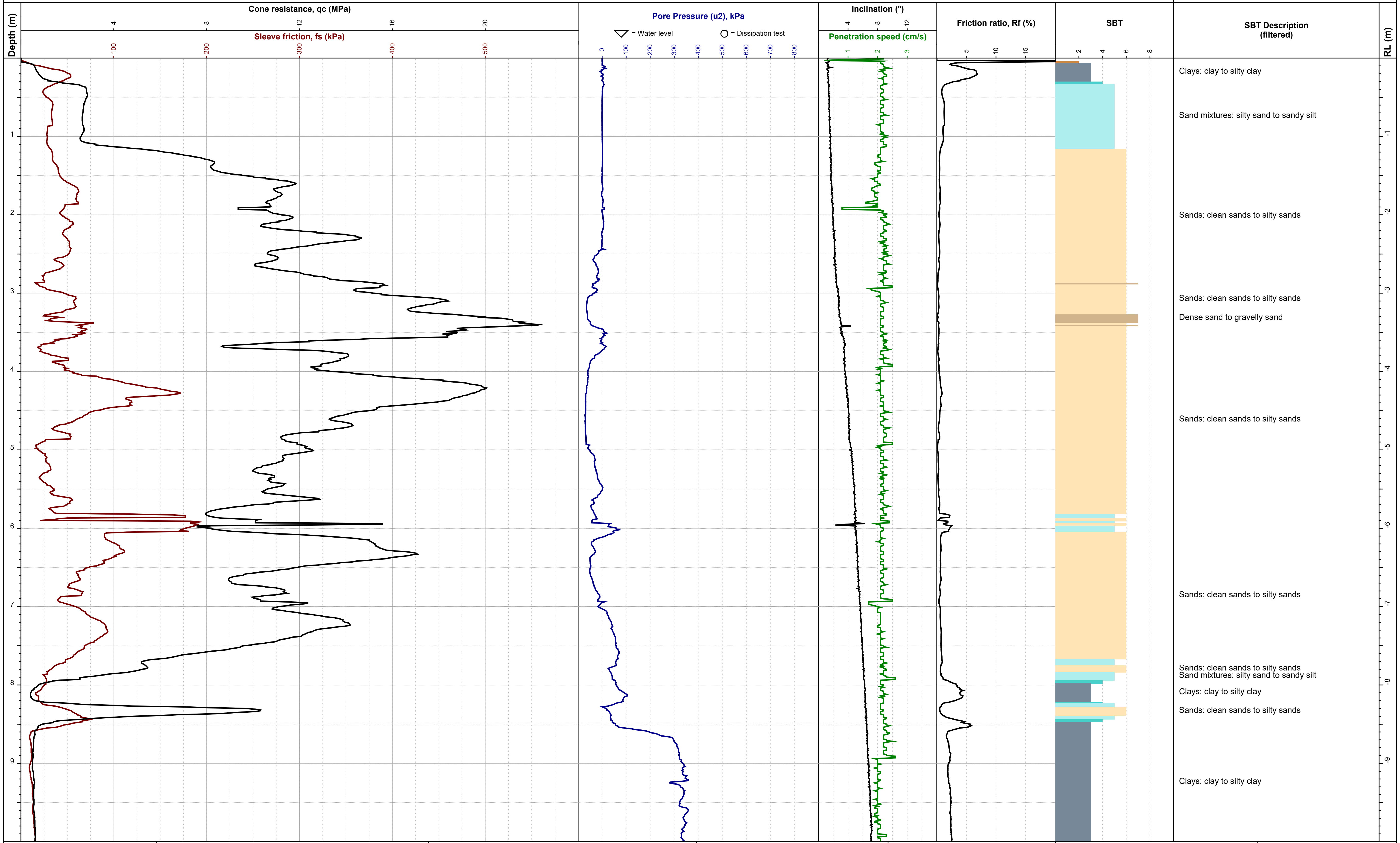
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:53 pm

# APPENDIX C

# CONE PENETROMETER TEST LOGS

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT01



LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

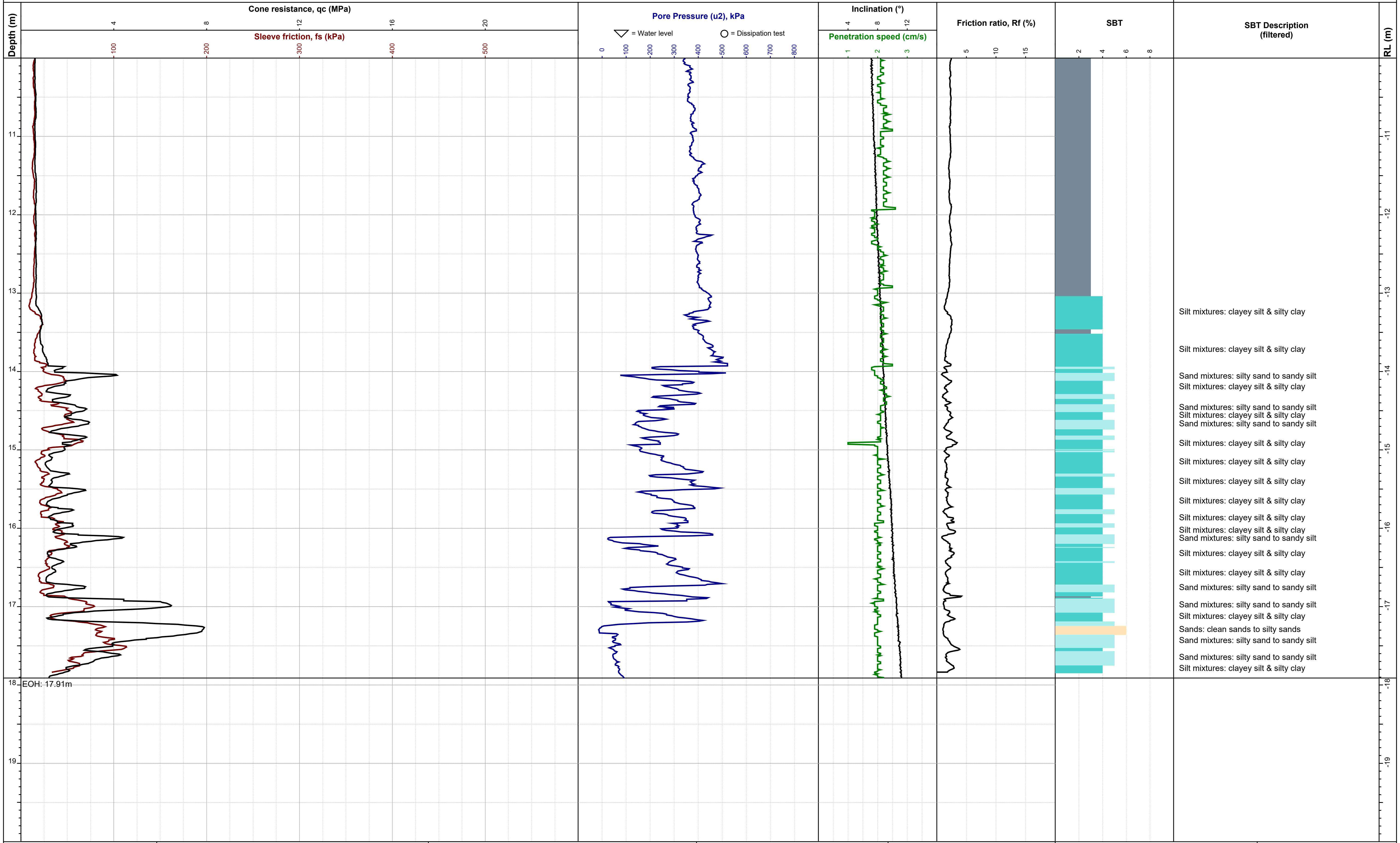
**Test ID:**
CPT01

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 1 of 2 |
| **Date:** | 03/10/2023 |

Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:08 am

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT01**



LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

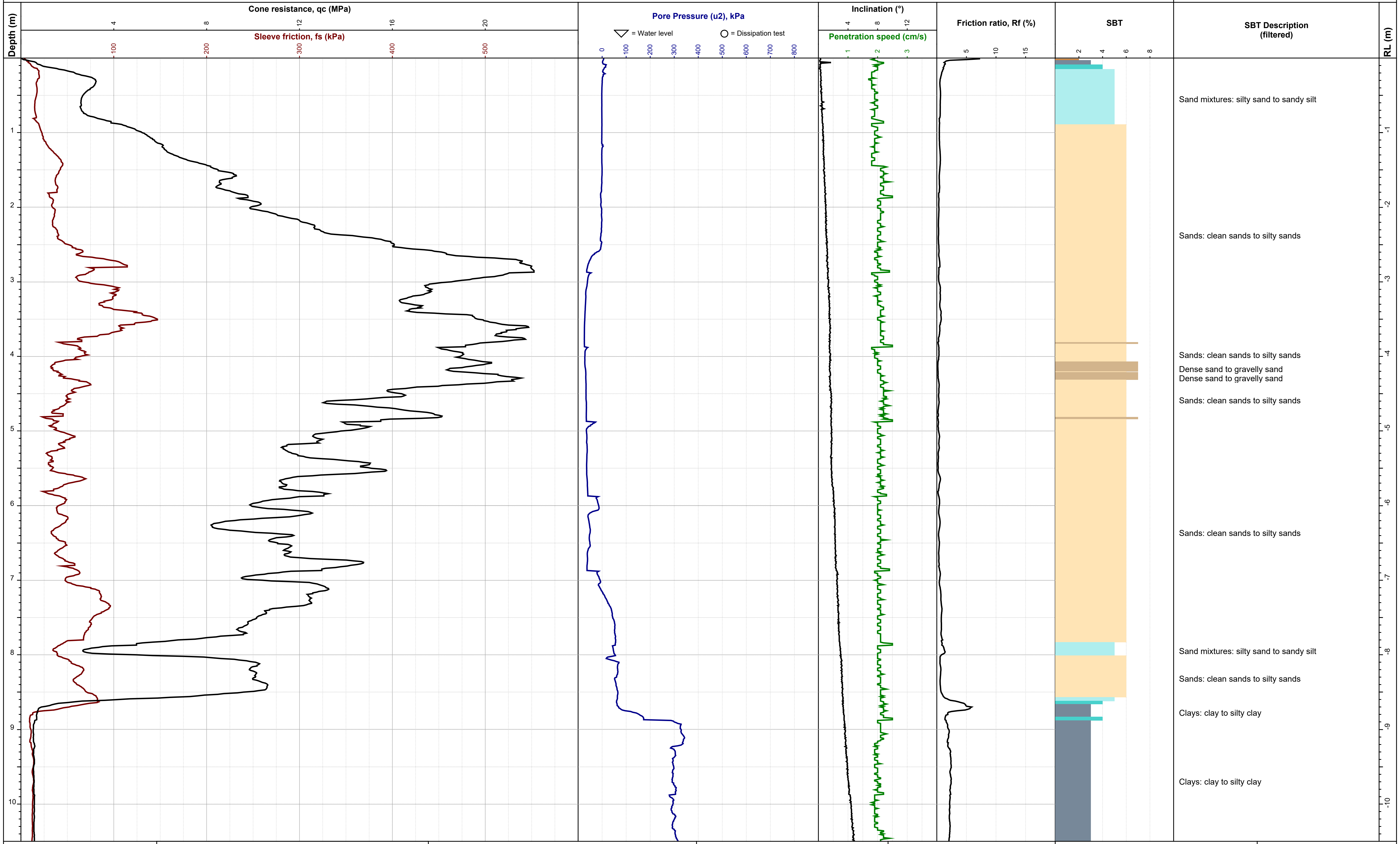
**Test ID:**

**CPT01**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 2 of 2 |
| **Date:** | 03/10/2023 |

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT02



| | |
|---|---|
| **Client:** | TW Property Holdings Limited |
| **Project:** | Geotechnical Investigation for Proposed Subdivision |
| **Location:** | 99A Stanley Road, Gisborne |

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

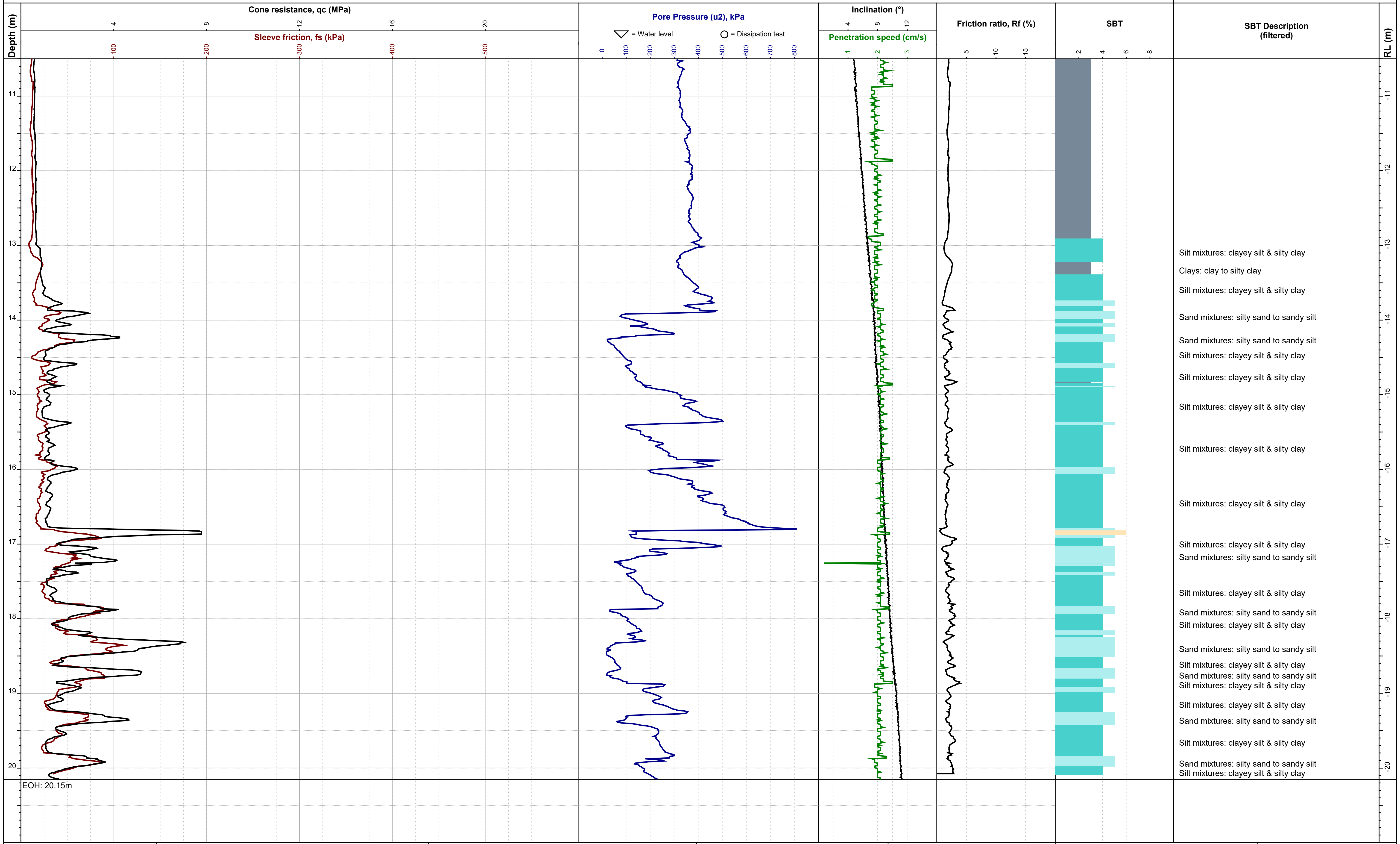
**Test ID:**
CPT02

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 1 of 2 |
| **Date:** | 14/09/2023 |

Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 2/10/2023 11:42:11 am

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT02**



Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 2/10/2023 11:42:12 am

LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

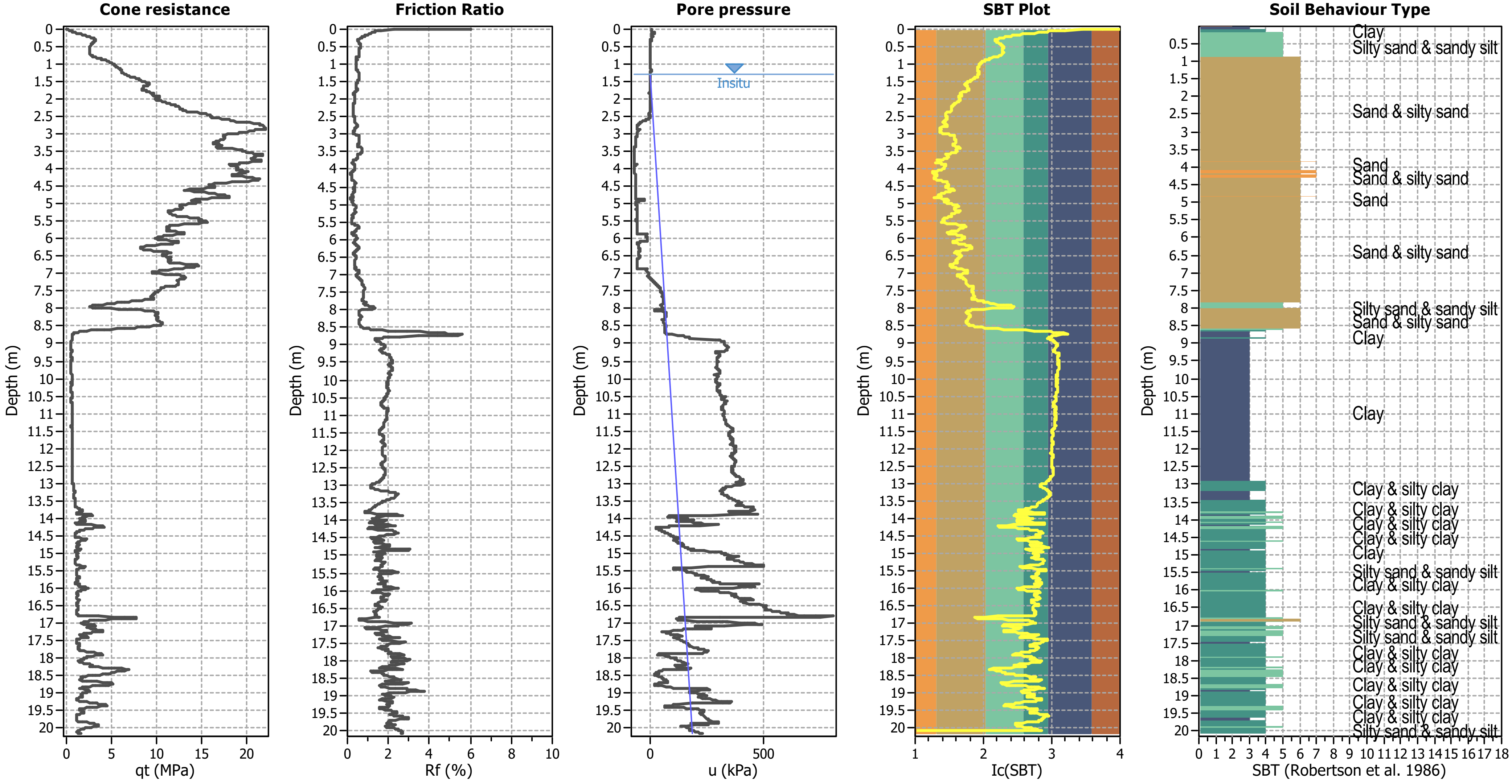
**Test ID:** **CPT02**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 2 of 2 |
| **Date:** | 14/09/2023 |

# APPENDIX D

# LIQUEFACTION ANALYSIS RESULTS

# CPT basic interpretation plots


Cone resistance

Friction Ratio

Pore pressure

SBT Plot

Soil Behaviour Type

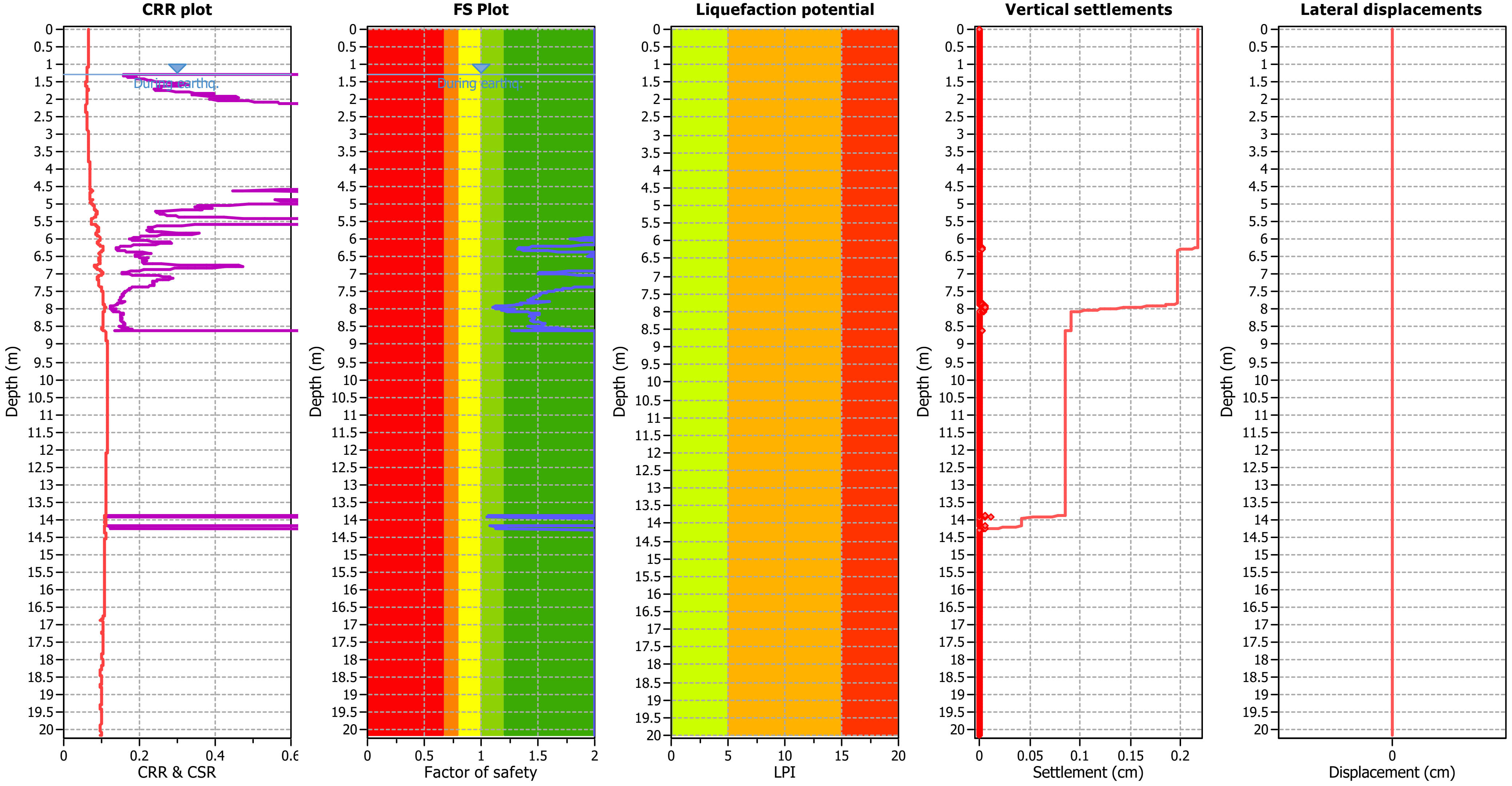
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟫 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬛ 8. Very stiff sand to |
| 🟦 3. Clay to silty clay | 🟨 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

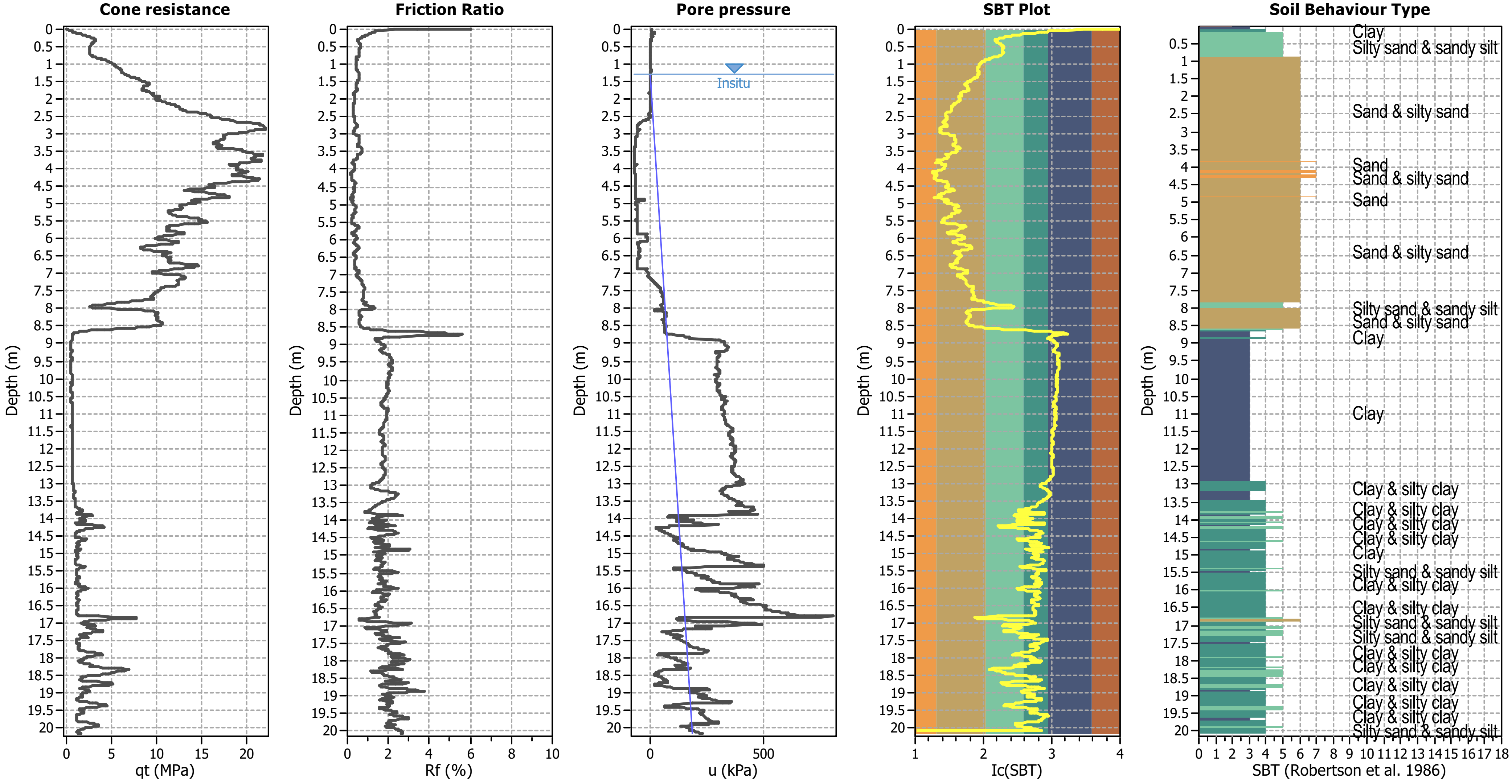
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

# CPT basic interpretation plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.30
Peak ground acceleration: 0.12
Depth to water table (insitu): 1.30 m

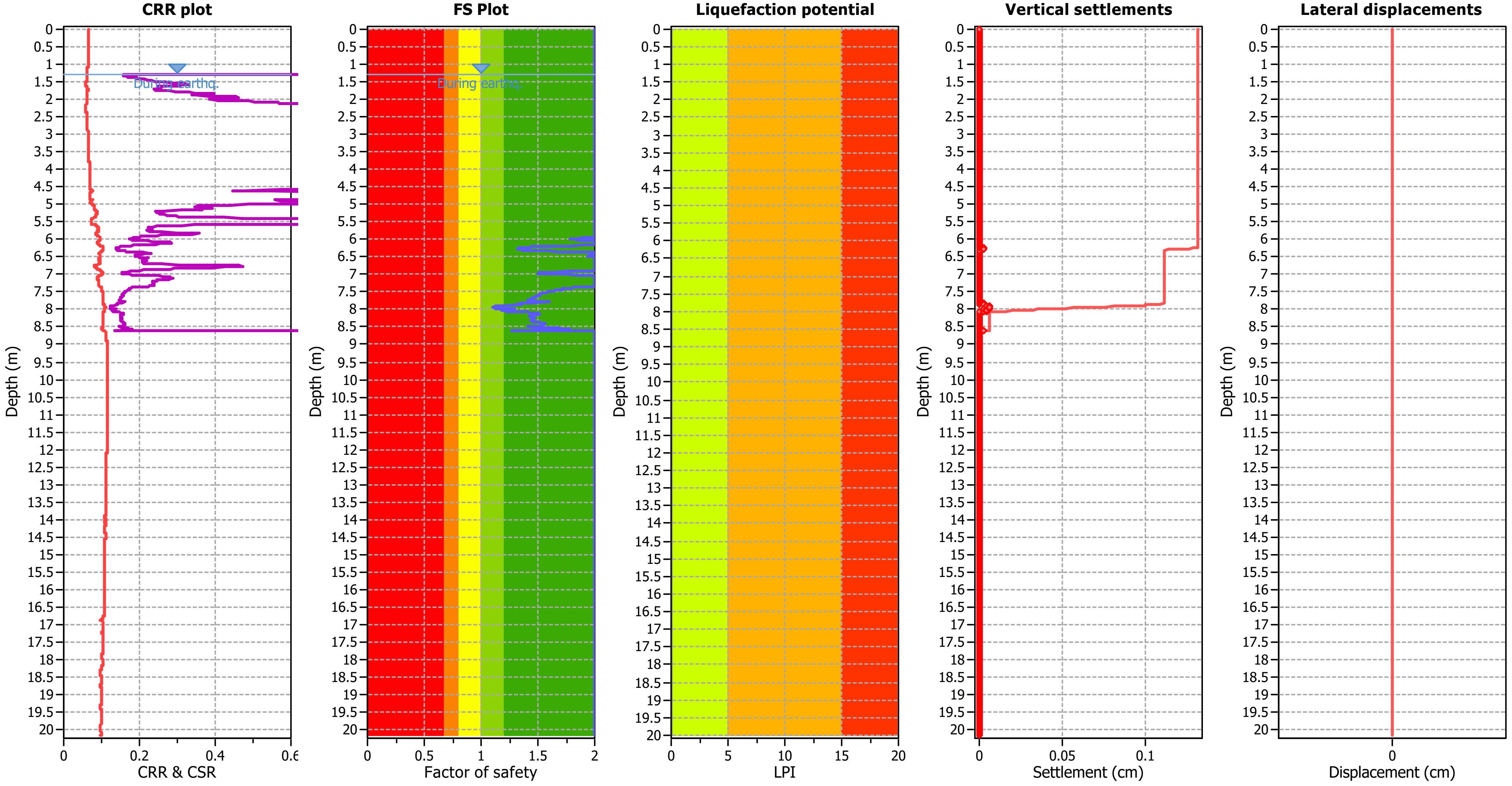
Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

## SBT legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟫 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬜ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.30
Peak ground acceleration: 0.12
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

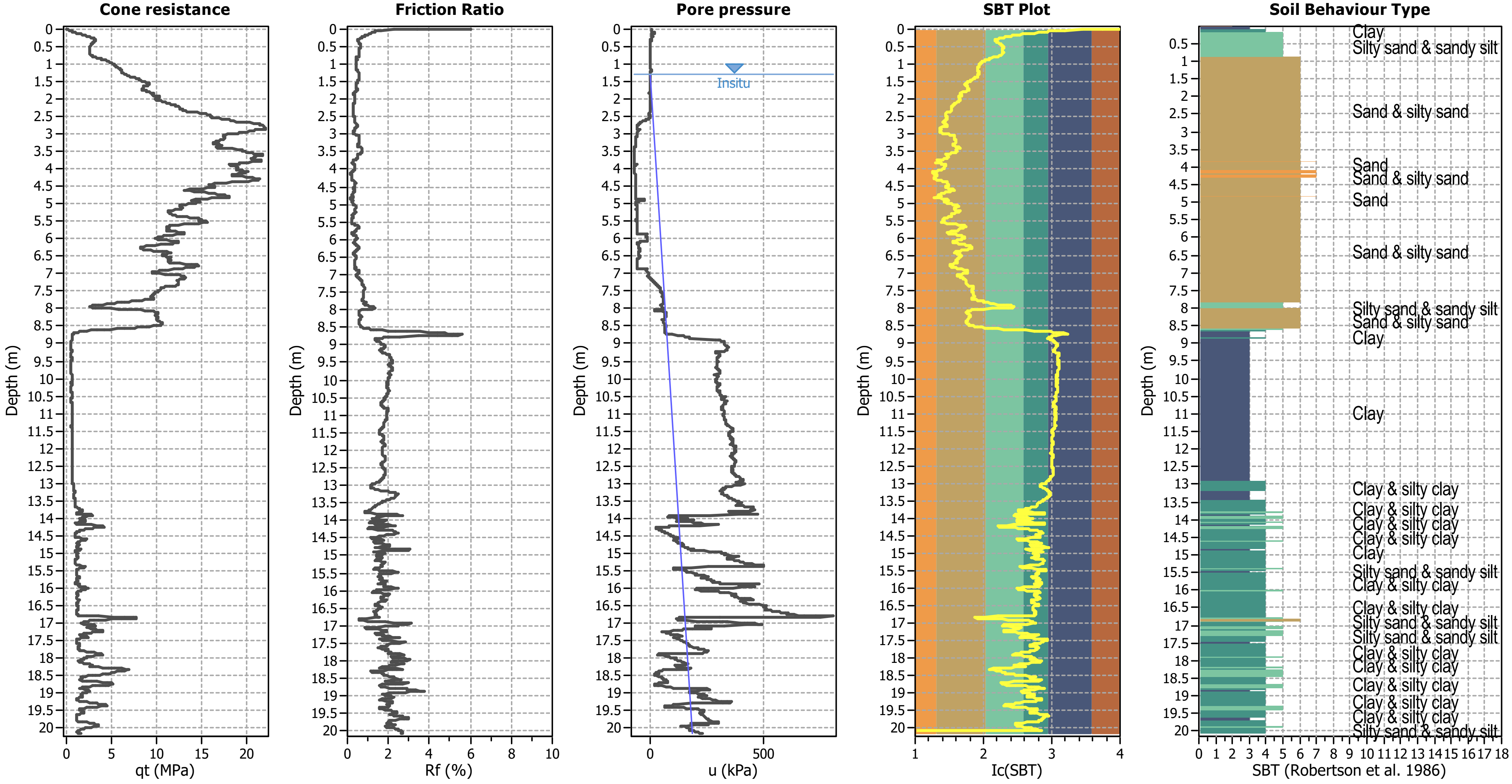
### F.S. color scheme

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

### LPI color scheme

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

## CPT basic interpretation plots



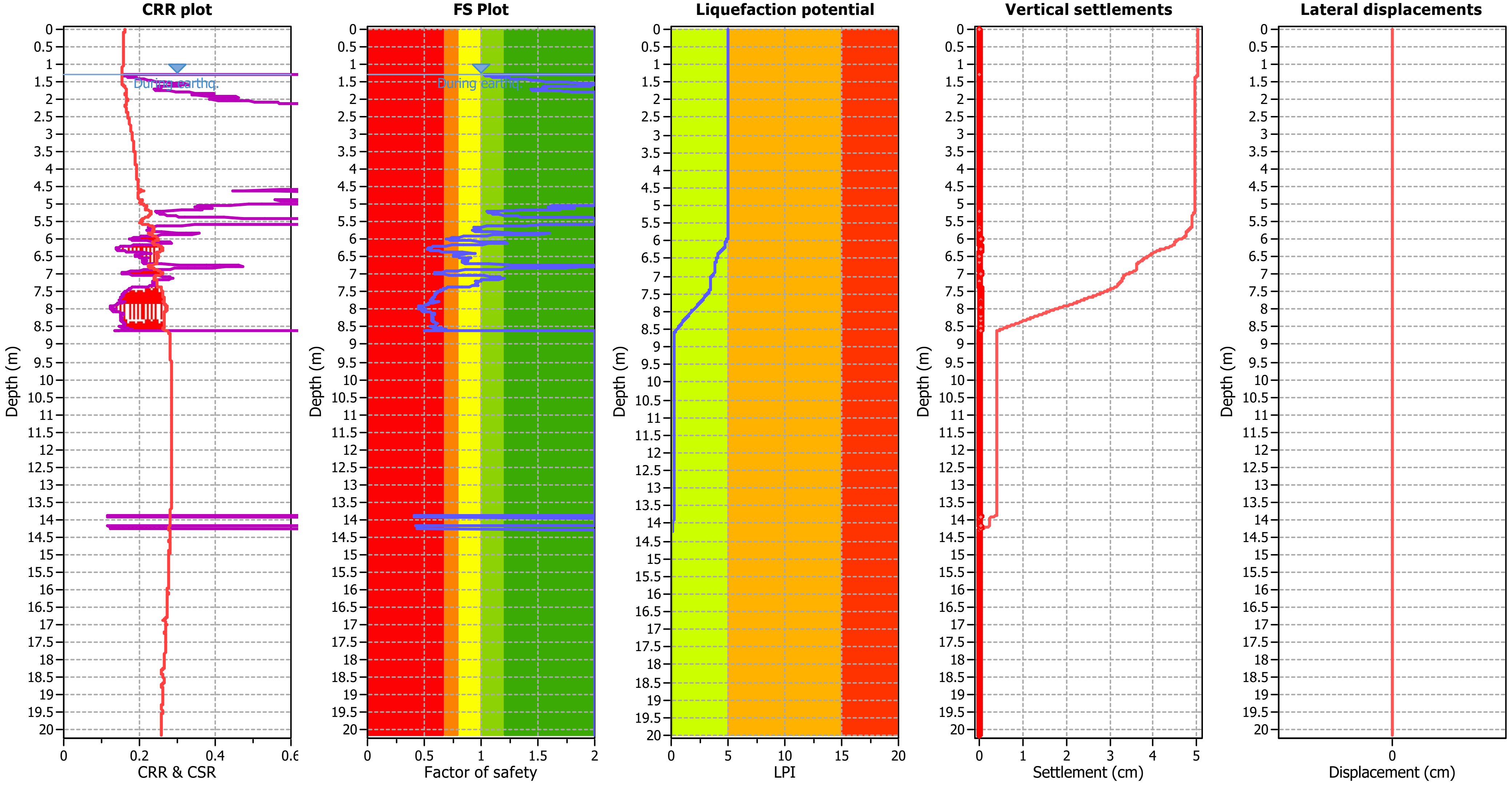
### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

### SBT legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.80
Peak ground acceleration: 0.28
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_{\sigma}$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 15.00 m

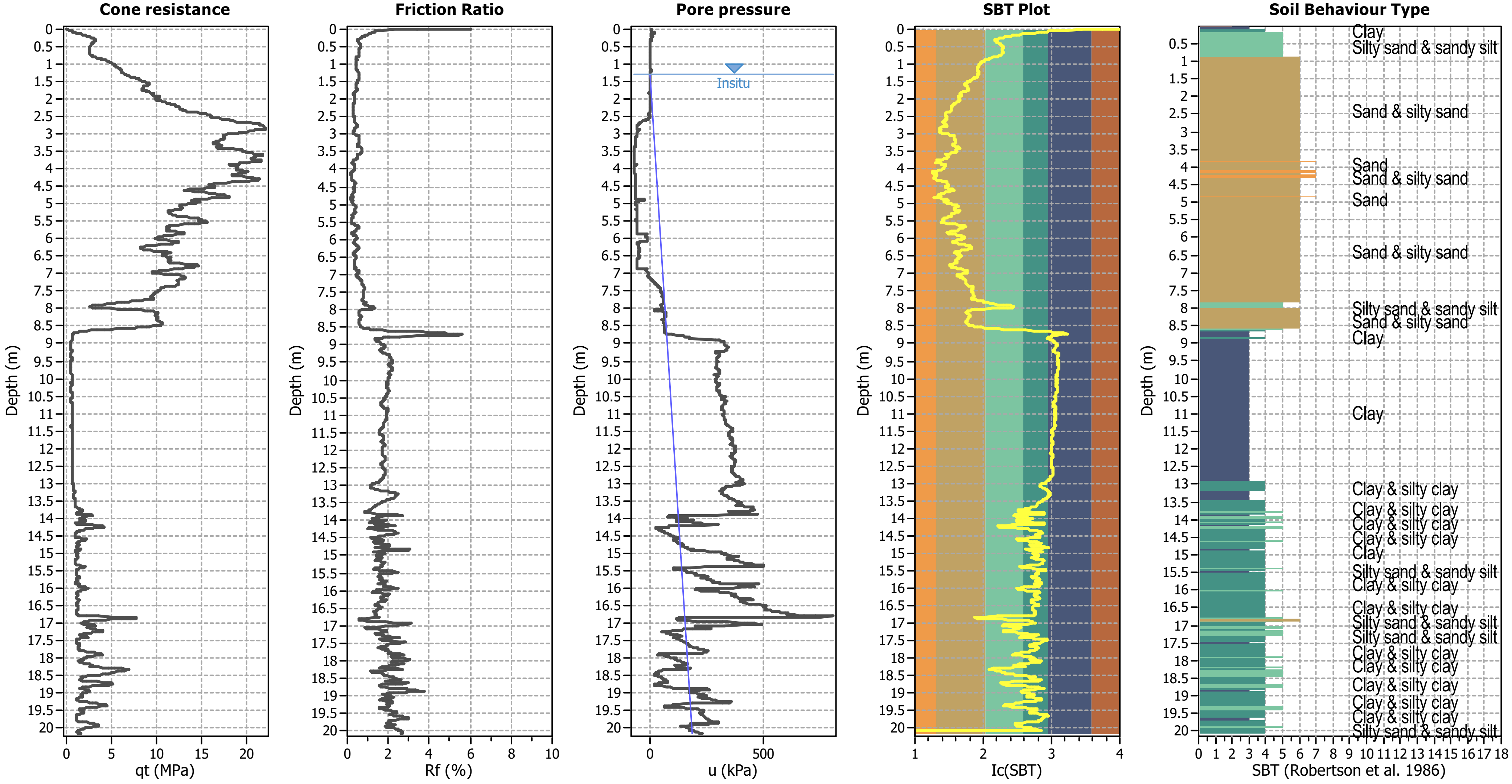
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟩 Low risk

# CPT basic interpretation plots



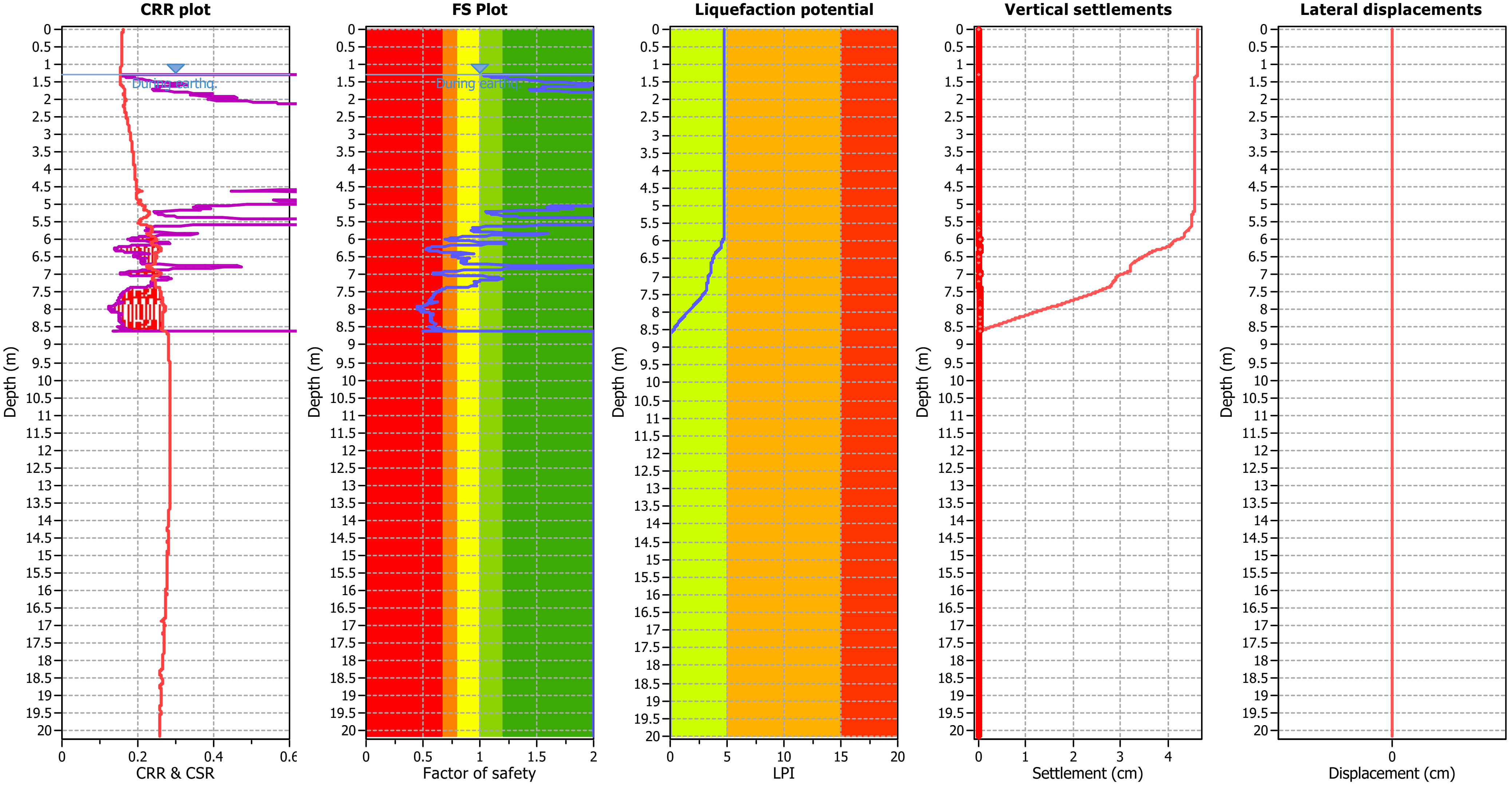
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

### SBT legend

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬛ 8. Very stiff sand to |
| 🟦 3. Clay to silty clay | 🟨 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

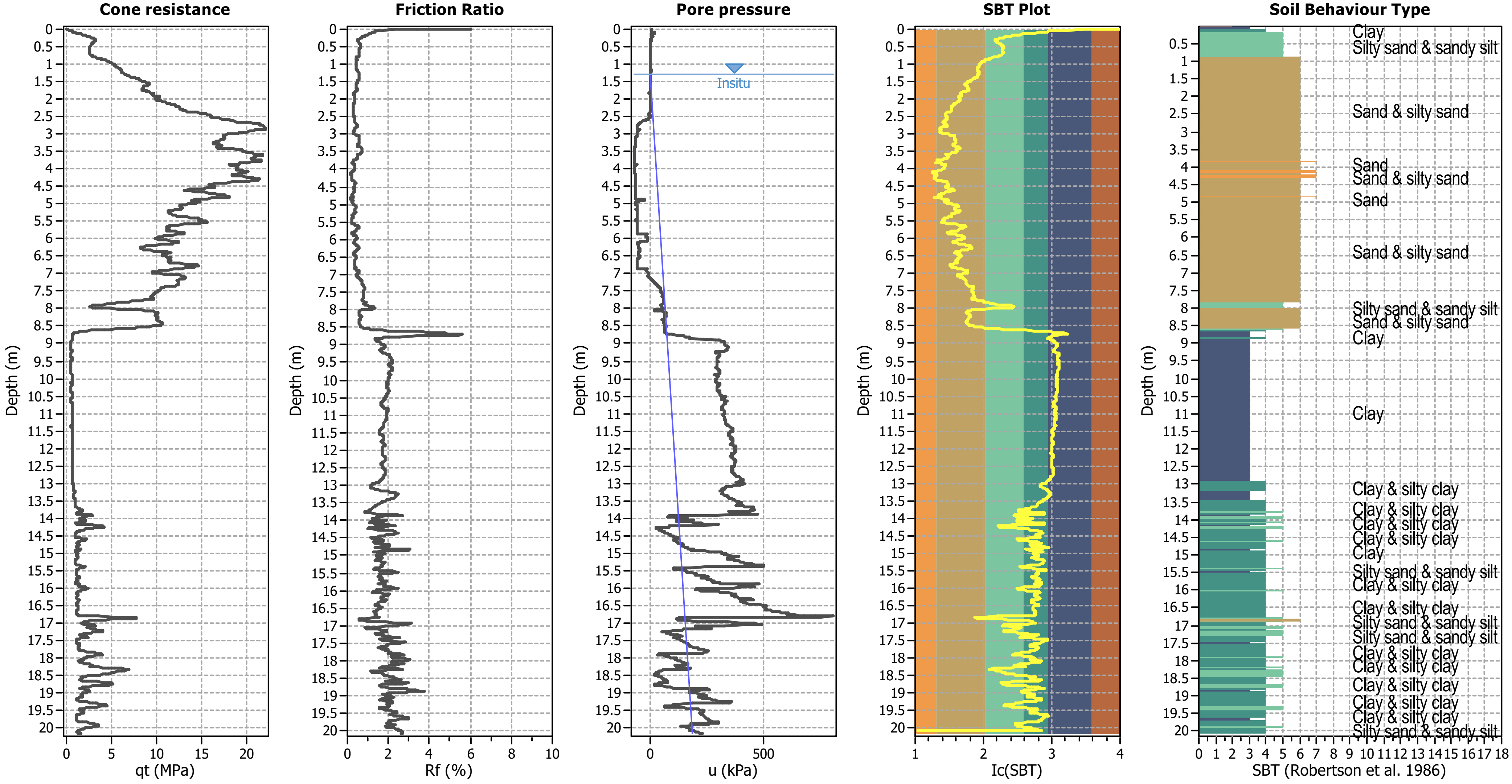
## F.S. color scheme

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

## LPI color scheme

- 🟥 Very high risk
- 🟧 High risk
- 🟩 Low risk

# CPT basic interpretation plots



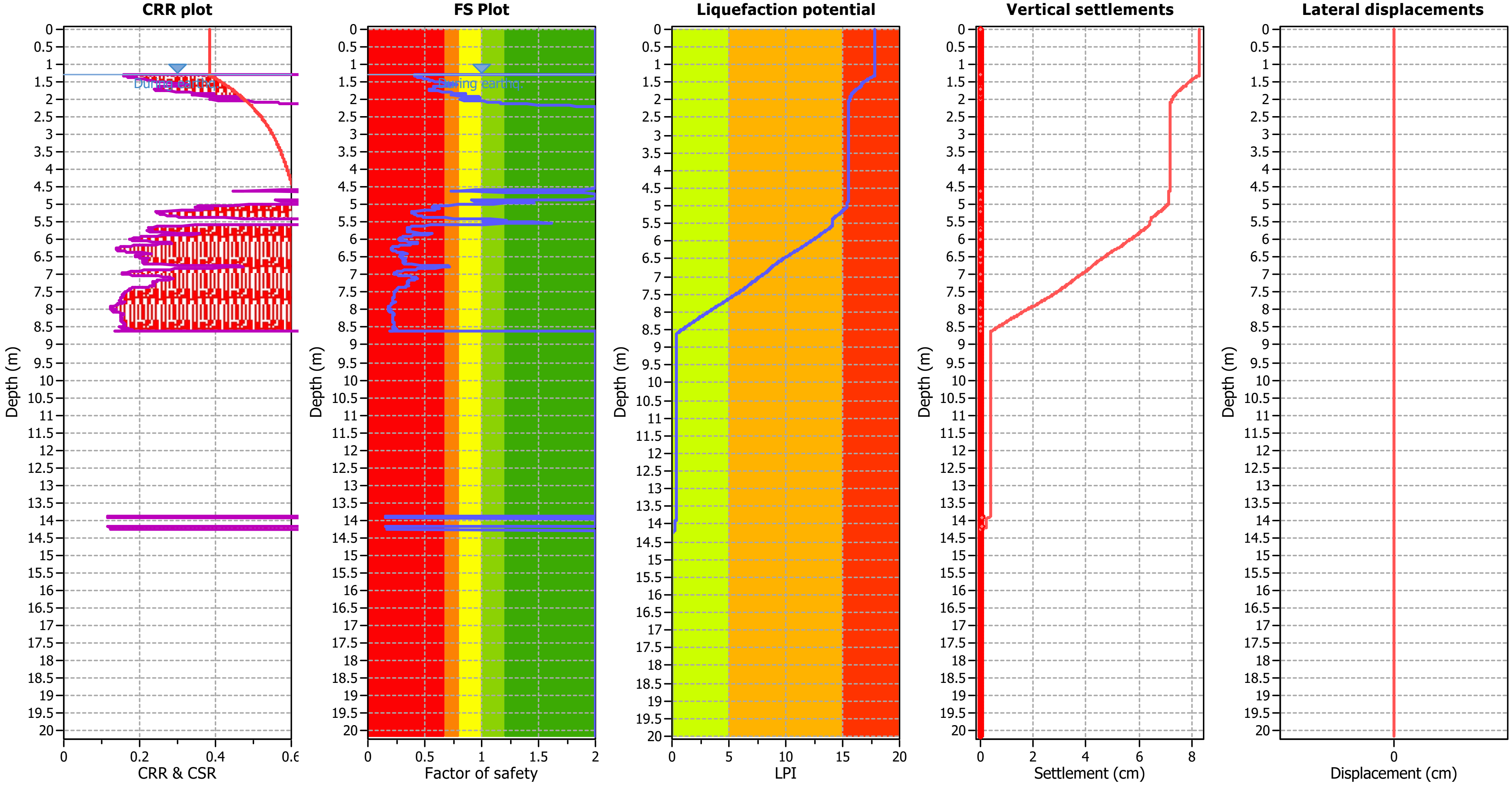
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.65 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

## SBT legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟫 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

## Liquefaction analysis overall plots



### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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### F.S. color scheme

| | |
|---|---|
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| 🟨 | Liquefaction and no liq. are equally likely |
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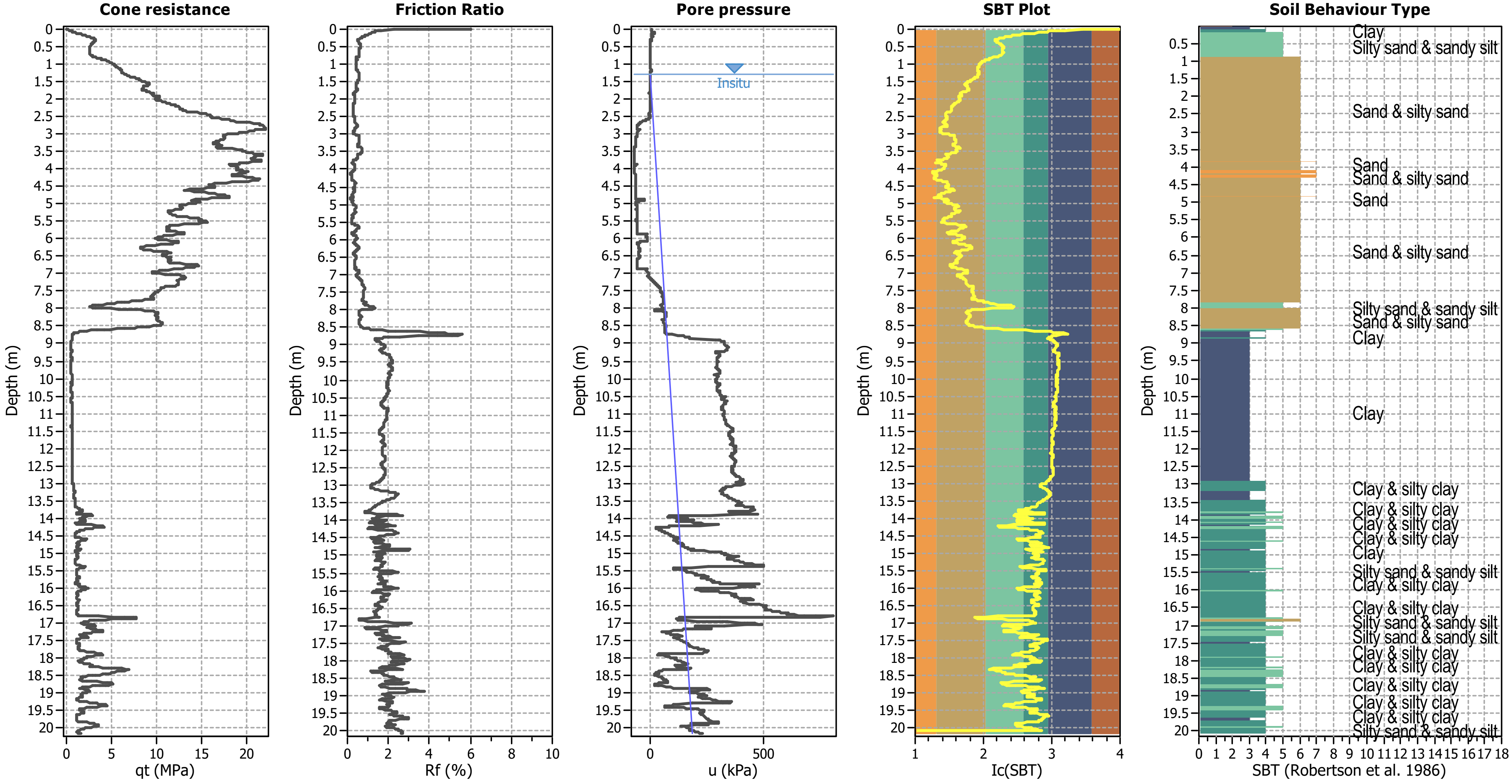
| 🟩 | Almost certain it will not liquefy |

### LPI color scheme

| | |
|---|---|
| 🟥 | Very high risk |
| 🟧 | High risk |
| 🟩 | Low risk |

# CPT basic interpretation plots



## Input parameters and analysis data

| | | | | | |
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| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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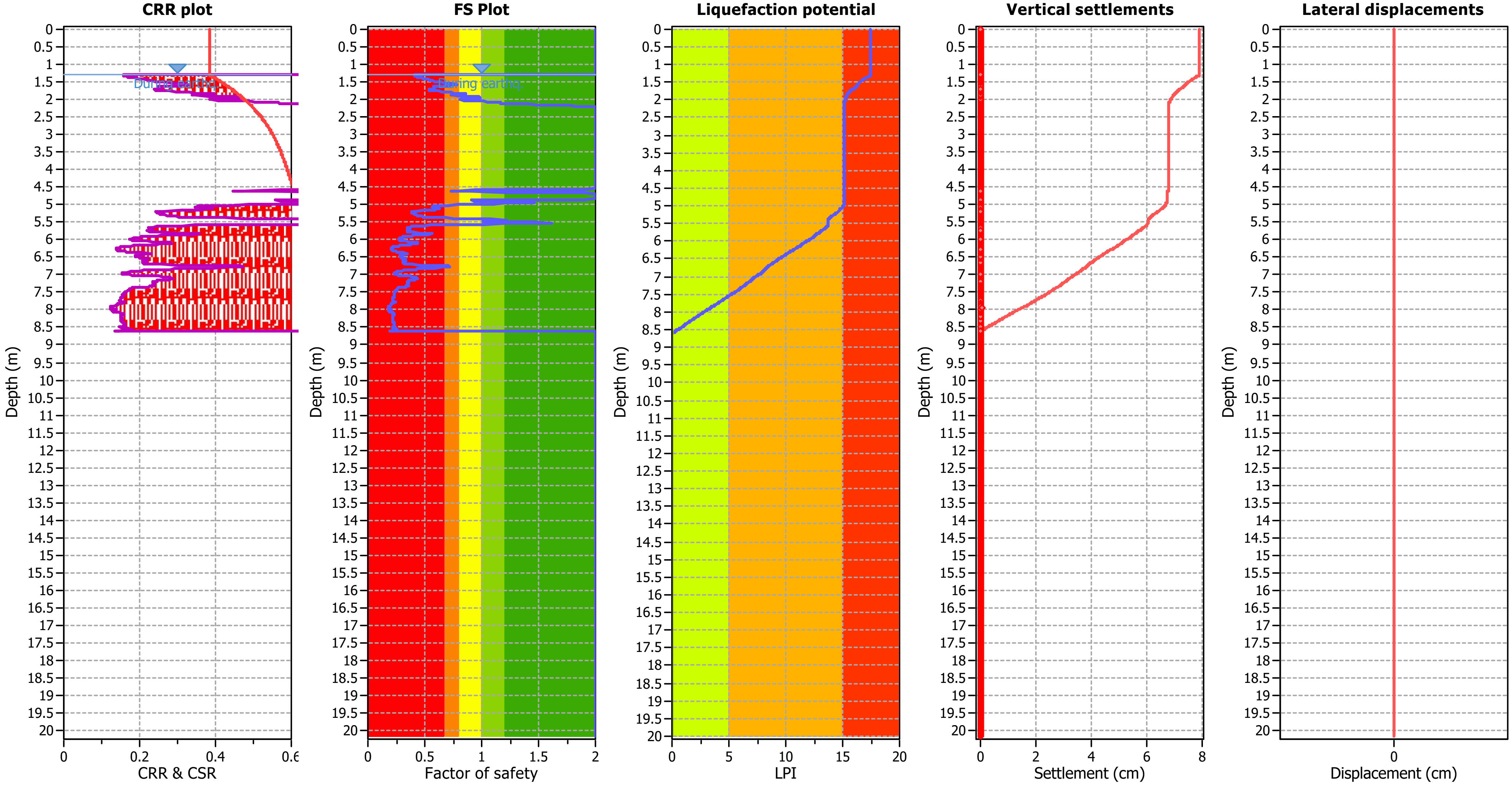
| Peak ground acceleration: | 0.65 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

### SBT legend

| | | | | | |
|---|---|---|---|---|---|
| 🟥 | 1. Sensitive fine grained | 🟩 | 4. Clayey silt to silty | 🟧 | 7. Gravely sand to sand |
| 🟫 | 2. Organic material | 🟩 | 5. Silty sand to sandy silt | ⬛ | 8. Very stiff sand to |
| 🟦 | 3. Clay to silty clay | 🟨 | 6. Clean sand to silty sand | ⬜ | 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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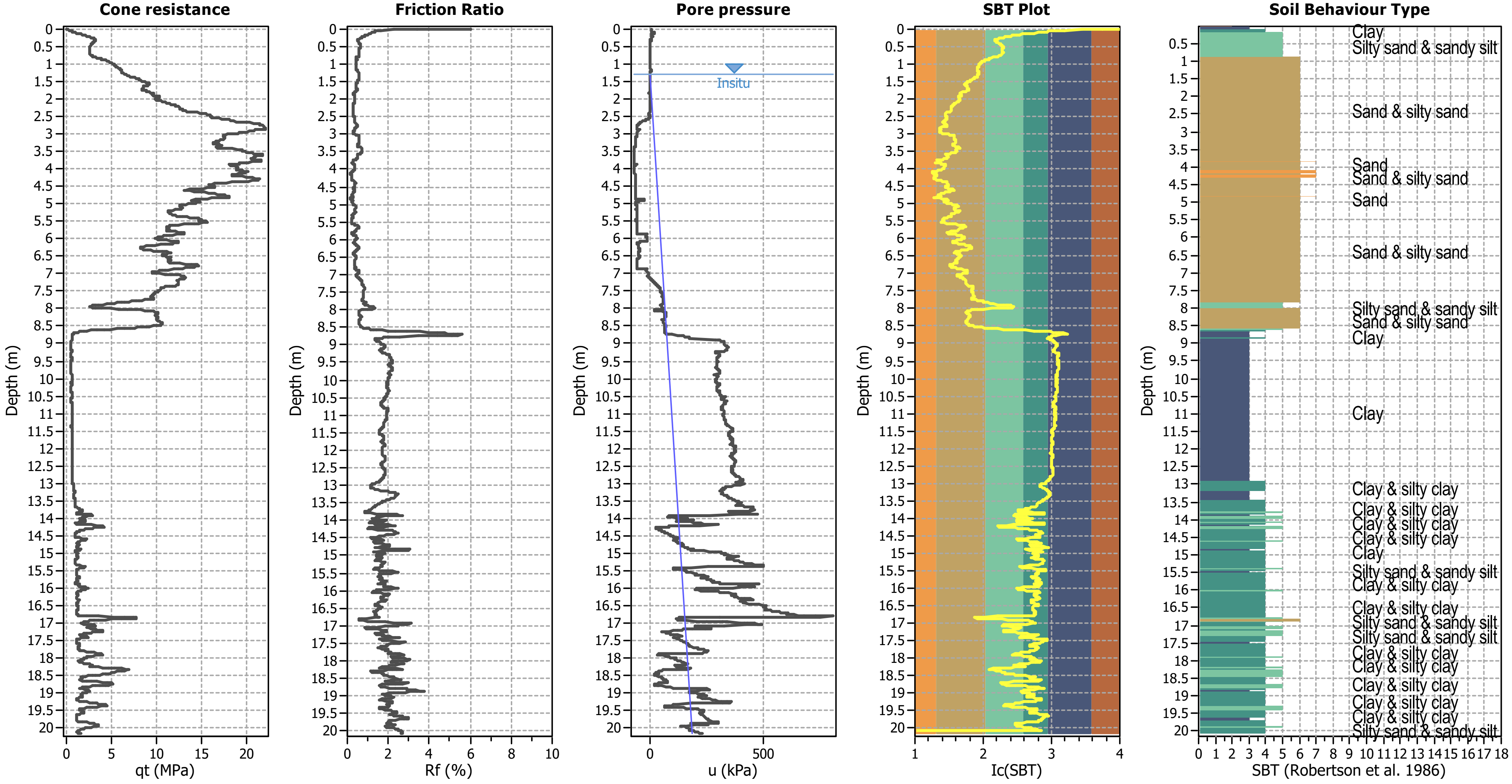
# CPT basic interpretation plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 7.50
Peak ground acceleration: 0.65
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sand & Clay
Limit depth applied: Yes
Limit depth: 15.00 m

## SBT legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
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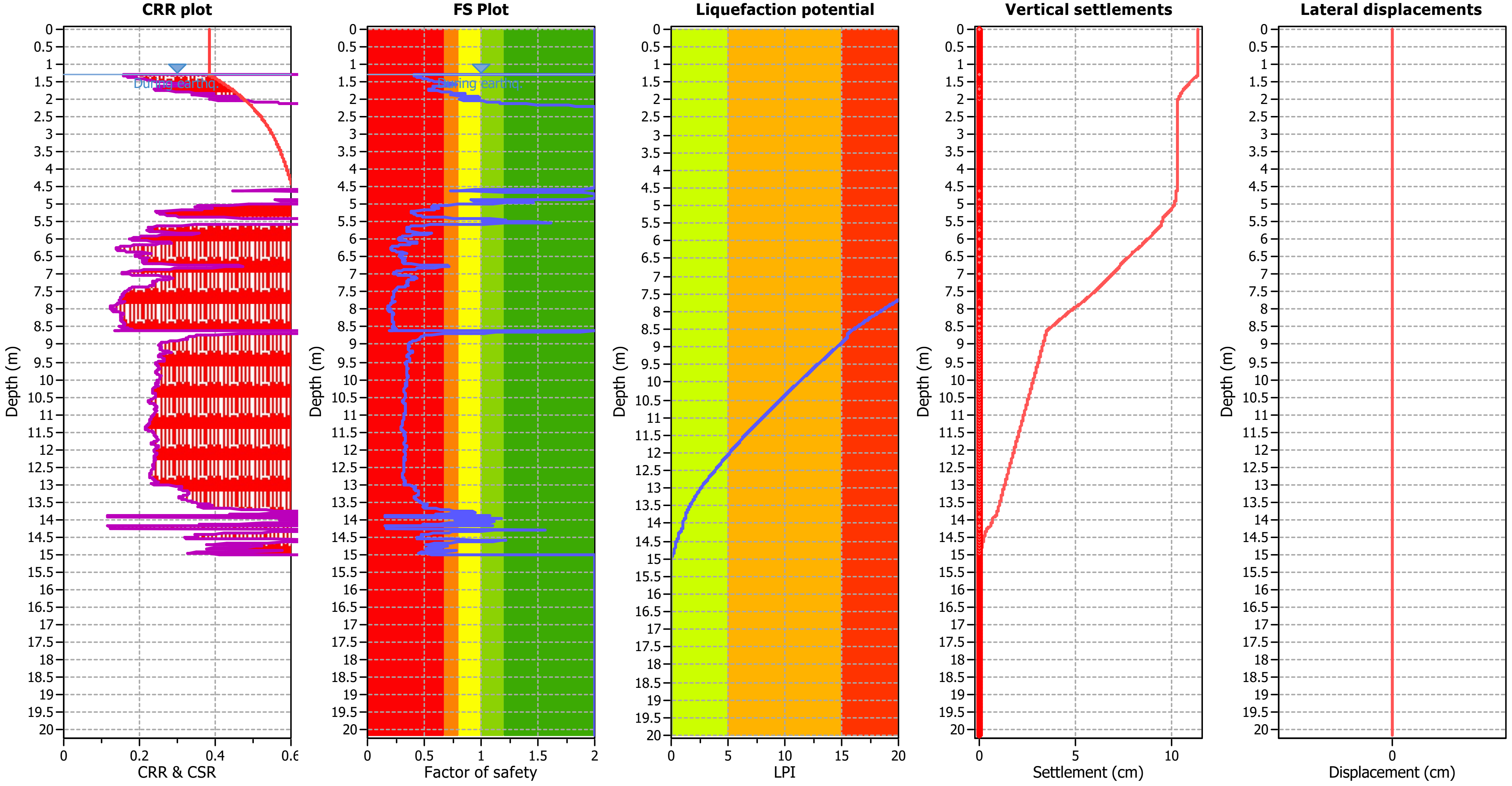
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sand & Clay |
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**LPI color scheme**

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- 🟨 Low risk

NZHG Gisborne Limited

# SITE SPECIFIC GEOTECHNICAL REPORT FOR PROPOSED RESIDENTIAL DWELLING, LOT 3 AND 4

99A Stanley Road, Gisborne

**Project Reference: 24729**
**October 17, 2023**

# DOCUMENT CONTROL

| Version | Date | Comments |
|---|---|---|
| 01 | 17/10/2023 | Issued for Resource Consent. Plan review required prior to submission for Building Consent. |

| Version | Issued For | Date | Prepared By | Reviewed & Authorised By |
|---|---|---|---|---|
| 01 | Issued for Resource Consent | 17/10/2023 | Sahil Sathwara<br>*B.Tech (Civil), MEngNZ*<br>Geotechnical Engineer | Dan Bond<br>*CMEngNZ, PEngGeol.*<br>*Associate Engineering Geologist* |

# CONTENTS

# 1 INTRODUCTION

Land Development & Engineering Ltd (LDE) was engaged by NZHG Gisborne Limited to undertake geotechnical investigations of a site located at 99A Stanley Street, Te Hapara, Gisborne (Figure 1), with legal description Lot 1 DP 5799. The 1,590m$^2$ site is proposed to be subdivided into 8 Lots for residential development (Figure 1). This geotechnical report pertains to proposed **Lot 3 and 4**, 99A Stanley Road, Gisborne.

Figure 1: Site location outlined in blue, with the proposed subdivision outlined in yellow, Lot 3 and 4 highlighted in white. Image source: Tairāwhiti Maps (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2023) Accessed: September 2023.

The purpose of this investigation was to determine and assess the nature of the ground beneath the building site to inform our geotechnical recommendations for site development and design of the building's foundations. The investigation was completed to satisfy the Gisborne District Council (2022) for Resource and Building Consent.

# 2 PROPOSED DEVELOPMENT

An 8-lot subdivision is proposed at 99A Stanley Road. Demolition and removal of existing structures is proposed, with the development consists of 4 structures formed of three double-storey duplex buildings and one single-storey duplex building (Figure 1).

The proposed driveway is located centrally in the site to provide access to the lots from Stanley Road. Proposed access and building platform locations are shown in Figure 1 and Appendix A.

A 92.8m$^2$ double storey building is proposed across Lot 3 and 4 (Figure 2), with timber framing in accordance with NZS3604 (2011), with weatherboard and sheet wall cladding, profiled metal roofing and either concrete floor or suspended timber floor, which has yet to be determined.

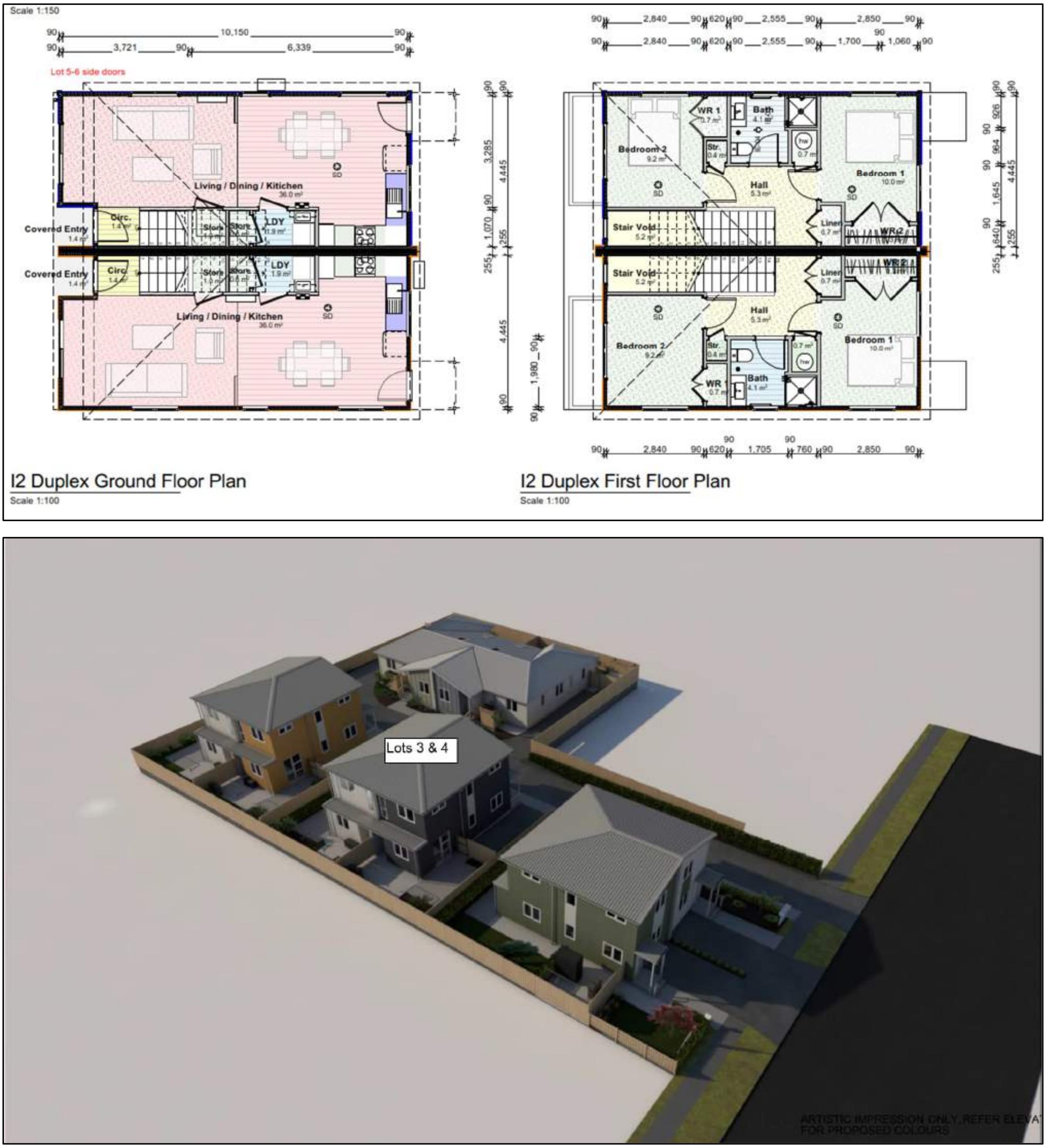


Figure 2: (From top to bottom): Floor plan for proposed duplex building across Lot 3 and 4, alongside the architect's drawing (Lot 3 and 4 are labelled) Image source: Client supplied.

# 3 SITE STUDY

## 3.1 Description

The site is located within the established suburb of Te Hapara, Gisborne, approximately 1.7km northwest of the Gisborne CBD. The site is generally flat and is elevated approximately 5m (New Zealand Vertical Datum (NZVD) 2016).

The site is within a General Residential zoning based on the Tairāwhiti Resource Manage Plan (2023) and recent aerials show the site to be developed has an existing dwelling and ancillary structure. The site does not contain any open drainage pathways or watercourses and we did not identify any significant geomorphological features nearby.

## 3.2 Published Geology

The 1:250,000 geological map of the region (Mazengarb & Speden, 2000) indicates the site is underlain by Holocene aged beach deposits which consist predominantly of sand.

## 3.3 Geotechnical Risks

Our review of Gisborne District Council's (GDC) GIS viewer, Tairāwhiti Maps (Gisborne District Council, 2022), and GNS Science's Active Faults Database (GNS Science, 2022) revealed following:

- The site is mapped as being within an area of moderate liquefaction risk.
- The nearest active fault is the Repongaere Fault, located approximately 16km north-west of the property.
- The site is mapped as yellow tsunami evacuation zone.

## 3.4 Historic Site Imagery

Historical aerial imagery was also reviewed as part of the investigation using Retrolens and Google Earth aerial photography, which revealed the following:

- Early images indicate that the site was developed prior to 1942, with a dwelling placed over the southwestern corner of Lot 1 DP 5799, occupying the corner of Stanley Road and Childers Road. These images also indicate the site to be within relic dune forms.
- The historic dwelling on the corner of Stanley Road and Childers Road was demolished between 1966 and 1972.
- The current, existing dwelling and a carport first appear in 1977 imagery.
- The surrounding developments on Childers Road are constructed by 1986.

After which the site appears to remain largely unchanged through to the present day.

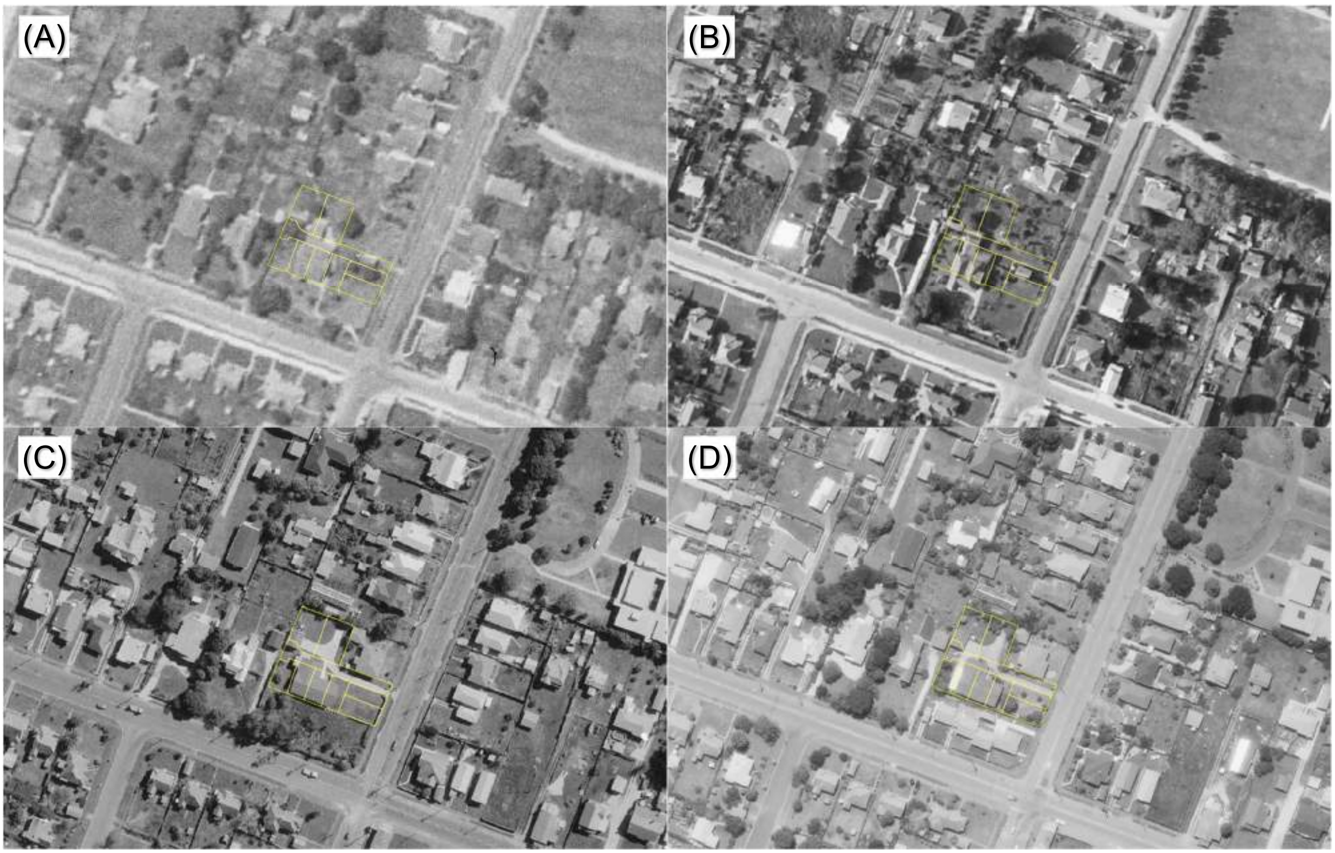


Figure 3: Historical aerial imagery of the Stanley Road subdivision (Source: (Retrolens.co.nz)), with the location of the individual lots marked in yellow. (a) Aerial imagery from 1942, (b) 1951, (c) 1977, (d) 1986.

# 4 GEOTECHNICAL INVESTIGATION

## 4.1 Development wide Investigation Scope

Our investigation of the entire site included the following scope of work:

- A walkover assessment of the site and immediate surrounding area to assess its geomorphology and identify any features which may influence our engineering recommendations, or the long-term performance of the ground.
- Twelve, 50mm diameter, hand auger boreholes to refusal or 2.5m target depth at the proposed building locations and associated Dynamic Cone Penetrometer (DCP) tests to the 2.5m target depth.
- Two cone penetrometer tests (CPTs) driven to between 17.9m and 20.15m depths, at either end of the proposed site.

## 4.2 Lot 3 and Lot 4 Investigation Scope

The investigation of the site, completed on 14 September 2023, included the following work:

- A walkover assessment of the site and immediate surrounding area to identify its geomorphology and features which may influence our engineering recommendations or the long-term performance of the ground.
- Two, 50mm diameter, hand-auger boreholes (HA04 and HA05), which refused at 2.3m and 2.2m below ground level (bgl), respectively. Associated DCP tests were carried out at each test location to the 2.5m target depth.

The test locations are shown on the Geotechnical Investigation Plan (Figure 4) and is included as Appendix A. Logs with details of the relevant testing completed are presented as Appendices B and C.

Figure 4: Geotechnical Investigation Plan for proposed development, Lot 1 and 2 highlighted in white.

## 5 GROUND CONDITIONS

This section addresses the ground conditions encountered during our investigations.

### 5.1 Site Stratigraphy

#### 5.1.1 Development Wide

Ground conditions are reasonably consistent across the site. Typically, the property is underlain by topsoil and/or fill to a depth between 0.25m and 0.7m below ground level (bgl), which overlies sand/ silt mixtures to a depth of 1.0m. Underlying this, medium dense to dense sand was encountered to around 8.5m to 9.0m.

Deposits of firm clay were encountered from around 8.5m to 9.0m to 13m depth followed by interbedded stiff silt/clay mixtures and silty sand, sandy silt extending to at least 20m depth.

### 5.1.2 Lot 3 & Lot 4 Site Specific

Topsoil was encountered in each hand auger borehole from the existing ground surface to depths of 0.4m and 0.3m in HA04 and HA05, respectively.

It is noted that an existing building is located over the proposed footprint of Lots 3 and 4 and that thicker layers of topsoil and uncontrolled fill may be present other than that encountered or from future demolition of the existing structure.

This was underlain by Holocene Beach Deposits, comprising a layer of loose to medium dense sand to the refusal depths between 2.2m to 2.3m bgl, due to saturated sand flowing into the borehole. Dynamic penetrometer testing in within the sand subgrade ranged between 1 and 7 blows per 50mm, between underside of topsoil and 2.5m depth.

## 5.2 Groundwater

The groundwater was encountered at depths of between 1.3m and 1.8m in hand auger boreholes across the site. The groundwater was not measured in CPTs due to hole collapse but is inferred to be a short way beneath the depths of hole collapse.

A groundwater level of 1.3m bgl was adopted in our assessments. Given that testing was completed in the wettest year on record for Gisborne, the groundwater level adopted is considered significantly elevated from typical levels and no further allowance has been applied for seasonal variations.

# 6 NATURAL HAZARDS

## 6.1 Definition & Legislation

This section summarises our assessment of the natural hazards that might affect the site including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding, that might affect the property, as generally defined in Section 106 of the Resource Management Act., including erosion (including coastal erosion, bank erosion, and sheet erosion), falling debris (including soil, rock, snow and ice), subsidence, inundation (including flooding, overland flow, storm surge, tidal effects and ponding), and slippage.

## 6.2 Seismic Hazard

### 6.2.1 Surface Fault Rupture

The GNS NZ Geology Web-map and Active Faults Database (GNS Science, 2020) do not show any faults passing beneath the subject site. There also does not appear to be any surface expressions which would indicate the presence of an active fault beneath or within close proximity to the site. We therefore consider the surface fault rupture risk to be low.

### 6.2.2 Site Subsoil Class

Based on the published geological information for the region discussed in Section 3.2 and obtained CPTs data, we consider that the site classification of D- "Deep or Soft Soil" Site is appropriate as defined by NZS 1170.5 (2004).

### 6.2.3 Seismic Actions

In accordance with the NZ Building Code and NZS 1170.5 (2004): The proposed structure is considered Importance Level 2 (IL2) with a design working life of 50 years, and therefore;

- The Serviceability Limit State (SLS) design earthquake has an annual exceedance probability of 1/25, and;
- The Ultimate Limit State (ULS) design earthquake has an annual exceedance probability of 1/500.
- Furthermore, an intermediate state event (ILS) has been considered in accordance with Module 1 recommendations (2021) for an annual exceedance probability of 1/100.

The modules of the Earthquake Geotechnical Engineering Practice series jointly published by Ministry of Business Innovation and Employment (MBIE) and the New Zealand Geotechnical Society (NZGS) (2021) provides guidance under Section 175 of the Building Act (2004), to assist with ensuring compliance with the Act. We have adopted the ground motions published within Module 1 (2021) for geotechnical design which are summarised in Table 1 below.

Table 1 Summary of adopted seismic parameters.

| Seismic Parameters | SLS | ILS | ULS |
|---|---|---|---|
| **Horizontal Peak Ground Accelerations (PGA), g** | 0.12 | 0.28 | 0.65 |
| **Effective magnitude, Mw** | 6.3 | 6.8 | 7.5 |

## 6.3 Liquefaction and Cyclic Softening Assessments

### 6.3.1 Liquefaction

Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground, and structure settlement, and in lateral (spreading) displacement of the ground.

The liquefaction potential was assessed with site-specific CPT data using specialist geotechnical software (CLiq Ver.3.3.1.13) in general accordance with NZGS/ MBIE Module 3 Guidance (2021). Liquefaction triggering was assessed using the method proposed by Boulanger and Idriss (2014). Liquefaction-induced, free-field, vertical, volumetric strains were estimated using the method proposed by Zhang et al (2002). A groundwater level of 1.3m bgl was adopted as discussed in Section 5.2.

### 6.3.2 Cyclic-Softening

Cyclic softening is a phenomenon that occurs when the strength and stiffness of a soil decreases due to repeated cyclic loading such as that resulting from strong seismic shaking. Relatively soft clay soils are commonly susceptible to this phenomenon, which can be accentuated where these soils are sensitive i.e., there is a significant difference between the soil’s peak and residual shear strength.

Due to the presence of the clay rich estuarine soils at this site, we have undertaken a cyclic softening analysis for the ULS design case. The Gisborne 2007 earthquake was of comparable magnitude and PGA to the ILS design case. No liquefaction or induced settlements were identified within the proximity of the subject site because of this earthquake. Accordingly, cyclic softening has been assessed for the ULS design case only.

Our assessments assumed:

- An $N_{kt}$ value of 14 for the clay-like soils, based on previous work undertaken proximally by LDE within the estuarine deposits.
- An estimate of the maximum, post-liquefaction, volumetric strain based on the work by Robertson and Cabal (Robertson & Cabal, 2014) which recommends a default value of 0.5% for clay-like soils.

### 6.3.3 Liquefaction and Cyclic Softening Results

The results of the analysis are summarised below in Table 2 and detailed outputs are provided as Appendix D.

The Liquefaction Potential Index (LPI) and Liquefaction Severity Number (LSN) are indices used to assess the general performance level of liquefied deposits in accordance with the NZGS/MBIE Module 3 Guidance (2021).

Our analyses indicate that liquefaction-induced settlements are likely to be negligible (<5mm) in a design SLS seismic event.

Table 2 Summary of Seismic Site Performance

| Limit State / Return Period | CPT ID | LPI | LSN | Estimated Seismic Volumetric Settlements (mm) [Limited to 10m] (3) | | | Effects of Liquefaction |
|---|---|---|---|---|---|---|---|
| | | | | Liquefaction | Cyclic Softening | Total Seismic Settlement | |
| **SLS 1/25 year** | CPT-01 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | **L0** |
| | CPT-02 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | |
| **ILS 1/100 year** | CPT-01 | 4 | 6 | ~45 [~45] | - | **~45 [~45]** | **L2** |
| | CPT-02 | 5 | 7 | ~50 [~50] | - | **~50 [~50]** | |
| **ULS 1/500 year** | CPT-01 | 17 | 15 | ~80 [~75] | ~30 | **~110 [~75]** | **L3** |
| | CPT-02 | 18 | 17 | ~85 [~80] | ~35 | **~120 [~80]** | |
| **Effects of liquefaction Key** | | **L0: Insignificant** | **L1: Mild** | **L2 Moderate** | **L3: High** | **L4 Severe** | **L5: Very Severe** |

**Notes:**

- Liquefaction triggering Boulanger and Idriss (2014) methodology limited to upper 15m. Limited to 10m of soil profile shown in [brackets].
- Settlements are free-field estimated settlements and do not include any building induced settlements.
- Effects of Liquefaction based on NZGS Module 3 (New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE), 2021)

Under the ILS design case, liquefaction-induced settlements are estimated to be between 45mm and 50mm. As discussed in Section 6.3.2 , no liquefaction, or liquefaction-induced settlements were identified within the proximity of the subject site as a result of the Gisborne 2007 earthquake, which had almost identical ground motions. Accordingly, we consider it unlikely that liquefaction would be realised under ILS seismic shaking and conclude that the software is likely to be over-estimating liquefaction potential.

Under design ULS seismic shaking, 110mm to 120mm of settlement is estimated. However, given the rationalisation to the Gisborne 2007 earthquake, discussed above, we consider that total, free-field, seismic settlements are likely to less than 100mm.

## 6.4 Lateral Spreading

The site is generally level and the nearest free face is associated with an unnamed tributary to the Waikanae Creek, approximately 700m south of the proposed building area. Given that there are no significant slopes within influencing distance of the proposed dwelling, and grades on site are very low, we consider the risk of lateral spreading in the event of a significant earthquake to be low.

## 6.5 Liquefied Bearing

Liquefaction may lead to foundation bearing failure, by either 'punch through' failure or a reduction in bearing capacity when liquefaction occurs within the zone of influence of load bearing foundations. A preferred foundation option has not been identified for the proposed structures at the time of writing and we have completed liquefied bearing assessments for both raft-type surface structures and piled foundations.

A unit weight of 17kN/m$^3$ was adopted for both the non-liquefied and liquefied soil layers. An angle of internal friction of 34 degrees was adopted for the non-liquefied material. The tau/sigma ratio for these assessments was based on site-specific CPT data and taken as 0.075 for the liquefied material within the zone of influence of the foundations. Groundwater level was taken as 1.3m, as discussed in Section 5.2.

A reduction factor of 0.75 was applied to the ultimate capacities calculated for the proposed, two-storey, duplex buildings, in accordance with MBIE Module 5 (2021) for moderately loaded structures.

### 6.5.1 Pile Foundation Assessment

Our assessment of pile foundations assumed: -

- Ordinary piles embedded to a minimum depth of 0.7m at 0.3m diameter (including concrete cover),
- Anchor piles embedded to a minimum depth of 0.9m at 0.4m diameter (including concrete cover), and
- A 100kPa design load.

Both projected area and 'punch-through' failure mechanisms were assessed.

#### 6.5.1.1 Results

The design load exceeded capacity in both design cases with the 'punch-through' failure mechanism governing. Maximum design loads were calculated as follows:

Ordinary piles

75kPa for the single-storey structures and 55kPa for the two-storey duplex buildings.

Anchor Piles

45kPa for the single-storey structures and 30kPa for the two-storey duplex buildings.

### 6.5.2 Raft type Surface Structure Foundation Assessment

For the raft-type surface structures assessments were completed for the single-storey and two-storey buildings assuming:

- Foundation widths as presented in the 15% architectural drawings, and

- An embedment depth of 0.2m.

#### 6.5.2.1 Results

Liquefied bearing capacities were calculated to be 14.5kPa for the proposed single-story buildings and 11kPa for the proposed two-storey duplex structures.

The values presented above are dependent on the assumptions listed. Should the foundation breadth, embedment depth or design loads change, the liquefied bearing capacities will need to be reassessed.

## 6.6 Equivalent MBIE Technical Category

Considering the rationalisation provided in Section 6.3, we consider that seismic ground performance at this site would be equivalent to a TC2 classification in accordance with Table 15.6 of the MBIE Guidance (2015).

## 6.7 Slope Stability

The site is generally flat-lying and there are no significant slopes within, or near the site. Therefore, we do not consider slope stability to be a geotechnical constraint.

## 6.8 Flood Hazard

The site is not located in a mapped flood hazard zone.

## 6.9 Tsunami

The Gisborne / East Cape coastline is classified as being at the highest risk in the country of being affected by tsunami. Modelling for the Gisborne region (GNS Science Te Pū Ao, 2016) indicates that the site is sufficiently elevated and is unlikely to be inundated in 1:100, 1:500, and 1:2500-year return period tsunami events, respectively. Civil defence tsunami inundation maps show that the site mapped as a yellow zone, which may be subject to tsunami hazard in the case of a severe (i.e. M8.9) local earthquake on the Hikurangi subduction margin (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2019) .

## 6.10 Expansive Soils

No laboratory testing of the soil properties was completed. Based on field tests, the surficial soils below the topsoil are granular in nature and therefore not subject to expansivity.

## 6.11 Natural Hazards Summary

From our assessment of the natural hazards and ground deformation risks presented to the proposed development we consider that the proposed structures can be safely located on the site, provided that the recommendations given in Section 7 are adopted.

# 7 ENGINEERING RECOMMENDATIONS

## 7.1 Site Contouring and Topsoiling

The finished ground level should be graded so that water cannot pond against, beneath or around the buildings for the economic life of structure. To achieve this, it will be important that the building platform beneath the topsoil grades away from the site. Contouring should avoid the potential for concentration and discharge of surface water over point locations which could result in soil erosion or instability.

## 7.2 Access Road Construction

Access is proposed from Stanley Road. No major/ significant earthworks are anticipated to form access to the proposed dwellings.

## 7.3 Foundation Recommendations

### 7.3.1 Foundation Type

Based on the site investigation and analysis, we consider that foundations comprising pile foundations or raft-type surface structures are suitable for the site conditions providing the recommendations and limitations presented within this section are addressed in design.

### 7.3.2 Design Considerations

Based on the scope of work completed, the following aspects need to be considered in detailed design:

- Site Class - Class D - Deep or soft soil
- Liquefaction-induced vertical settlements - TC2 equivalent
- Relatively high groundwater level
- Liquefied bearing capacity
- Potential for consolidation settlement

### 7.3.3 Bearing Capacity and Founding Depth

Foundations must extend beneath any topsoil, uncontrolled fill, organic and/ or otherwise unsuitable material. It is noted that an existing building is located over the proposed footprint of Lots 3 and 4 and that thicker layers of topsoil and uncontrolled fill may be present other than that encountered or from future demolition of the existing structure.

For the Lot 3/4 duplex structure we anticipate that a static geotechnical ultimate bearing capacity (GUBC) of 210kPa will be available from 0.4m depth. A reduction factor of 0.45 should be applied to the GUBC given above to give the design bearing strength ($q_{dbs}$).

A short-term, post-seismic (static), liquefied bearing capacity, equivalent to the values presented in Section 6.5, should be assessed in structural design. Note that these liquefied bearing capacities are contingent on the assumptions listed within Section 6.5. Should these assumptions change in design, the liquefied bearing capacities will need to be reassessed. This may require some iterative design between the geotechnical and structural engineers.

## 7.4 Surface Water

The site is proposed to be connected to the council stormwater system. On-site disposal is not proposed.

The stormwater system for the buildings should be operational as soon as the roof is in place. This is to ensure that the ground within the vicinity of the building is not compromised by the negative effects and potential consequences of soil saturation.

### 7.4.1 Service Pipes

All service pipes, stormwater structures should be designed and constructed to ensure adequate capacity, strength, and water tightness to prevent leakage into the platform through blockage, running under pressure, or structural failure.

All service pipes installed within any fill should be flexible, or flexibly joined, so that they may deflect without breaking if the ground settles.

A record should be kept of the position, type, and size of all subsoil drains, and in particular of their outlets.

## 7.5 Trees and Shrubs

There are multiple trees on the property, within the vicinity of the structure proposed dwellings. Trees can cause damage through heaving as a result of root growth and / or settlement resulting from soil shrinkage from the moisture uptake of the roots. Preliminary landscaping plans show that most of onsite trees and shrubs will be removed, we recommend one of the following options:

- The plant and its major root structure should be removed.

- A root barrier should be designed and installed between the offending plant and the structure.
- Foundations should be taken to a depth no less than 1.0m where damage from the roots of the plant is unlikely.

If new trees, shrubs or gardens are established, or the lemon tree relocated on site, care should be taken to ensure:

- The vegetation does not interfere with any subfloor ventilation or services to the structure.
- Over-watering of the vegetation does not saturate the ground near the foundations.
- Trees or shrubs with the potential to develop significant root systems should be planted a minimum distance equal to the mature height of the plant away from the foundations.

# 8 SUSTAINABILITY

Considering sustainability as early as possible in a project's development, could lead to significant project opportunities and wider positive outcomes. Geotechnical opportunities for increased sustainability for this project include:

- Striping and stocking topsoil for reuse (dependant on presence/ levels of contaminants).
- Designing for cut and fill balance where possible.
- Reuse of site won materials, or using materials won from other sites including use of recycled crushed concrete aggregate for hard fill.
- Contributing site investigation data to the New Zealand Geotechnical Database (NZGD) to help reduce the site investigations needed in the future.
- Using local consultants and contractors to reduce transport related emissions.

# 9 CONCLUSIONS

Following development of the site in accordance with our recommendations, we consider that:

a) The land in respect of which a consent is sought, or any structure on the land built in accordance with our recommendations, is unlikely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and

b) Any subsequent use that is likely to be made of the land is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; and

c) Sufficient provision has been made for physical access to each allotment to be created by the subdivision.

# 10 PLAN REVIEW

Prior to an application for Building Consent, it is important we are given the opportunity to review the final development drawings to ensure the recommendations contained within this report have been followed and interpreted correctly. Following successful review of the development drawings, we will update this report to support applications for Resource Consent and Building Consent.

# 11 VERIFICATION

Verification requirements will be provided once the form of the foundations has been determined.

# 12 LIMITATIONS

This report should be read and reproduced in its entirety including the limitations to understand the context of the opinions and recommendations given.

This report has been prepared exclusively for NZHG Gisborne Limited in accordance with the brief given to us or the agreed scope and they will be deemed the exclusive owner on full and final payment of the invoice. Information, opinions, and recommendations contained within this report can only be used for the purposes with which it was intended. LDE accepts no liability or responsibility whatsoever for any use or reliance on the report by any party other than the owner or parties working for or on behalf of the owner, such as local authorities, and for purposes beyond those for which it was intended.

This report was prepared in general accordance with current standards, codes and best practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods and subsurface investigations at discrete locations designed to the constraints of the project scope to provide the best assessment of the environment. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from those described in this report.

# 13 REFERENCES

Ambraseys, N., & Srbulov, M. (1995). Earthquake induced displacements of slopes. *Soil Dynamics and Earthquake Engineering*, 14(1), 59-71.

Boulanger, R., & Idriss, I. (2014). *CPT and SPT based liquefaction triggering proceedures.* Report No. UCD/CGM-14, 1.

Bray, J. D., & Travasarou, T. (2007). Simplified procedure for estimating earthquake-induced deviatoric slope displacement. *Journal of geotechnical and geoenvironmental engineering*, 133(4), 381-392.

Cetin, K., Bilge, H. T., Wu, J., Kammerer, A. M., & Seed, R. B. (2009). Probabilistic model for assessment of cyclically induced reconsolidation (volumetric) strains. *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, 387-398.

Chu, D. B., Stewart, J. P., Youd, T. L., & Chu, B. L. (2006). Liquefaction-Induced Lateral Spreading in Near-Fault Regions during 1999 Chi-Chi, Taiwan Earthquake. *Journal of Geotechnical & Geoenvironmental Engineering*, 1549-1565.

Gisborne District Council. (2022). Bearing Capacity and Geotechnical Investigation Requirements for Buildings.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2019). Tsunami inundation and evacuation maps.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2021). Minimum Requirements for Geotechnical Reports.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2023). Tairāwhiti Maps. Retrieved 2022, from https://maps.gdc.govt.nz/H5V2_12/

GNS Science. (2020). New Zealand Active Faults Database.

GNS Science. (2022, November 5). *New Zealand Active Faults Database*. Retrieved from https://data.gns.cri.nz/af/

GNS Science Te Pū Ao. (2016). *Probabilitistic Mapping of Tsunami Hazard and Risk for Gisborne City and Wainui Beach.* Wellington: GNS.

Jibson, R. W. (2007). Regression models for estimating coseismic landslide displacement. *Engineering geology*, 91(2-4), 209-218.

Mazengarb & Speden. (2000). Geology of the Raukumara area. *Institute of Geological and Nuclear Sciences 1:250,000 geological map 6*.

Ministry of Business Innovation and Employment Hīkina Whakatutuki. (2015). *Repairing and rebuilding houses affected by the Canterbury earthquakes - Part C Technical Guidance.* Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 1. Overview of the Guidelines, Rev 1. Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 3. Identfication, assessment and mitigation of liquefaction hazards Rev1. Wellington.

*Retrolens.co.nz*. (n.d.). Retrieved from retrolens.co.nz.

Robertson, P. K., & Cabal, K. L. (2014). *Guide to Cone Penetration Testing for Geotechnical Engineering. 6th Edition.* Gregg Drilling & Testing Inc.

Standards New Zealand Te Mana Tautikanga O Aotearoa. (2004). *NZS1170.5 Structural Design Actions: Part 5: Earthquake Actions- New Zealand.* Wellington: Standards New Zealand.

Tonkin & Taylor. (2015). *Liquefaction vulnerability and Geotechnical Assessment - Guidance for Gisborne District Council.*

Zhang, G., Robertson, P., & Brachman, R. (2002). Estimating liquefaction-induced groundsettlements from CPT for level ground. *Canadian Geotechnical Journal, 39*(5), 1168-1180.

Zhang, G., Robertson, P., & Brachman, R. (2004). Estimating liquefaction-induced lateral displacements using the standard penetration test or cone penetration test. *Journal of Geotechnical and Geoenvironmental Engineering, 130*(8), 861-871.

# 14 GLOSSARY

| | |
|---|---|
| **Compressible Soils:** | Compressible soils are those that will undergo a reduction in volume under an imposed load, such as the weight of fill or a structure. This occurs firstly as a result of the expulsion of air and water from the soil void spaces (primary settlement) and secondly due to a restructuring of the soil skeleton to take the load (secondary settlement). |
| **Cyclic Softening:** | Cyclic-softening is a related condition to liquefaction can also affect clay soils when subjected to cyclic-loading. Clay soils may significantly soften and led to bearing capacity failure, in addition to post-earthquake consolidation settlements may occur as a result of the earthquake shaking. |
| **Expansive Soils:** | Cohesive soils containing significant proportions of certain clay minerals can be subject to appreciable volume change caused by variations in soil moisture content, most notably between seasons or from the uptake of water through the root systems of trees and shrubs. This is also often referred to as soil reactivity or shrink-swell behaviour. |
| **Lateral Spread:** | Lateral spread of liquefied soils is the lateral displacement of blocks of land moving laterally towards a free edge (for example a riverbank) or within sloping ground. More lateral movement tends to occur closest to the edge with less movement further back. Lateral spreading may result in large permanent ground displacements including cracks, fissures, vertical offsets, and overall settlement of the ground. |
| **Lateral Stretch:** | Lateral stretch is the amount of differential extension that a portion of land may experience during an episode of lateral spreading. The lateral stretch across a foundation is a main factor in foundation damage due to liquefaction and lateral spreading because of a large earthquake. |
| **LiDAR** | Light Detection and Ranging (LiDAR) is a method of remote sensing topographical survey. |
| **Limit States:** | Seismic design criteria for performance-based design. SLS, SLS2 & ULS are prescribed in NZS1170.5 (Standards New Zealand Te Mana Tautikanga O Aotearoa, 2004)<br>• **Serviceability Limit State (SLS):** Functional requirements for the serviceability limit state are assumed to be met if the structure or part can continue to be used as originally intended without the need for repair (SLS1) or can remain operational or continue to be occupied as appropriate (SLS2). SLS earthquakes are considered highly likely to occur during the lifetime of the structure.<br>• **Ultimate Limit State (ULS):** Functional requirements for the ultimate limit state are assumed to be met if:<br>a) People within, and adjacent to the structure are not endangered by the structure or part. |

b) Displacements of the structure are such that there is no contact between any parts of a structure for which contact is not intended, or between separate structures on the same site, if such contact would damage the structures or parts to the extent that persons would be endangered, or detrimentally alter the response of the structure(s) or parts, or reduce the strength of structural elements below the required strength.

c) The structure does not deflect beyond a site boundary adjacent to which other structures can be built or collision between the structure and any adjacent existing structures cannot occur.

d) There is no loss of structural integrity in either the structure or part.

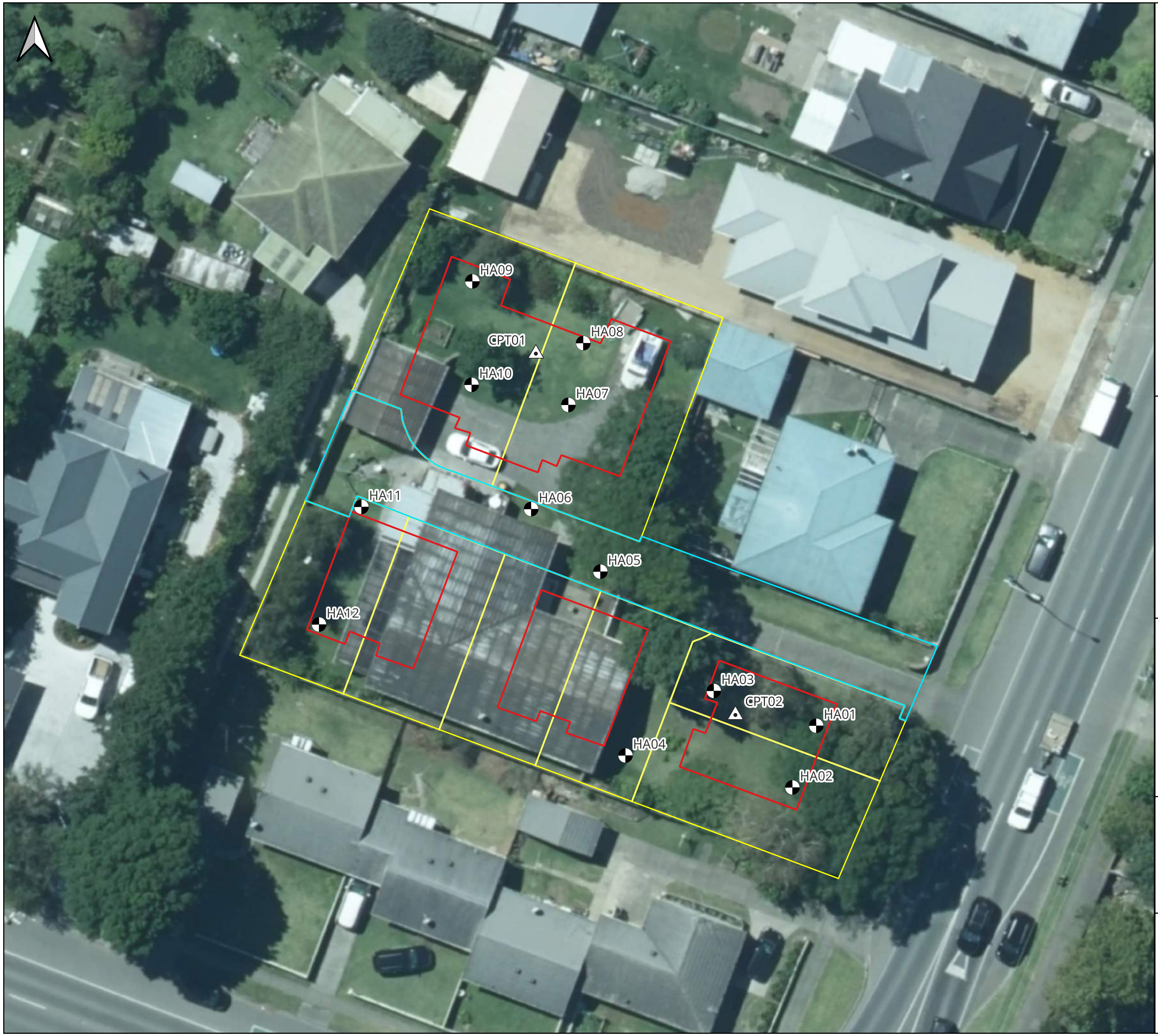
- **Intermediate Limit State (ILS):** ILS is an intermediate seismic event between SLS & ULS although is not a code requirement. The behaviour of soils and geotechnical systems under earthquake shaking may be highly non-linear and even exhibit a pronounced 'step change' in performance with increasing intensity of shaking. For such cases, only considering performance at the SLS and ULS levels of shaking would fail to identify potentially poor and unacceptable performance at intermediate return periods of shaking.

| | |
|---|---|
| **Liquefaction:** | Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground and structure settlement, and in lateral (spreading) displacement of the ground. |
| **LPI** | Liquefaction potential index is a liquefaction damage index. LPI ranges between 0 and 100 and sites with an LPI of 5 indicate a high liquefaction risk and sites with LPI greater than 15 indicate very high risk (Iwasaki et al, 1982). Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. |
| **LSN** | Liquefaction Severity Number is a liquefaction damage index. LSN varies from 0 (representing no liquefaction vulnerability) to more than 100 (representing very high liquefaction vulnerability (van Ballegooy et al, 2013). LSN places greater importance (than LPI) on the thickness of the non-liquefied crust when the groundwater table is close to the ground surface. Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. LNS was developed based on the observations/ investigations from the Canterbury earthquake sequence |
| **PGA:** | Peak Ground Acceleration (PGA) is the maximum ground acceleration during an earthquake as a proportion of gravity. |
| **Punch Through Failure:** | Punch through failure occurs when a foundation punches through a crust of non-liquefiable material due to underlying liquefaction occurring and can lead to potential damage to foundations and/ or large settlements. |

| | |
|---|---|
| **Technical Category:** | Following the 2010 -2011 Canterbury earthquake sequence the Ministry of Business Innovation and Employment (MBIE) assigned three technical categories (TC1, TC2, TC3) across the residential 'green zone' for foundation investigation and design guidance focusing on one and two storey timber-framed dwellings. These categories are broadly defined as below:<br>• **TC1:** Liquefaction damage is unlikely in future large earthquakes. Standard residential foundation assessment and construction is appropriate.<br>• **TC2:** Liquefaction damage is possible in future large earthquakes. Standard enhanced foundation repair and rebuild options in accordance with MBIE guidance are suitable to mitigate against this possibility.<br>• **TC3:** Liquefaction damage is possible in future large earthquakes. Individual engineering assessment is required to select the appropriate foundation repair or rebuild option.<br>• **TC2/ TC3 Hybrid:** A site that straddles liquefaction settlement limits of TC2 and TC3 where the SLS settlements are assessed as being less than 50 mm but the ULS settlements are assessed at greater than 100mm.<br>Whilst this guidance is intended for residential buildings in the Canterbury region, they have been widely adopted to convey liquefaction vulnerability across New Zealand. |
| **The Modules:** | The New Zealand Geotechnical Society (NZGS) and MBIE jointly published a series of guidelines for Earthquake Geotechnical Engineering Practice. Revision 1 of the Modules was published in November 2021, and they provide guidance under section 175 of the Building Act 2004 to assist parties to comply with their obligations under the Building Act 2004. The following modules currently form the collection:<br>• **Module 1:** Overview of the guidelines<br>• **Module 2:** Geotechnical investigation for earthquake engineering<br>• **Module 3:** Identification, assessment, and mitigation of liquefaction hazards<br>• **Module 4:** Earthquake resistant foundation design<br>• **Module 5:** Ground improvement<br>• **Module 5A:** Specification of ground improvement for residential properties in the Canterbury region<br>• **Module 6:** Retaining walls |

# APPENDIX A

# SITE PLAN



## LEGEND

Project Data

🟨 Proposed Lots Boundary

🟥 Proposed Building Platform

— Proposed Access Way

◐ Hand Auger + DCP

△ Cone Penetrometer Test (CPT)

0 5 10 15 20 m

SCALE A3: 1:300

NOTES

1. Aerial basemap and property boundaries sourced from LINZ Data Service (CC-BY 4.0).
2. Investigation locations shown approximately only.

CLIENT

NZHG Gisborne Limited

PROJECT

Geotechnical Investigation for proposed subdivision
99A Stanley Road, Te Hapara
Gisborne

DRAWING TITLE

Geotechnical Investigation Plan

LDE
LAND DEVELOPMENT
& ENGINEERING

| | | |
|---|---|---|
| PROJECT REF | DRAWING REF | REVISION |
| 24729 | GIP | A |
| DATE | PREPARED BY | CHECKED BY |
| 13/10/2023 | SS | RH |

FILE PATH

M-FILES\LDE - Project\76038-24729 Trans to 9602\Geo QGIS Zip Folder (ID 79084)\24729-QGIS Site Maps\24729- 99A Stanley Rd.qgz

# APPENDIX B

# HAND AUGER TEST LOGS

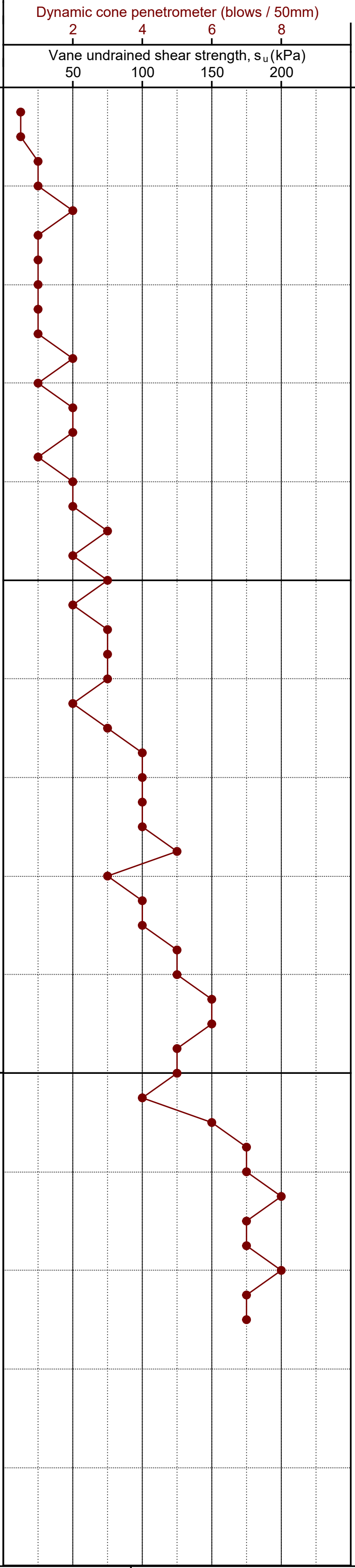
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | HA01 |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709080mN, 2035843mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.00–0.70 | Topsoil | SAND, with trace rootlets and silt; dark brown. Very loose; moist; sand, fine to medium.<br>0.40m: With trace rootlets; brown. | |
| 0.70–2.00 | Holocene Beach Deposits | SAND; light brown. Medium dense; moist; sand, fine to coarse.<br>1.30m: Wet.<br>1.35m: Dense.<br>1.60m: Saturated.<br>1.80m: Poor recovery > 30%. | ▼ (1.60m) |

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.00m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

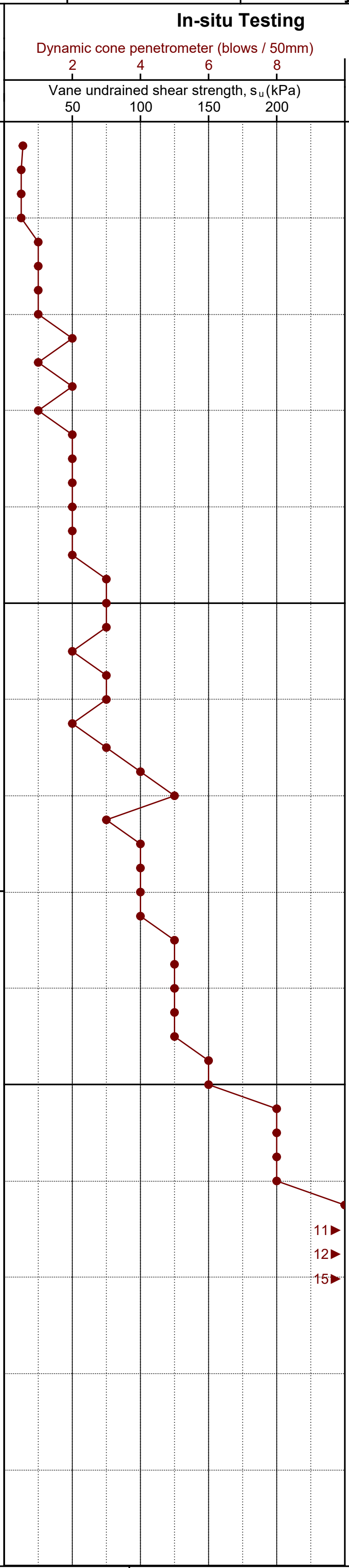
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:38 pm

# Hand Auger Borehole Log

**Test ID:** HA02
**Project ID:** 24729
**Sheet:** 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709075mN, 2035841mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water | RL (m) |
|---|---|---|---|---|---|
| 0.0–0.25 | Topsoil | | SILT, with minor sand, with trace rootlets; dark brown. Very loose; moist; sand, fine.<br>0.10m: SAND. Sand, fine to medium. | | |
| 0.25–1.60 | Holocene Beach Deposits | | SAND; light brown. Loose; moist; sand, fine to coarse.<br>0.65m: Medium dense.<br>1.10m: Wet.<br>1.30m: Saturated.<br>1.50m: Dense; poor recovery > 30%. | ▼ (1.30m) | |



**Hole Depth:** 1.60m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow
UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:39 pm

# Hand Auger Borehole Log

LAND DEVELOPMENT & ENGINEERING

| | |
|---|---|
| **Test ID:** | **HA03** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

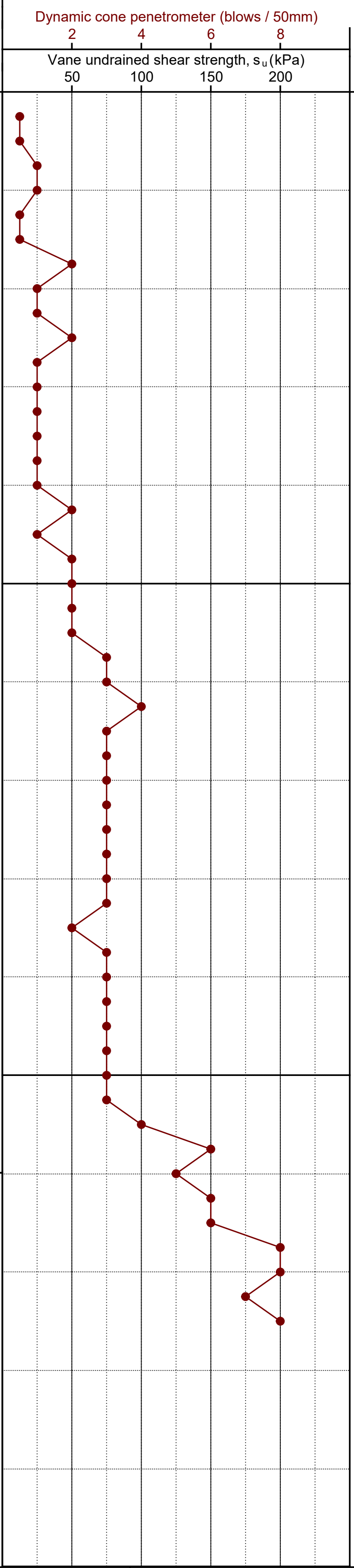
| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709084mN, 2035835mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water | RL (m) |
|---|---|---|---|---|---|
| 0.0–0.4 | Topsoil | | SAND, with minor silt, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium. | | |
| 0.4–2.2 | Holocene Beach Deposits | | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>0.95m: Medium dense.<br>1.10m: Light brown.<br>1.50m: Wet.<br>1.80m: Saturated.<br>2.10m: Dense; poor recovery > 50%. | ▼ 1.80 | |

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

**Hole Depth:** 2.20m

**Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:41 pm

LDE LAND DEVELOPMENT & ENGINEERING

# Hand Auger Borehole Log

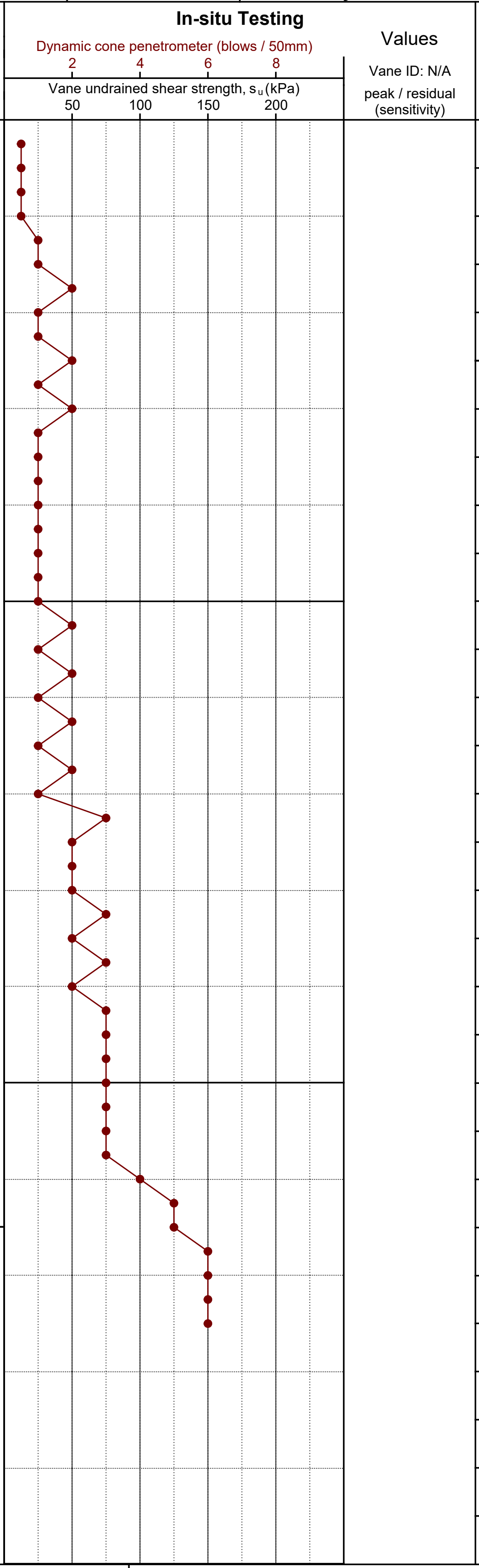
**Test ID:** HA04
**Project ID:** 24729
**Sheet:** 1 of 1

**Client:** NZHG
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne
**Test Site:** Refer to site plan

**Coordinates:** 5709077mN, 2035830mE
**System:** NZTM
**Elevation:** 5m (Presumably)
**Located By:** Site plan/map

**Test Date:** 14/09/2023
**Logged By:** SS
**Prepared By:** SS
**Checked By:** RH

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.0–0.4 | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | |
| 0.4–2.3 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | |
| 1.10 | | 1.10m: Light brown. | |
| 1.45 | | 1.45m: Medium dense. | |
| 1.60 | | 1.60m: Wet. | |
| 1.90 | | 1.90m: Saturated. | ▼ |
| 2.10 | | 2.10m: Poor recovery>50%. | |
| 2.20 | | 2.20m: Dense. | |



**Hole Depth:** 2.30m
**Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

**Test ID:** HA05
**Project ID:** 24729
**Sheet:** 1 of 1

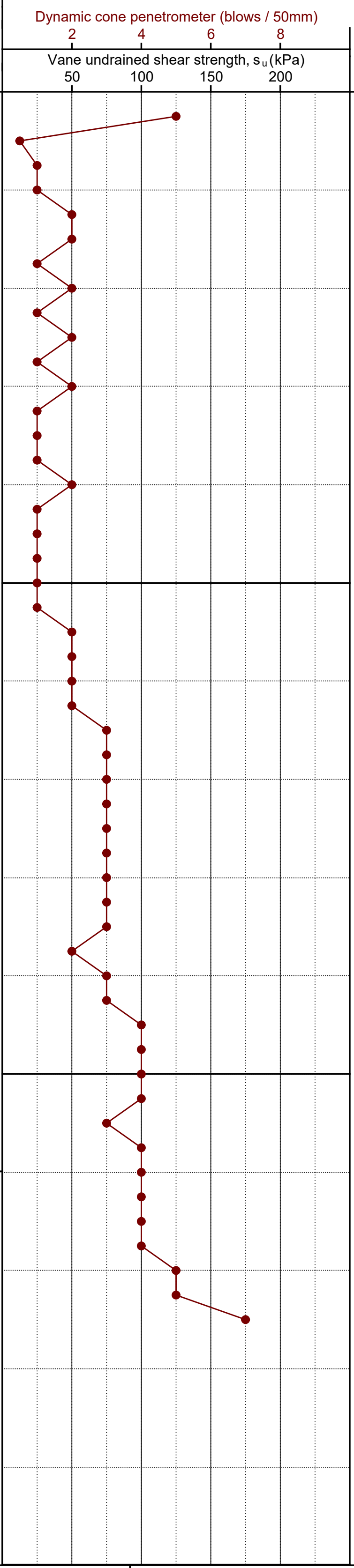
**Client:** NZHG
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne
**Test Site:** Refer to site plan

**Coordinates:** 5709093mN, 2035825mE
**System:** NZTM
**Elevation:** 5m (Presumably)
**Located By:** Site plan/map

**Test Date:** 14/09/2023
**Logged By:** SS
**Prepared By:** SS
**Checked By:** RH

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.30 | Uncontrolled Fill / Topsoil | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium; trace rock fragments. | | |
| 0.30–2.20 | Holocene Beach Deposits | SAND; brownish orange. Medium dense; moist; sand, fine to medium. | | |
| 0.5 | | | | 4.5 |
| 1.0 | | 1.00m: Light brown. | | 4.0 |
| 1.5 | | 1.50m: Wet. | | 3.5 |
| 1.8 | | 1.80m: Saturated. | ▼ | |
| 1.9 | | 1.90m: Dense. | | |
| 2.0 | | 2.00m: Poor recovery > 50%. | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



**Values**

Vane ID: N/A
peak / residual
(sensitivity)

**Hole Depth:** 2.20m
**Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA06** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035819mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

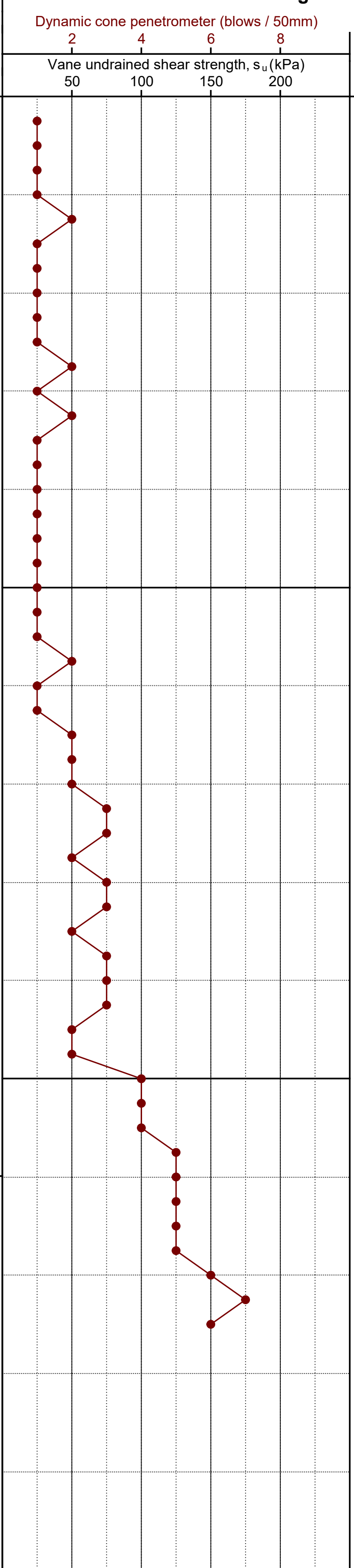
| Depth (m) | Geology | Material Description |
|---|---|---|
| 0.0 – 0.6 | Uncontrolled Fill / Topsoil | SAND, with minor silt, with trace rootlets and gravel; dark brown. Loose; moist; sand, fine to medium; gravel, fine to medium, subangular.<br>0.40m: Brownish black. |
| 0.6 – 2.2 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.30m: Medium dense.<br>1.60m: Wet.<br>1.80m: Saturated.<br>2.00m: Dense.<br>2.10m: Poor recovery > 30%. |

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

Water: ▼

**In-situ Testing**



**Values**

Vane ID: N/A
peak / residual
(sensitivity)

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:45 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | HA07 |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

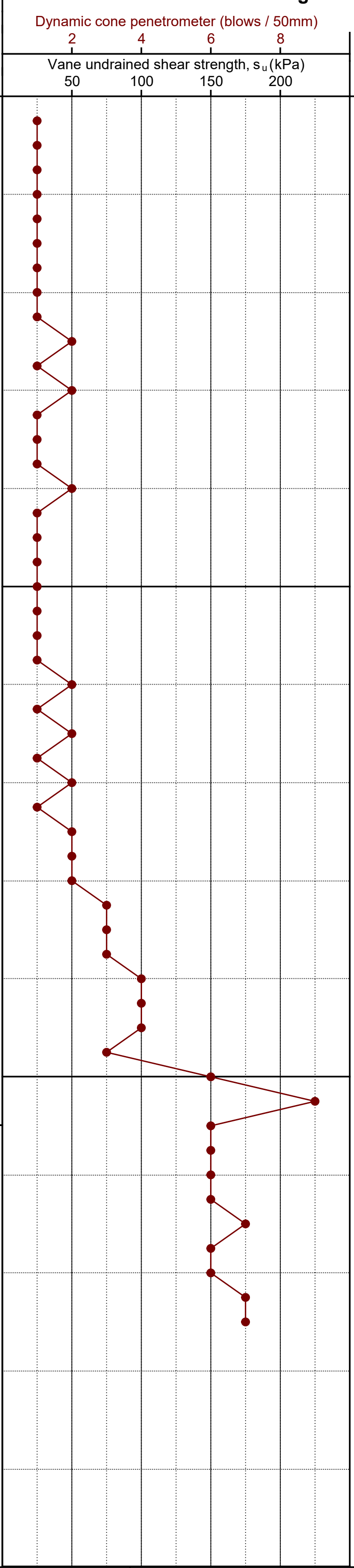
| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709106mN, 2035822mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.3 | Topsoil | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium. | | |
| 0.3–2.1 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.20m: Medium dense.<br>1.30m: Wet.<br>1.60m: Saturated.<br>1.80m: Dense; poor recovery > 50%. | ▼ (1.60m) | |

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5

RL scale: 4.5, 4.0, 3.5, 3.0, 2.5

**In-situ Testing**



**Values**

Vane ID: N/A

peak / residual (sensitivity)

**Hole Depth:** 2.10m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow

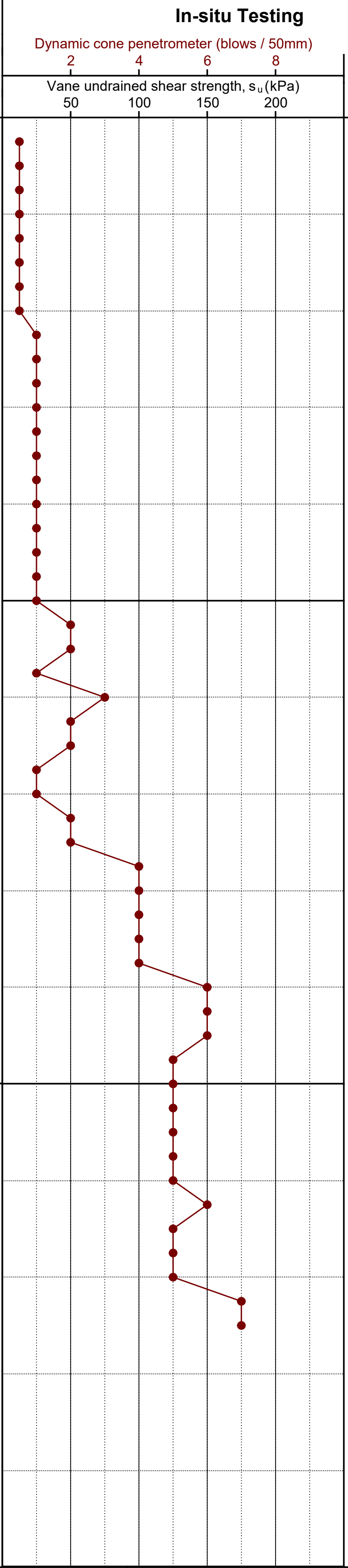
UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA08** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709111mN, 2035824mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.00–0.50 | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine.<br>0.20m: SAND, with minor silt. Sand, fine to medium. | | |
| 0.50–2.00 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.05m: Medium dense.<br>1.10m: Light brown.<br>1.40m: Wet.<br>1.55m: Dense.<br>1.60m: Saturated.<br>1.80m: Poor recovery > 30%. | ▼ (1.60m) | |



Values
Vane ID: N/A
peak / residual
(sensitivity)

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5
RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.00m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

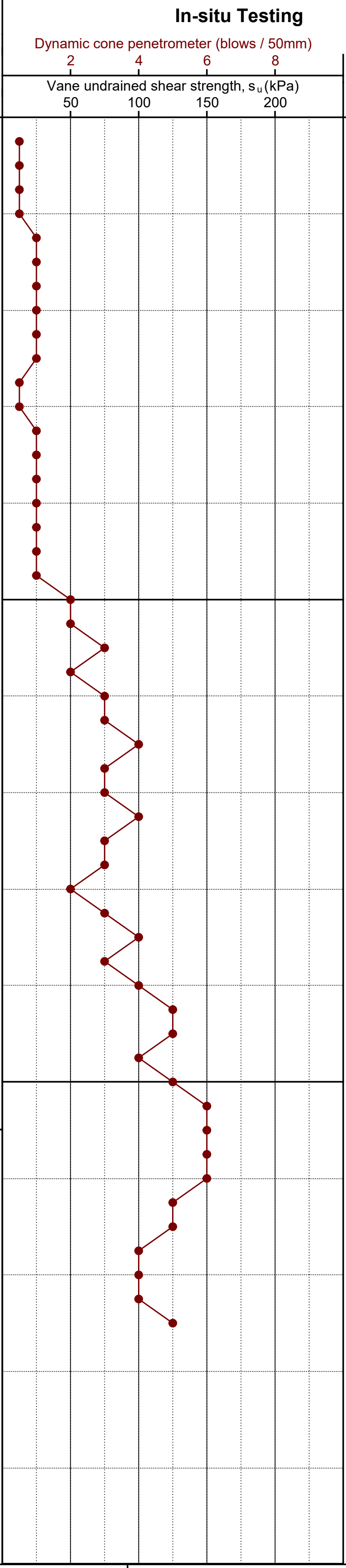
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:47 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA09** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709117mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| | Uncontrolled Fill / Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine; trace glass fragments. | | |
| 0.5 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | | 4.5 |
| 1.0 | | 1.00m: Medium dense.<br>1.10m: SAND; light brown. Sand, fine to coarse. | | 4.0 |
| 1.5 | | 1.50m: Wet.<br>1.70m: Dense; saturated. | ▼ | 3.5 |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |



Values
Vane ID: N/A
peak / residual
(sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.10m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

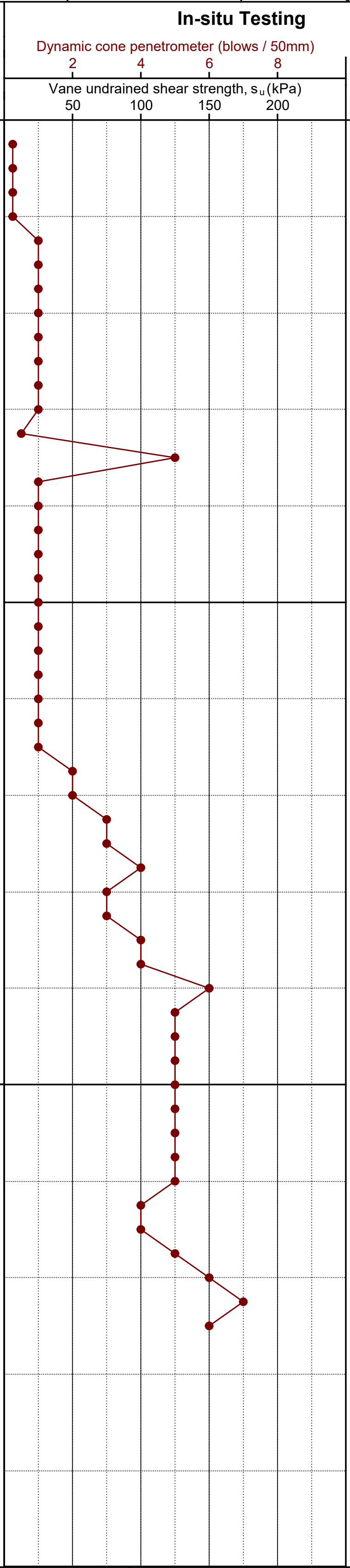
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA10** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709108mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description |
|---|---|---|
| 0.0–0.3 | Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. |
| 0.3–2.0 | Holocene Beach Deposits | SAND; light brown. Loose; moist; sand, fine to medium.<br>1.20m: With minor silt.<br>1.35m: Medium dense.<br>1.40m: SAND. Sand, fine to coarse.<br>1.50m: Wet.<br>1.70m: Dense; saturated. |

Water: ▼ 1.70m



Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.00m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:50 pm

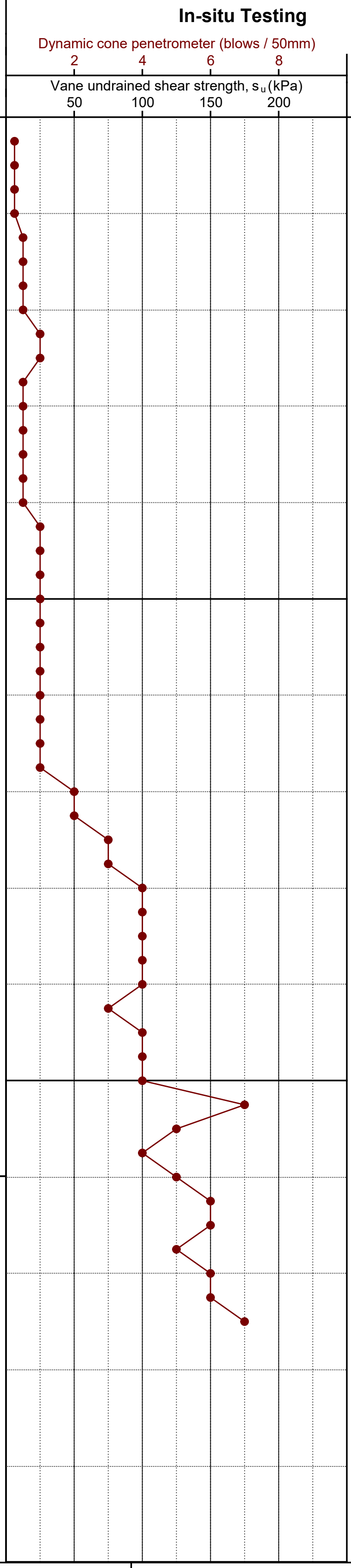
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA11** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035805mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.00 | Topsoil | Silty SAND, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium.<br>0.20m: With trace silt.<br>0.50m: Brownish black. | | |
| 0.5 | | | | 4.5 |
| 0.70 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.40m: Medium dense.<br>1.50m: Wet.<br>1.60m: Dense.<br>1.80m: Saturated.<br>2.10m: Poor recovery > 30%. | ▼ 1.80 | |
| 1.0 | | | | 4.0 |
| 1.5 | | | | 3.5 |
| 2.0 | | | | 3.0 |
| 2.20 | | | | |
| 2.5 | | | | 2.5 |

**In-situ Testing**



**Values**

Vane ID: N/A
peak / residual
(sensitivity)

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

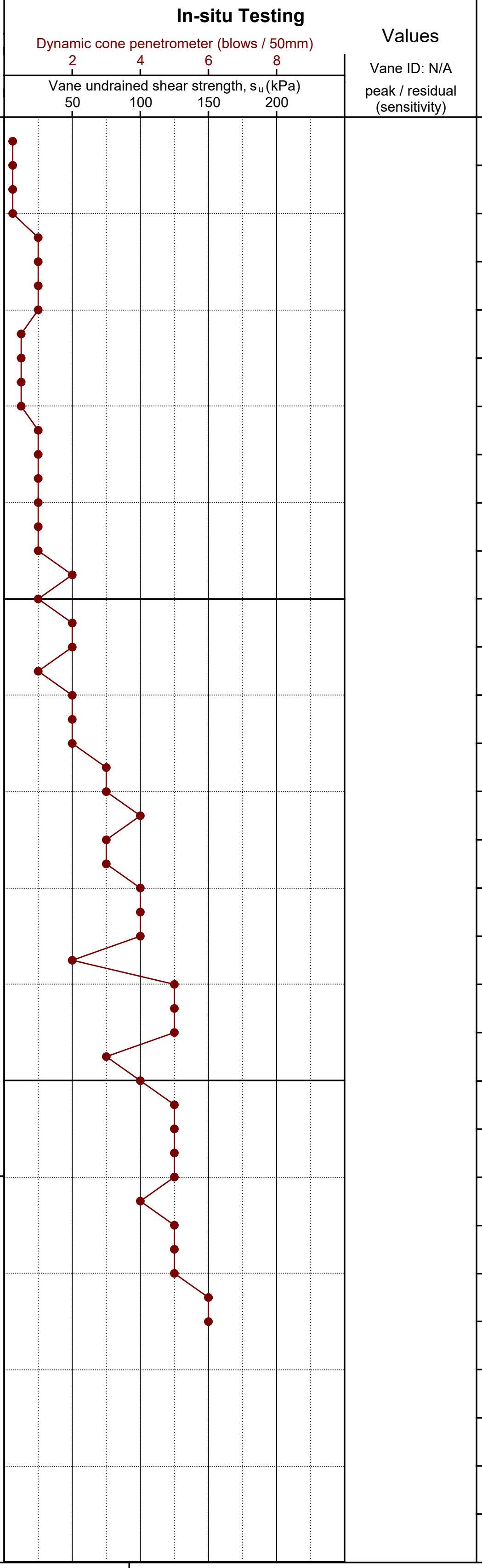
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:51 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA12** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709088mN, 2035801mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water |
|---|---|---|---|---|
| 0.0 – 0.6 | Topsoil | TS | Silty SAND, with trace rootlets; brownish black. Very loose; moist; sand, fine to medium.<br>0.50m: Brownish grey. | |
| 0.6 – 2.2 | Holocene Beach Deposits | | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.20m: Medium dense.<br>1.50m: Wet.<br>1.80m: Saturated.<br>2.00m: Dense; poor recovery > 50%. | ▼ (1.8) |



| | | |
|---|---|---|
| **Hole Depth:** 2.20m | **Termination:** HOLE COLLAPSE | |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

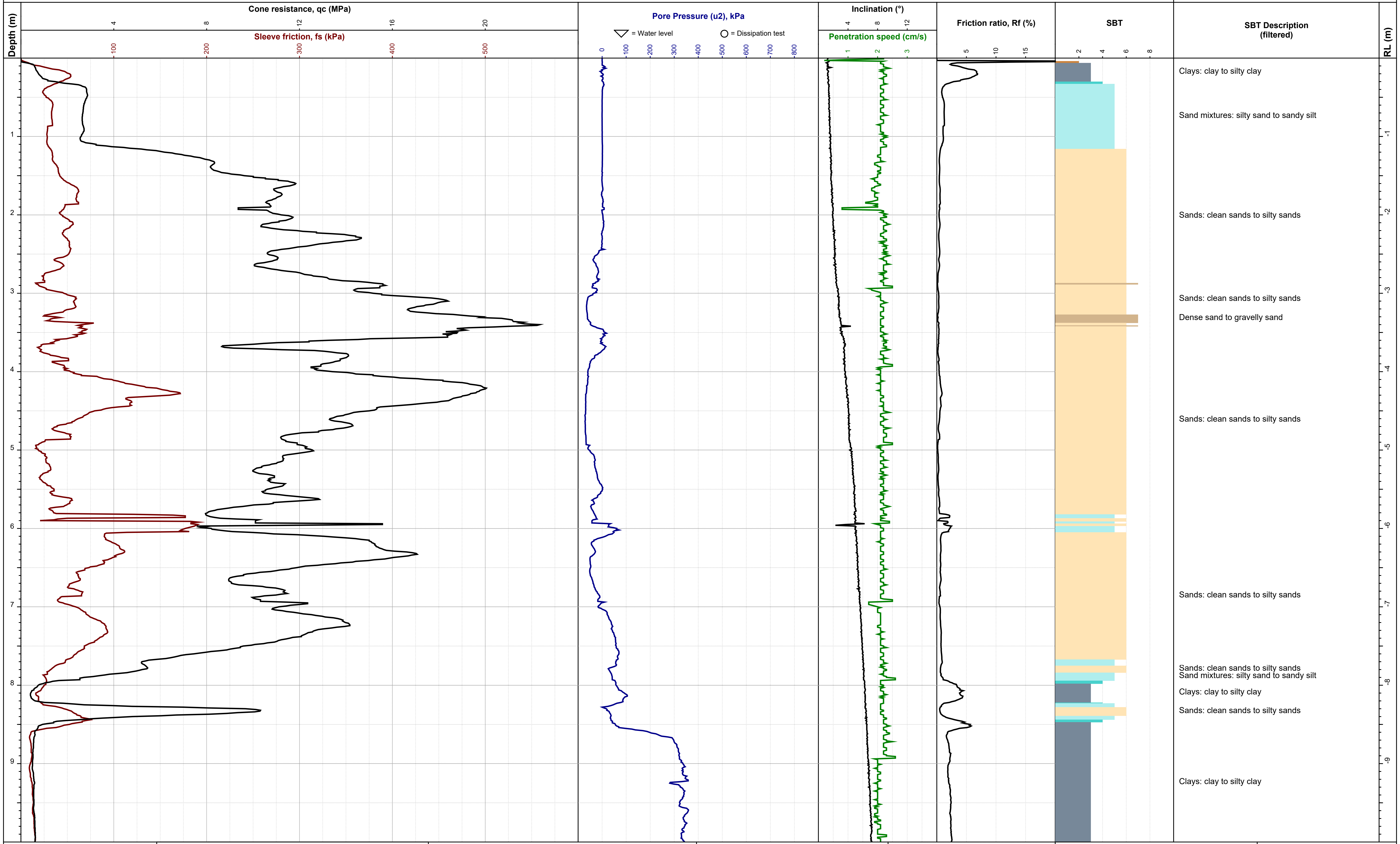
UTP = Unable to Penetrate

# APPENDIX C

# CONE PENETROMETER TEST LOGS

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT01**



Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:08 am

LAND DEVELOPMENT & ENGINEERING

| | |
|---|---|
| **Client:** | TW Property Holdings Limited |
| **Project:** | Geotechnical Investigation for Proposed Subdivision |
| **Location:** | 99A Stanley Road, Gisborne |

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 1986**

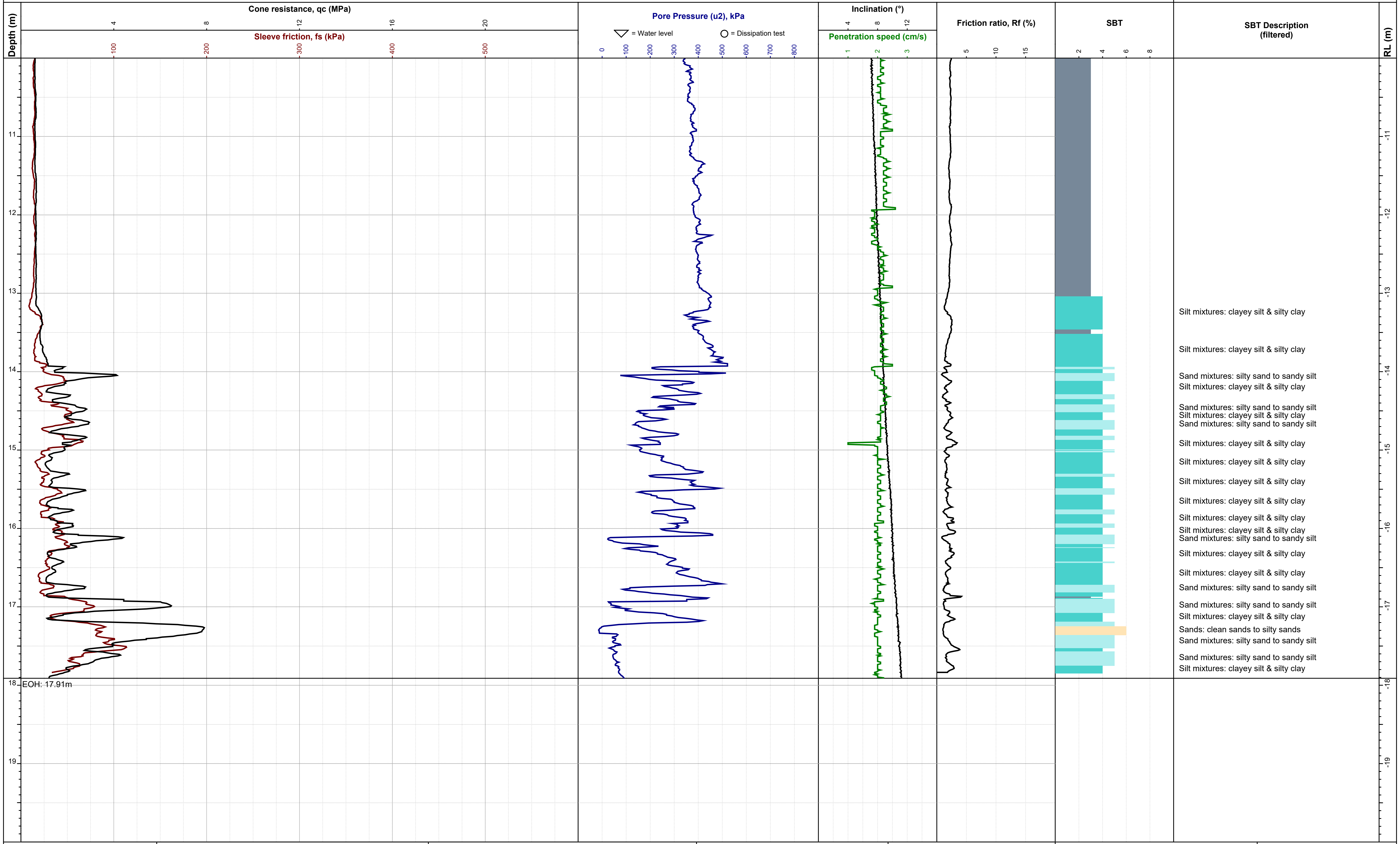
| | | | |
|---|---|---|---|
| 0 | Undefined | 5 | Sand mixtures: silty sand to sandy silt |
| 1 | Sensitive fine-grained | 6 | Sands: clean sands to silty sands |
| 2 | Clay - organic soil | 7 | Dense sand to gravelly sand |
| 3 | Clays: clay to silty clay | 8 | Stiff sand to clayey sand |
| 4 | Silt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

**Test ID:**
**CPT01**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 1 of 2 |
| **Date:** | 03/10/2023 |

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT01**



LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 1986**

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

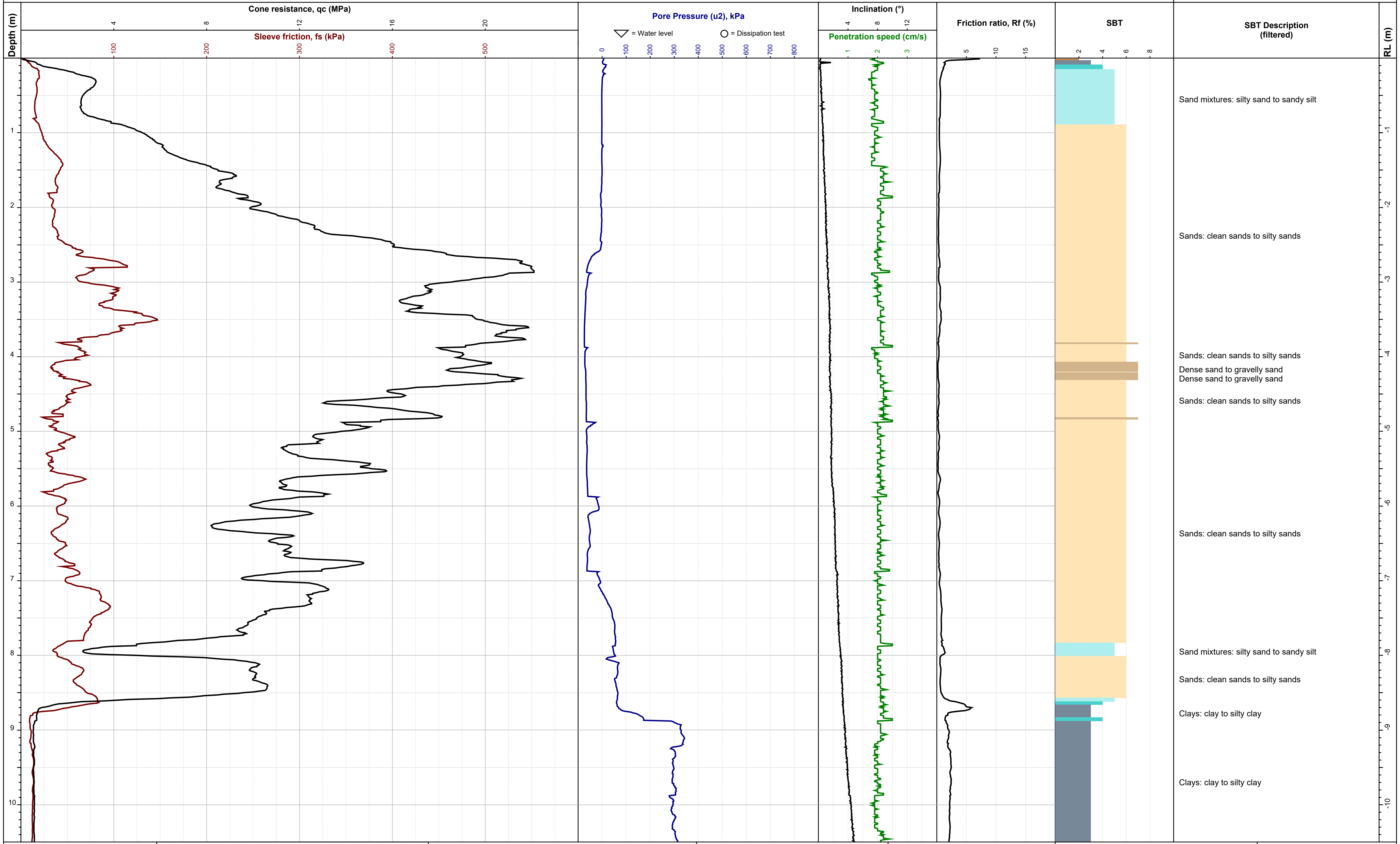
**Test ID:**
**CPT01**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 2 of 2 |
| **Date:** | 03/10/2023 |

Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:09 am

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT02



Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 2/10/2023 11:42:11 am

LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 1986**

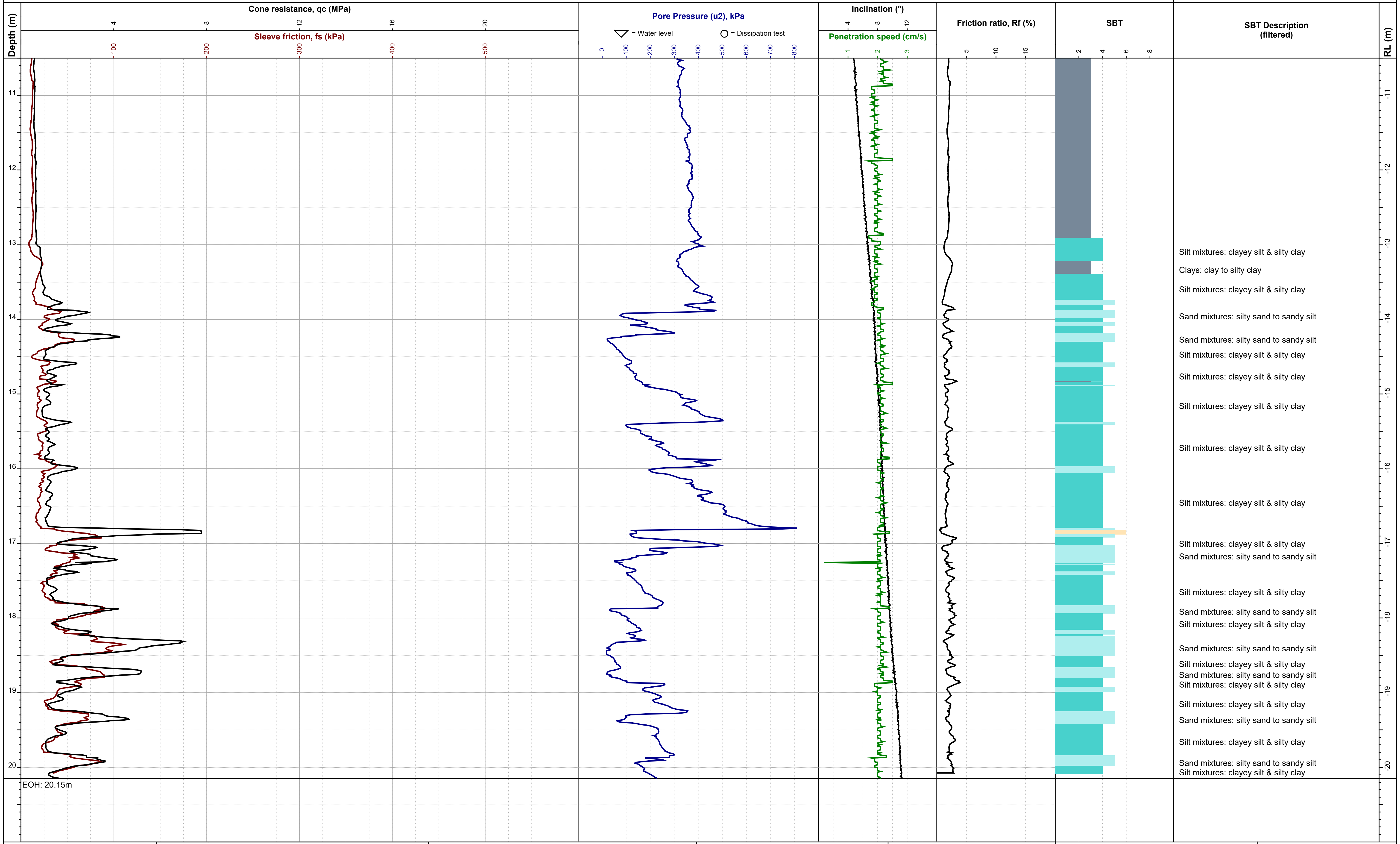
| | | | |
|---|---|---|---|
| 0 | Undefined | 5 | Sand mixtures: silty sand to sandy silt |
| 1 | Sensitive fine-grained | 6 | Sands: clean sands to silty sands |
| 2 | Clay - organic soil | 7 | Dense sand to gravelly sand |
| 3 | Clays: clay to silty clay | 8 | Stiff sand to clayey sand |
| 4 | Silt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

**Test ID:** CPT02

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 1 of 2 |
| **Date:** | 14/09/2023 |

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT02**



**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

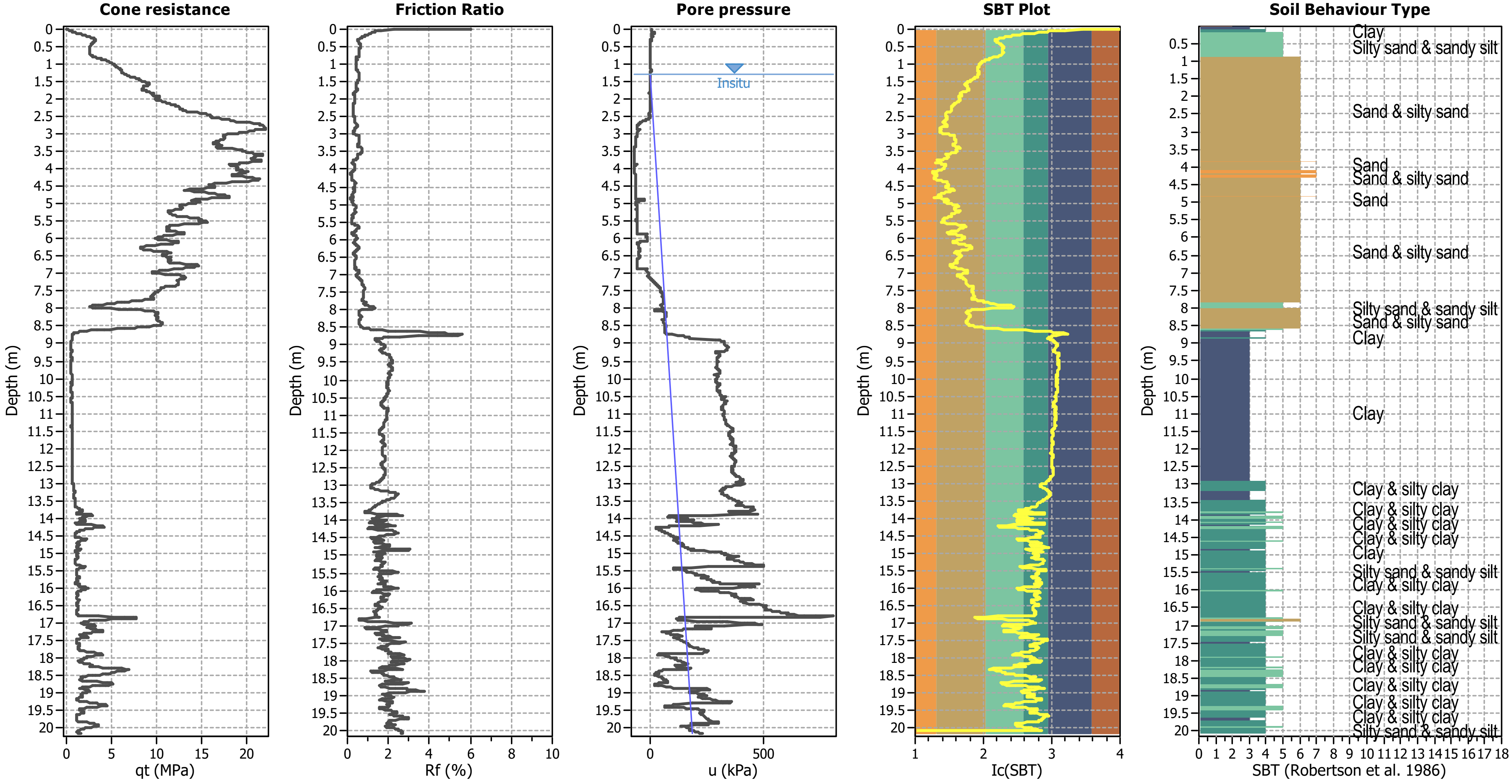
**Test ID:** **CPT02**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 2 of 2 |
| **Date:** | 14/09/2023 |

# APPENDIX D

# LIQUEFACTION ANALYSIS RESULTS

# CPT basic interpretation plots



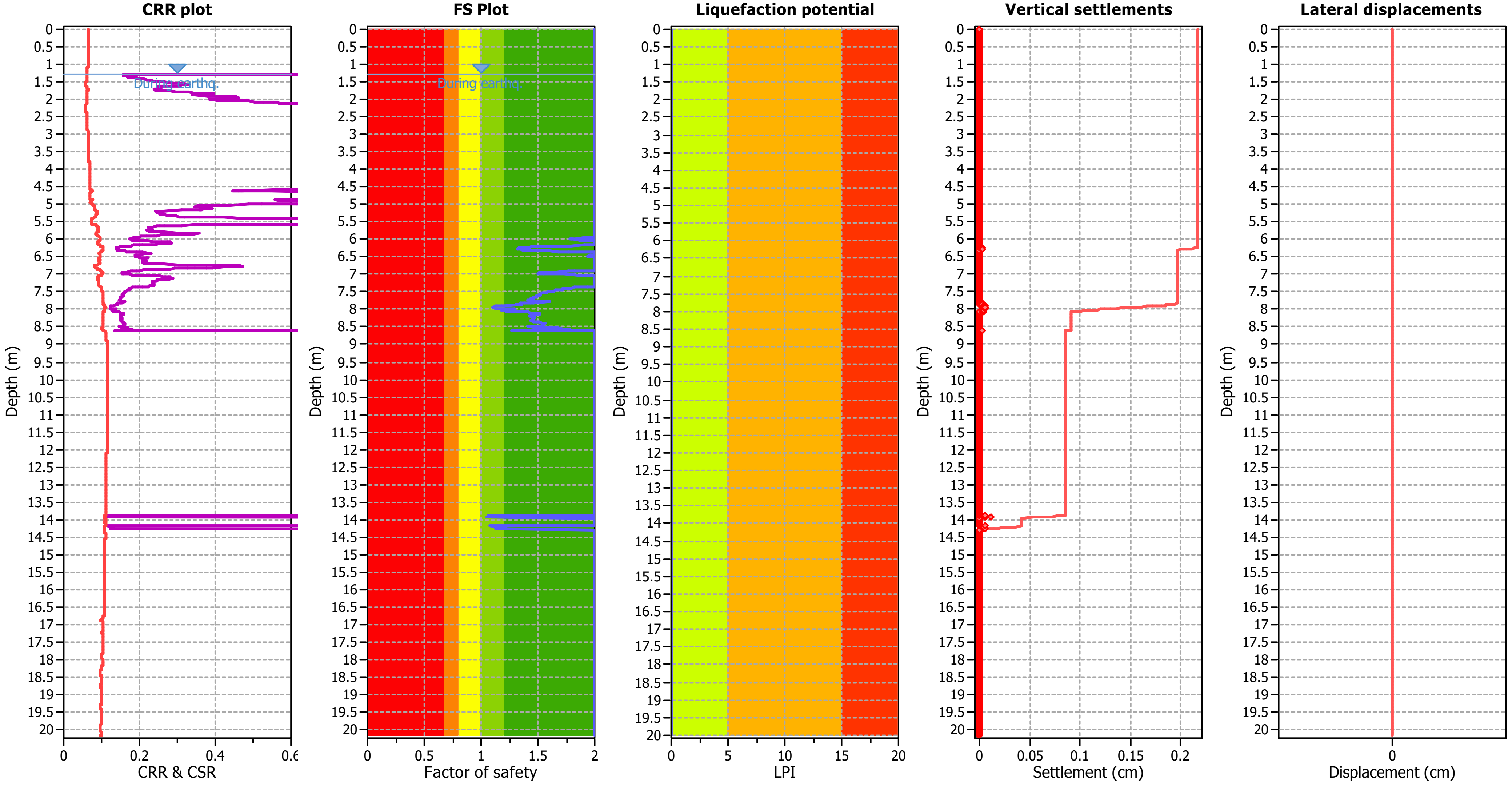
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬜ 8. Very stiff sand to |
| 🟦 3. Clay to silty clay | 🟨 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



**Input parameters and analysis data**

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.30
Peak ground acceleration: 0.12
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 15.00 m

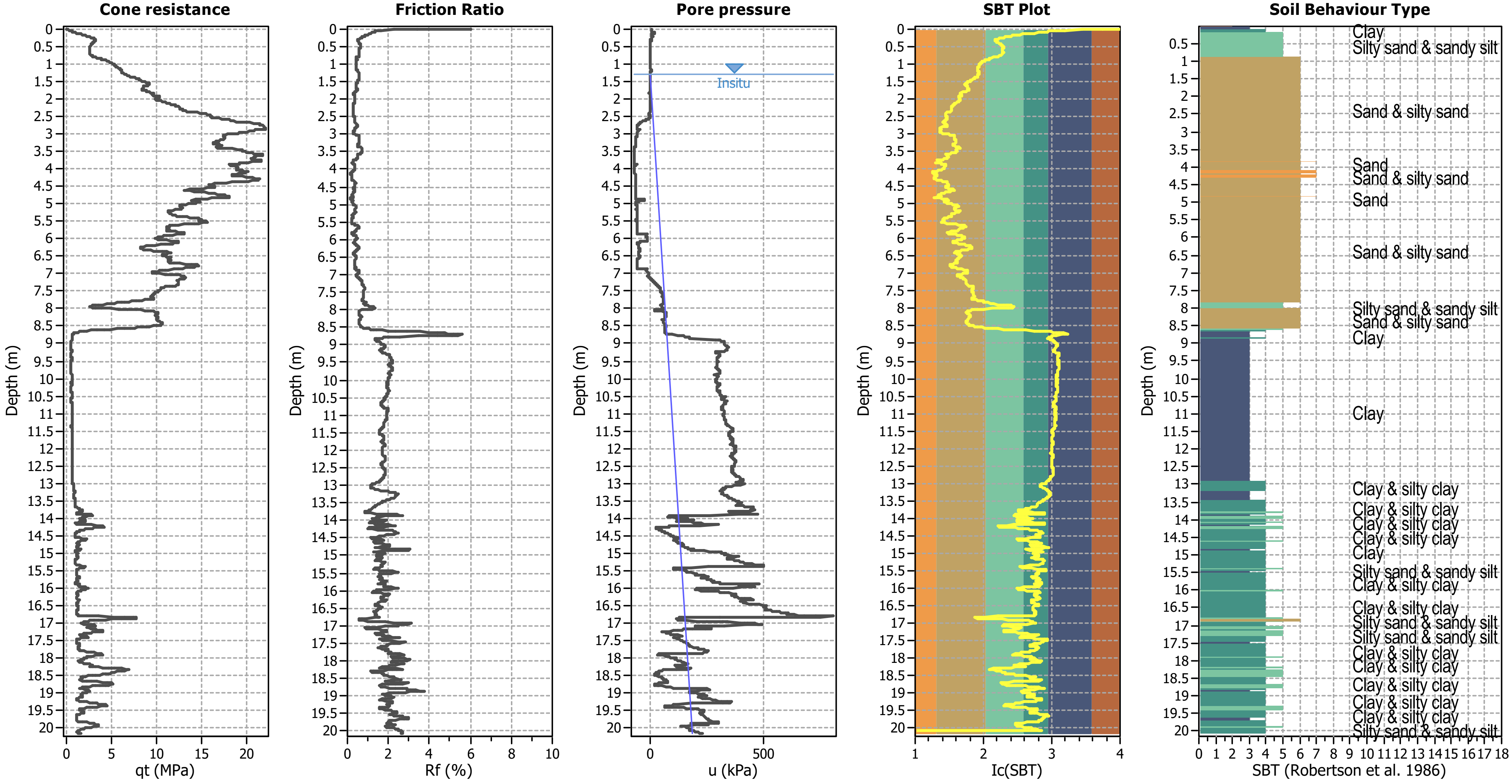
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

# CPT basic interpretation plots



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**SBT legend**

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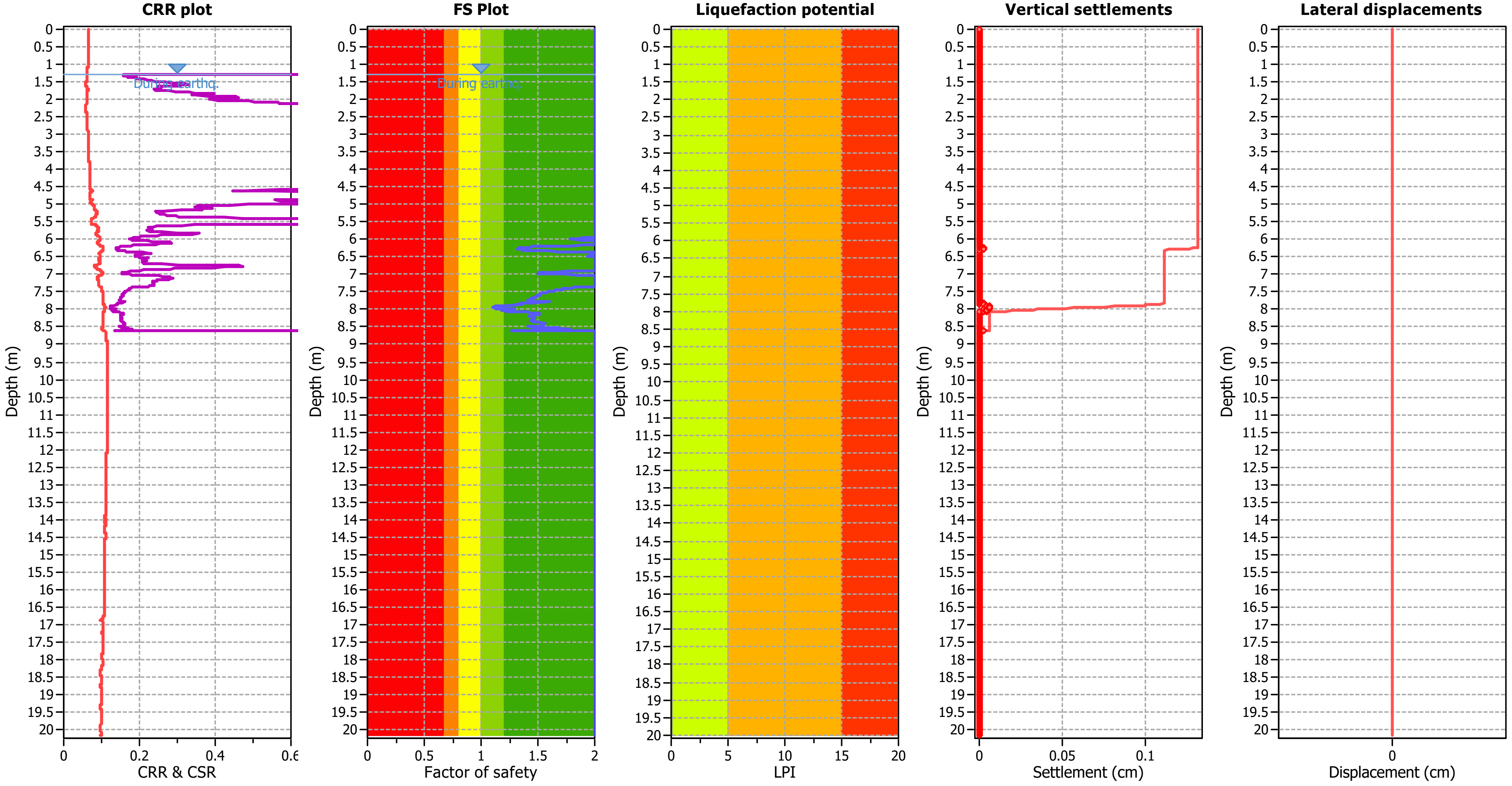
- 🟩 5. Silty sand to sandy silt
- 🟫 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬜ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



## Input parameters and analysis data

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|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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## LPI color scheme

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- 🟧 High risk
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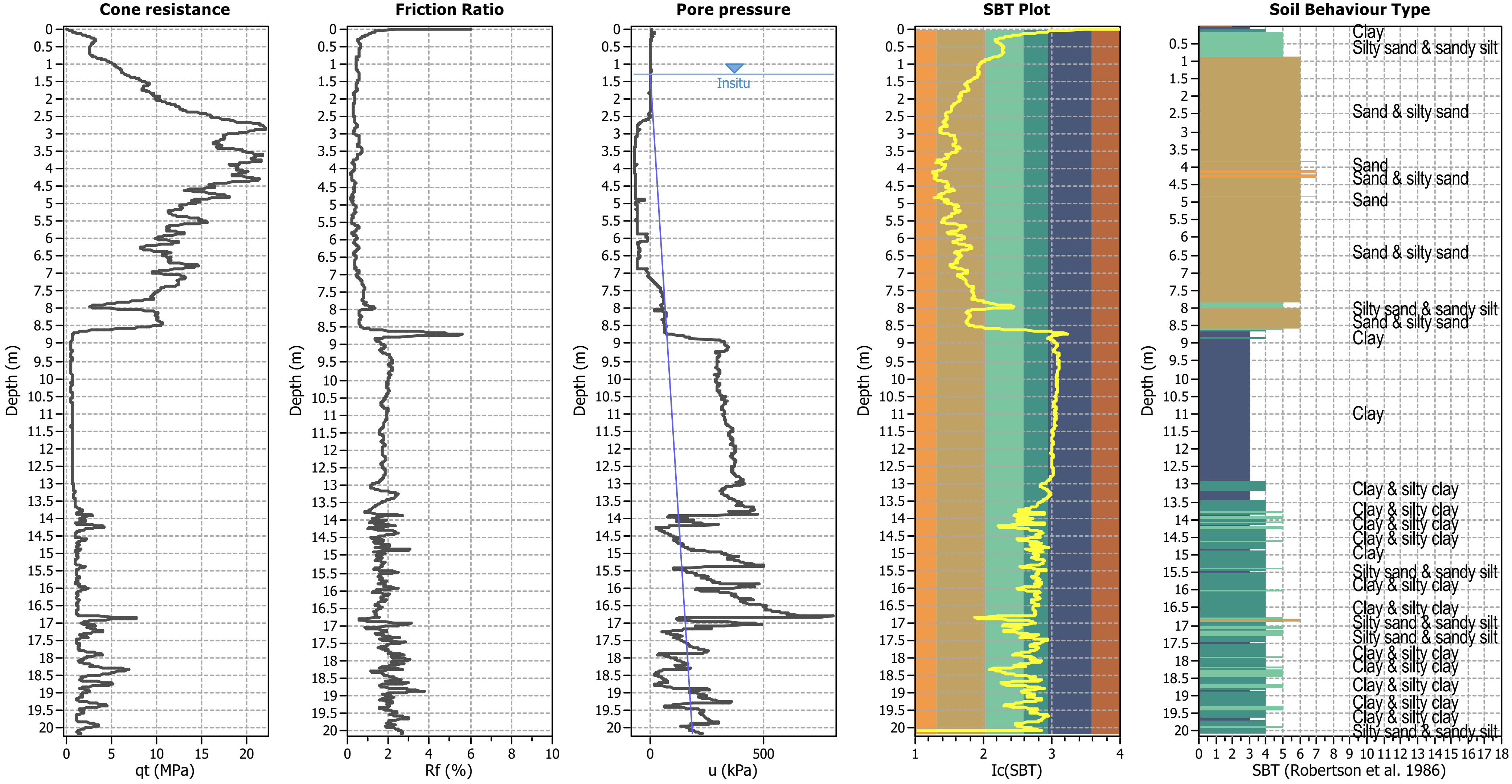
# CPT basic interpretation plots



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|---|---|---|---|---|---|
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| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
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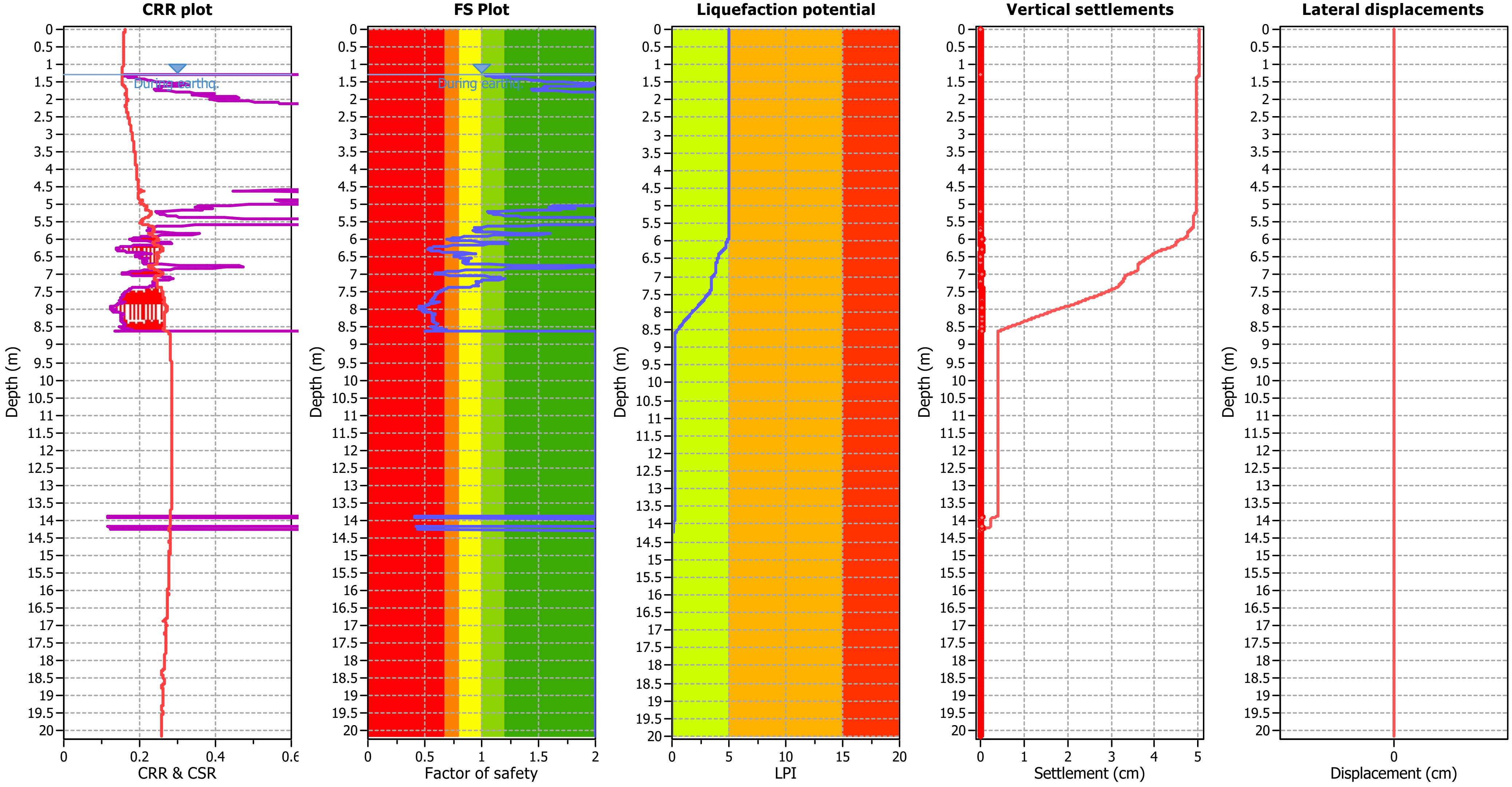
# Liquefaction analysis overall plots



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|---|---|---|---|---|---|
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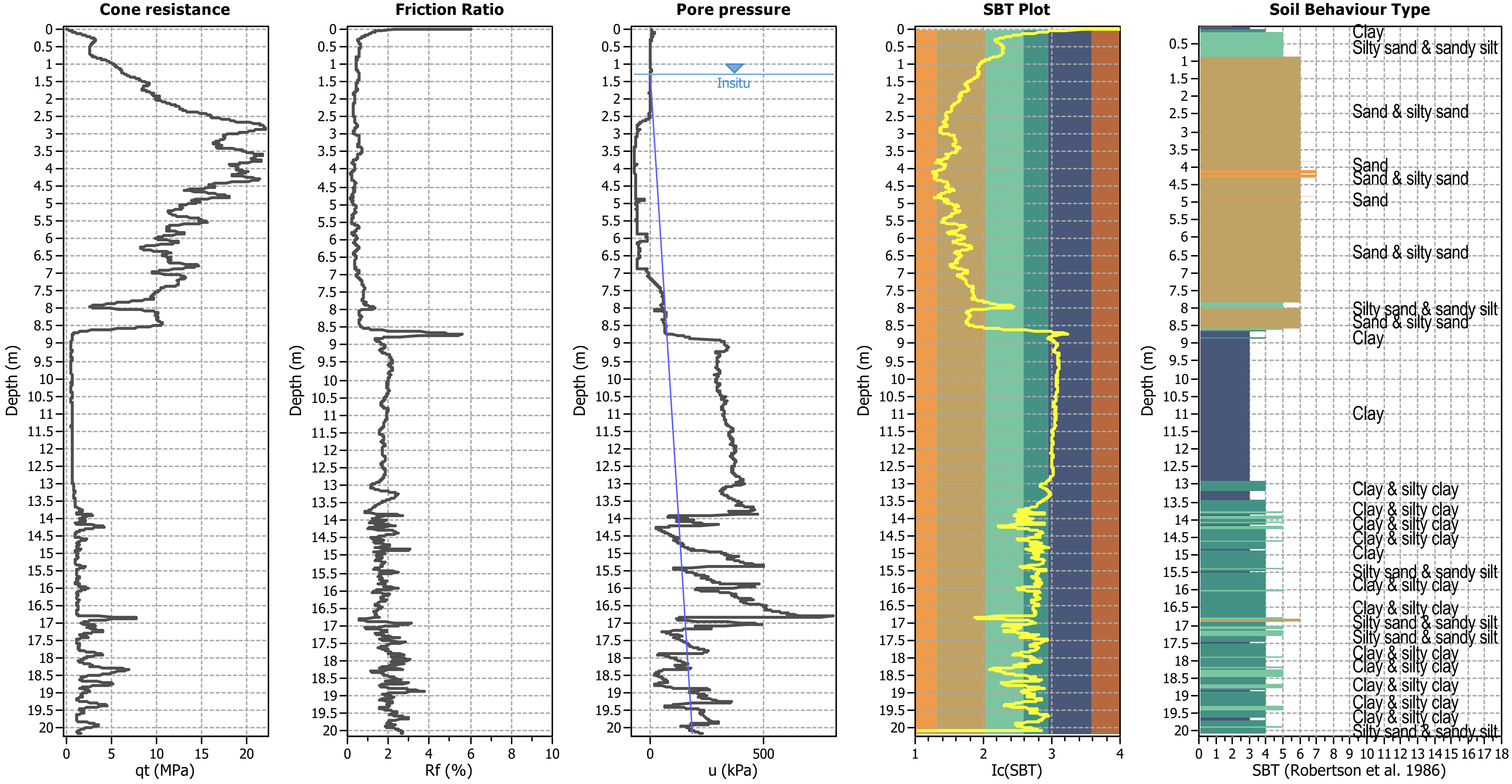
- 🟩 Low risk

CPT name: CPT02 - ILS (10m)

# CPT basic interpretation plots



Cone resistance

Friction Ratio

Pore pressure

SBT Plot

Soil Behaviour Type

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

## SBT legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
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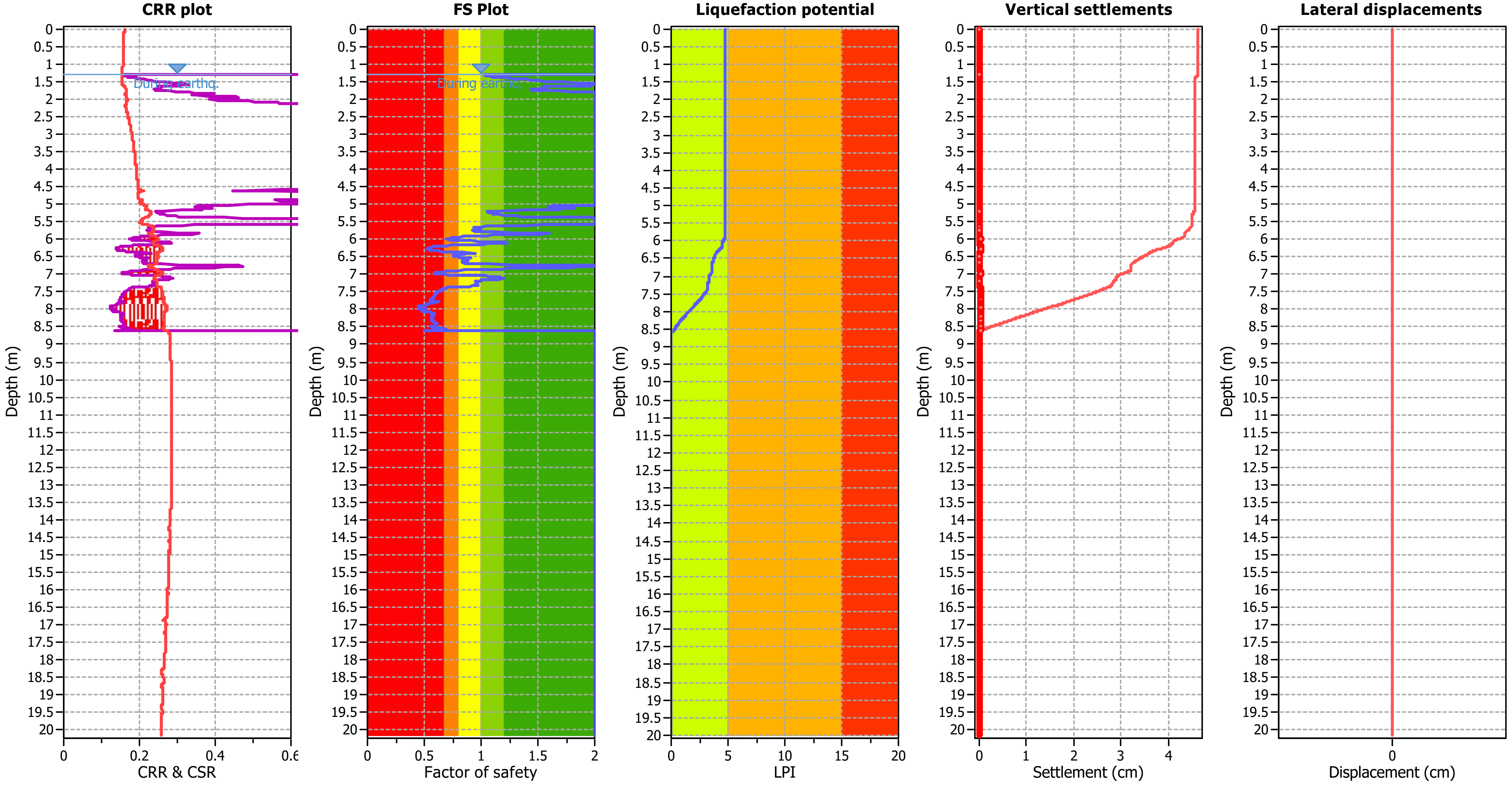
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.80
Peak ground acceleration: 0.28
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_{\sigma}$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

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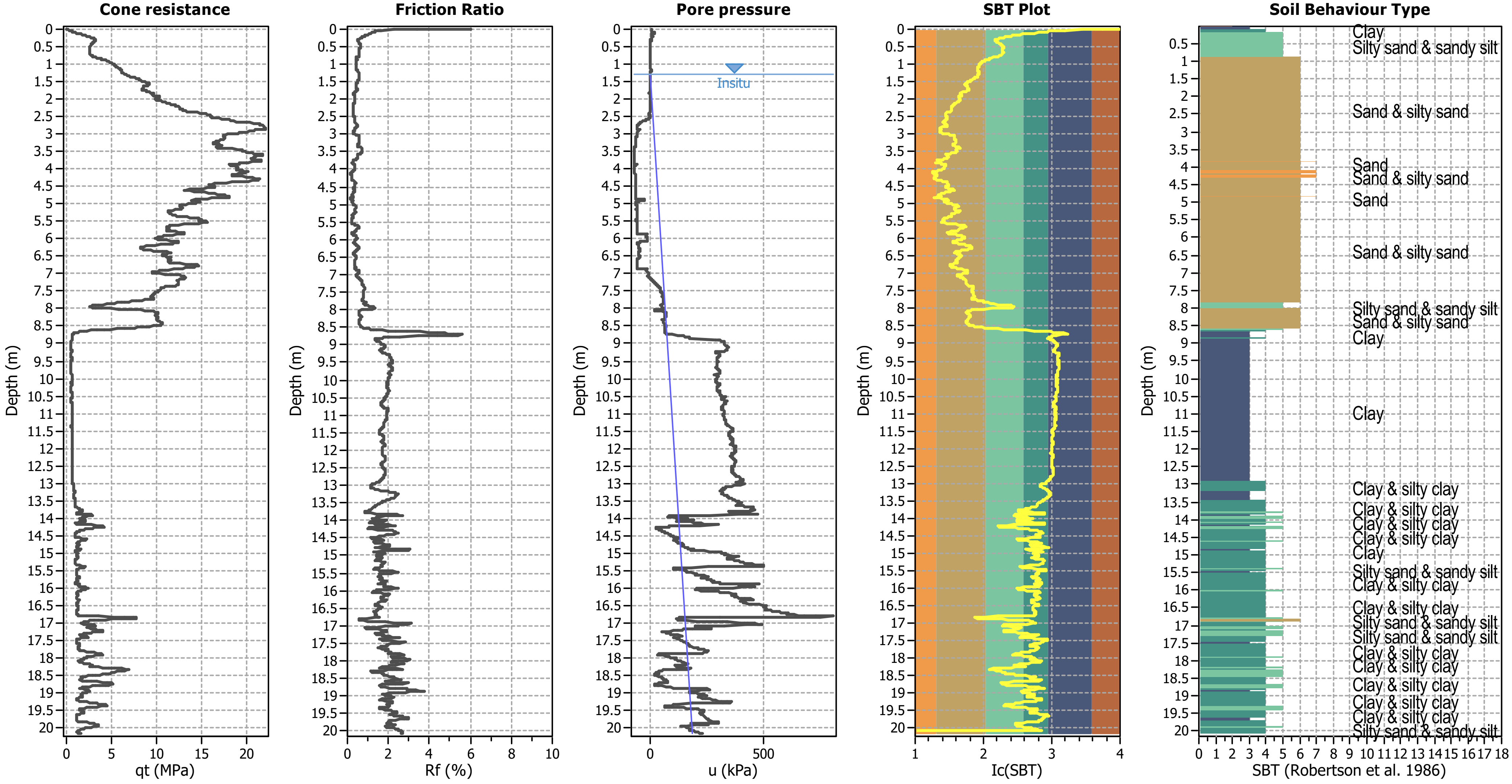
# CPT basic interpretation plots



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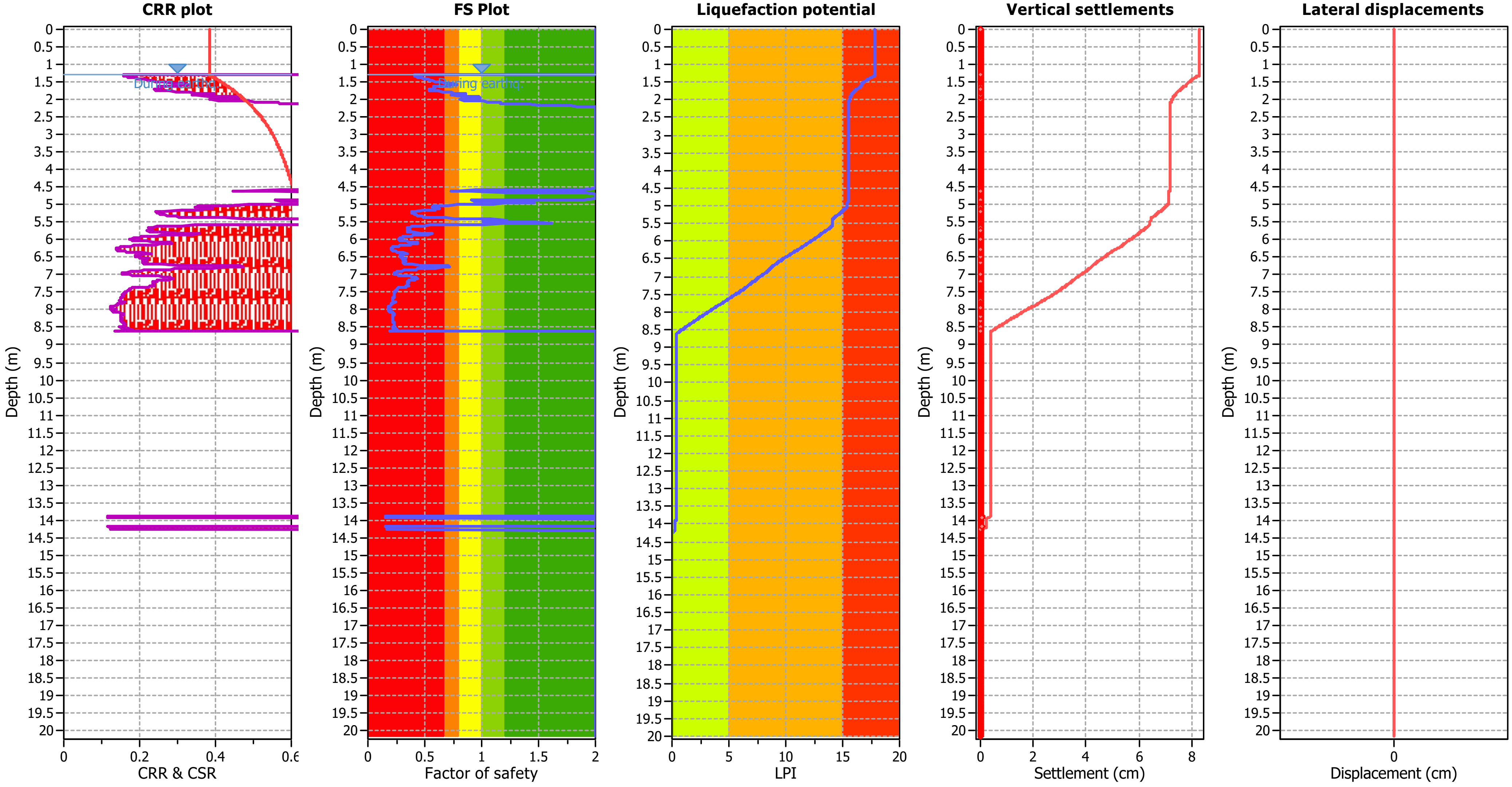

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|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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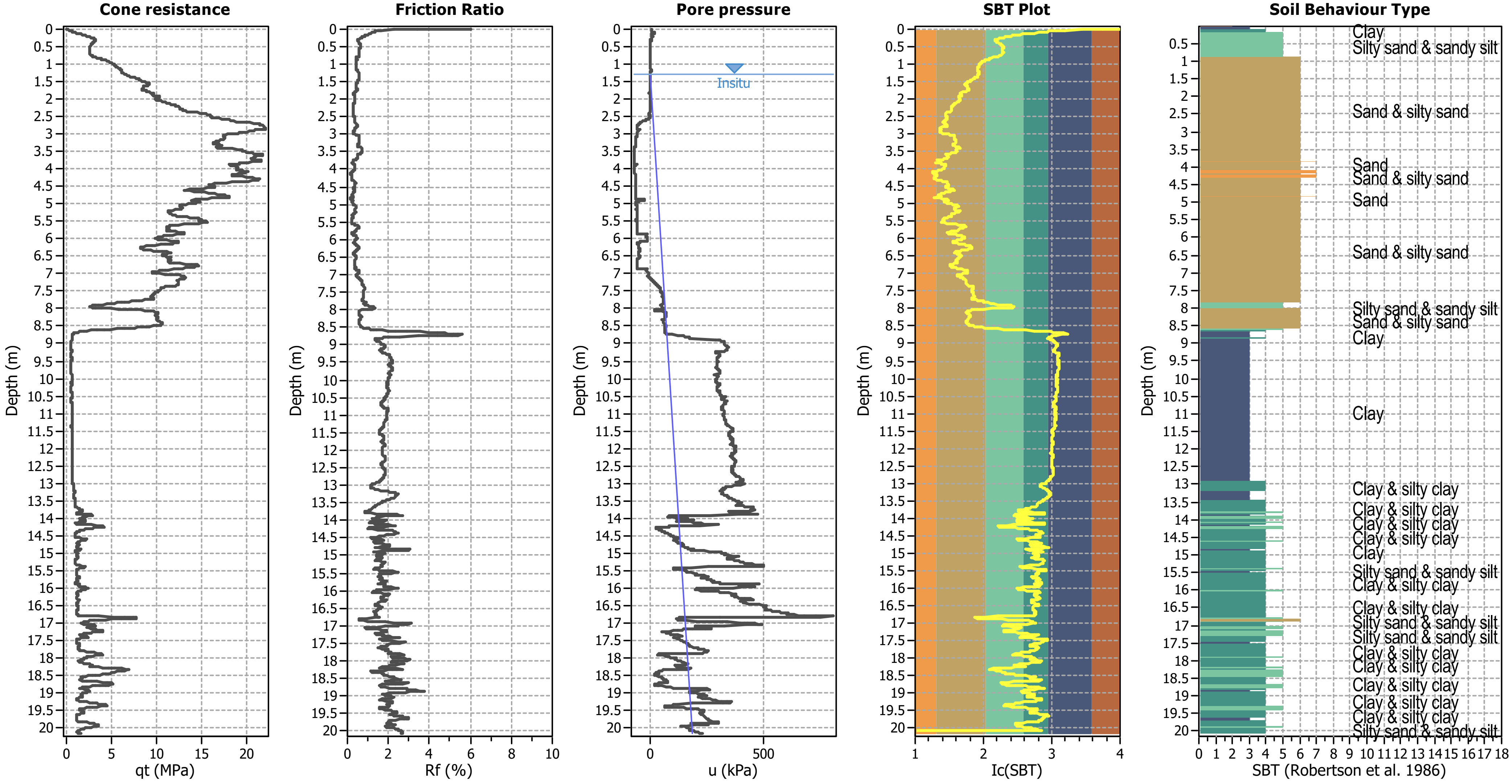

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| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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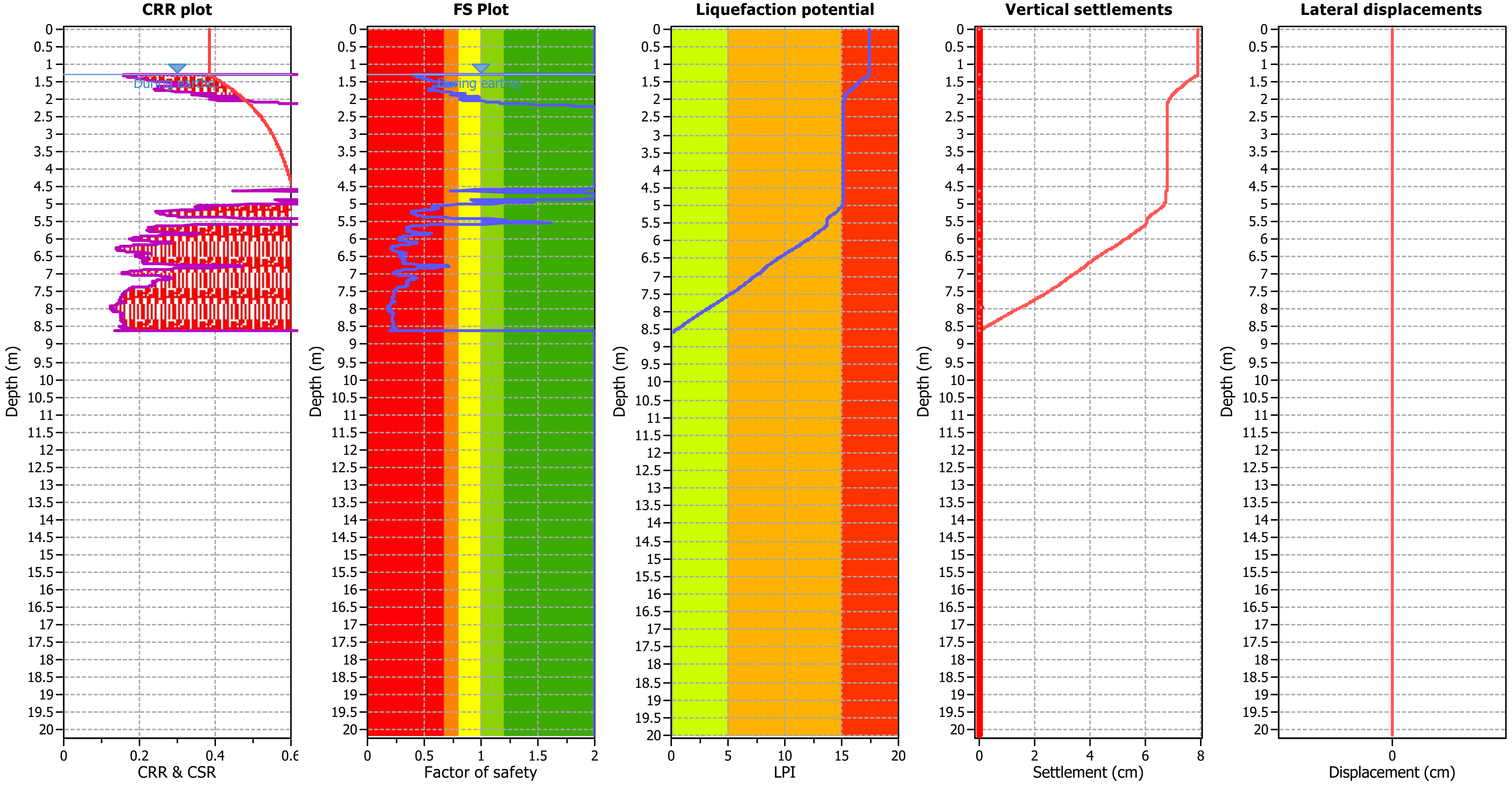
# LIQUEFACTION ANALYSIS OVERALL PLOTS



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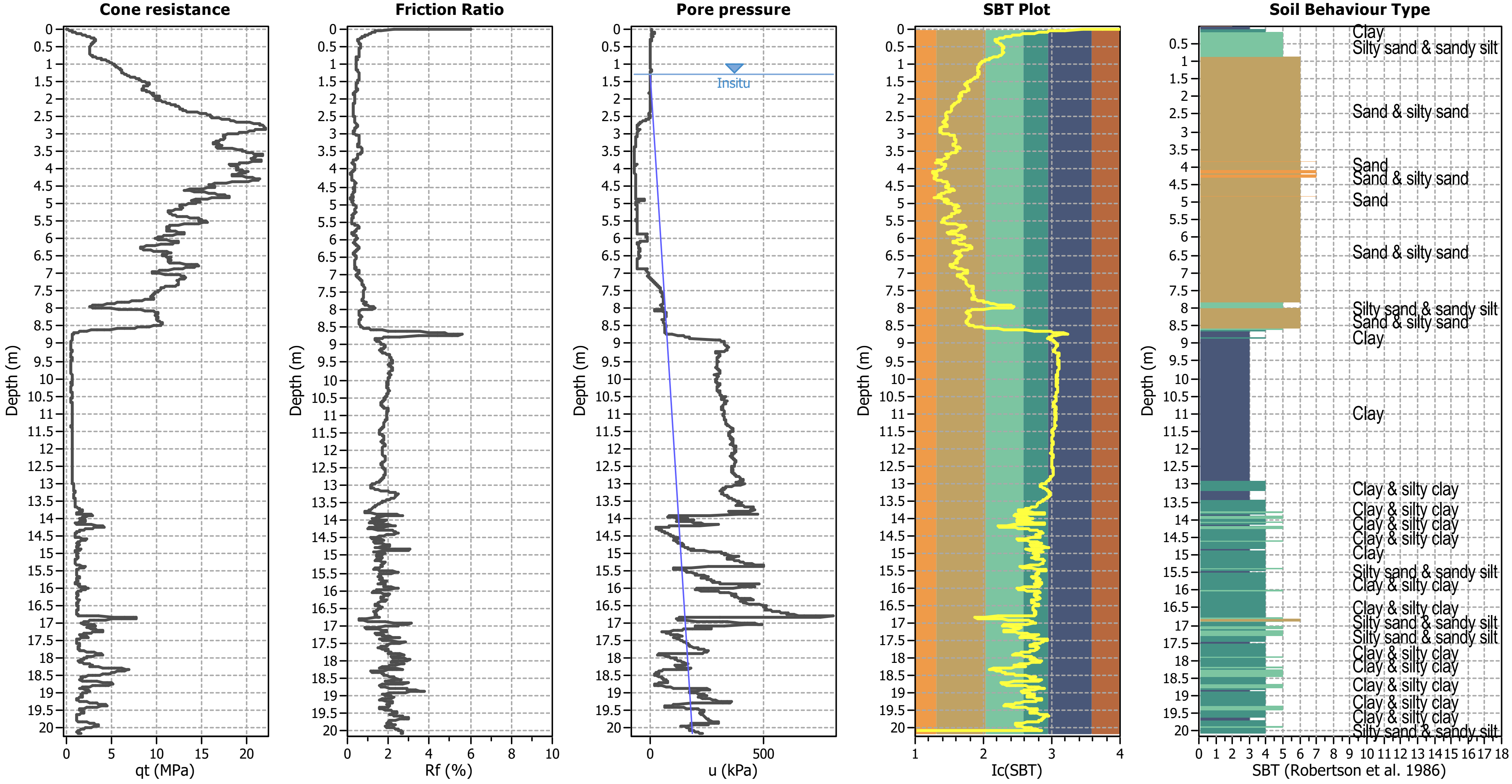
# CPT basic interpretation plots



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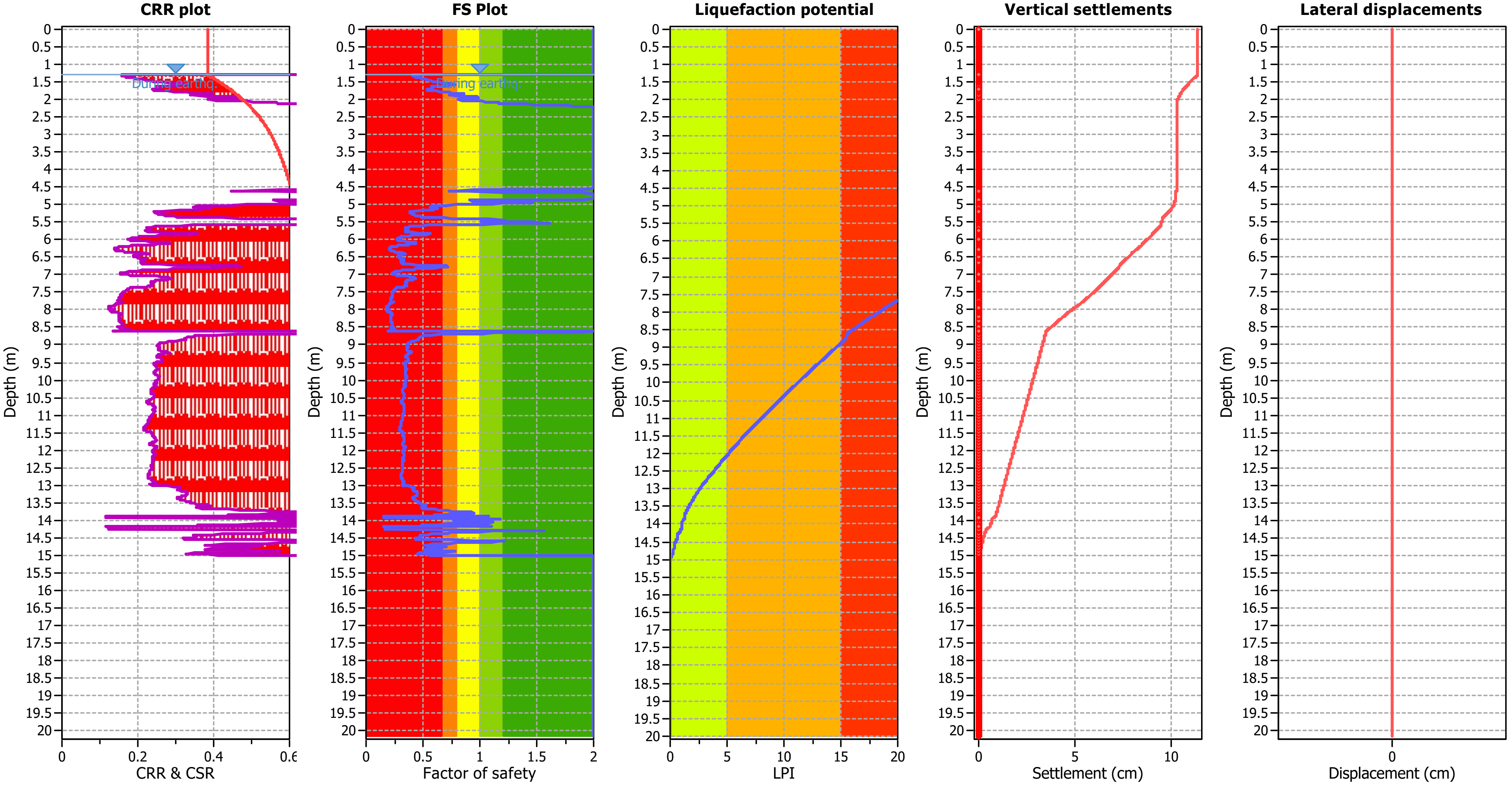
# Liquefaction analysis overall plots



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NZHG Gisborne Limited

# SITE SPECIFIC GEOTECHNICAL REPORT FOR PROPOSED RESIDENTIAL DWELLING, LOT 5 AND 6

99A Stanley Road, Gisborne

**Project Reference: 24729**
**October 17, 2023**

# DOCUMENT CONTROL

| Version | Date | Comments |
|---|---|---|
| 01 | 17/10/2023 | Issued for Resource Consent. Plan review required prior to submission for Building Consent. |

| Version | Issued For | Date | Prepared By | Reviewed & Authorised By |
|---|---|---|---|---|
| 01 | Issued for Resource Consent | 17/10/2023 | Sahil Sathwara<br>*B.Tech (Civil), MEngNZ*<br>Geotechnical Engineer | Dan Bond<br>*CMEngNZ, PEngGeol.*<br>*Associate Engineering Geologist* |

# CONTENTS

# 1 INTRODUCTION

Land Development & Engineering Ltd (LDE) was engaged by NZHG Gisborne Limited to undertake geotechnical investigations of a site located at 99A Stanley Street, Te Hapara, Gisborne (Figure 1), with legal description Lot 1 DP 5799. The 1,590m$^2$ site is proposed to be subdivided into 8 Lots for residential development (Figure 1). This geotechnical report pertains to proposed **Lot 5 and 6**, 99A Stanley Road, Gisborne.

Figure 1: Site location outlined in blue, with the proposed subdivision outlined in yellow, Lot 5 and 6 highlighted in white. Image source: Tairāwhiti Maps (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2023) Accessed: September 2023.

The purpose of this investigation was to determine and assess the nature of the ground beneath the building site to inform our geotechnical recommendations for site development and design of the building's foundations. The investigation was completed to satisfy the Gisborne District Council (2022) for Resource and Building Consent.

# 2 PROPOSED DEVELOPMENT

An 8-lot subdivision is proposed at 99A Stanley Road. Demolition and removal of existing structures is proposed, with the development consists of 4 structures formed of three double-storey duplex buildings and one single-storey duplex building (Figure 1).

The proposed driveway is located centrally in the site to provide access to the lots from Stanley Road. Proposed access and building platform locations are shown in Figure 1 and Appendix A.

A 92.8m$^2$ double storey building is proposed across Lot 5 and 6 (Figure 2), with timber framing in accordance with NZS3604 (2011), with weatherboard and sheet wall cladding, profiled metal roofing and either concrete floor or suspended timber floor, which has yet to be determined.

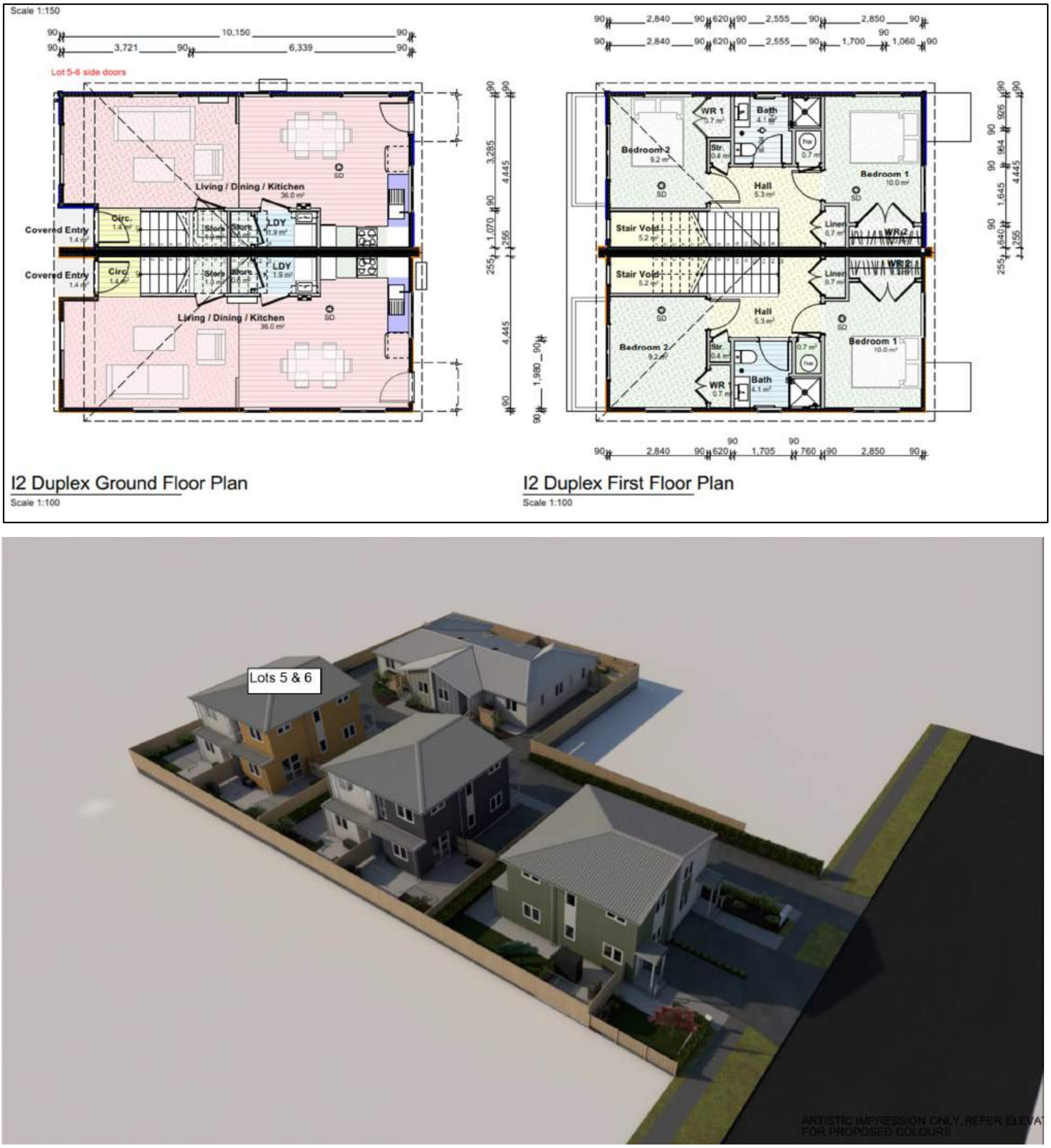


Figure 2: (From top to bottom): Floor plan for proposed duplex building across Lot 5 and 6, alongside the architect's drawing (Lot 3 and 4 are labelled) Image source: Client supplied.

# 3 SITE STUDY

## 3.1 Description

The site is located within the established suburb of Te Hapara, Gisborne, approximately 1.7km northwest of the Gisborne CBD. The site is generally flat and is elevated approximately 5m (New Zealand Vertical Datum (NZVD) 2016).

The site is within a General Residential zoning based on the Tairāwhiti Resource Manage Plan (2023) and recent aerials show the site to be developed has an existing dwelling and ancillary structure. The site does not contain any open drainage pathways or watercourses and we did not identify any significant geomorphological features nearby.

## 3.2 Published Geology

The 1:250,000 geological map of the region (Mazengarb & Speden, 2000) indicates the site is underlain by Holocene aged beach deposits which consist predominantly of sand.

## 3.3 Geotechnical Risks

Our review of Gisborne District Council's (GDC) GIS viewer, Tairāwhiti Maps (Gisborne District Council, 2022), and GNS Science's Active Faults Database (GNS Science, 2022) revealed following:

- The site is mapped as being within an area of moderate liquefaction risk.
- The nearest active fault is the Repongaere Fault, located approximately 16km north-west of the property.
- The site is mapped as yellow tsunami evacuation zone.

## 3.4 Historic Site Imagery

Historical aerial imagery was also reviewed as part of the investigation using Retrolens and Google Earth aerial photography, which revealed the following:

- Early images indicate that the site was developed prior to 1942, with a dwelling placed over the southwestern corner of Lot 1 DP 5799, occupying the corner of Stanley Road and Childers Road. These images also indicate the site to be within relic dune forms.
- The historic dwelling on the corner of Stanley Road and Childers Road was demolished between 1966 and 1972.
- The current, existing dwelling and a carport first appear in 1977 imagery.
- The surrounding developments on Childers Road are constructed by 1986.

After which the site appears to remain largely unchanged through to the present day.

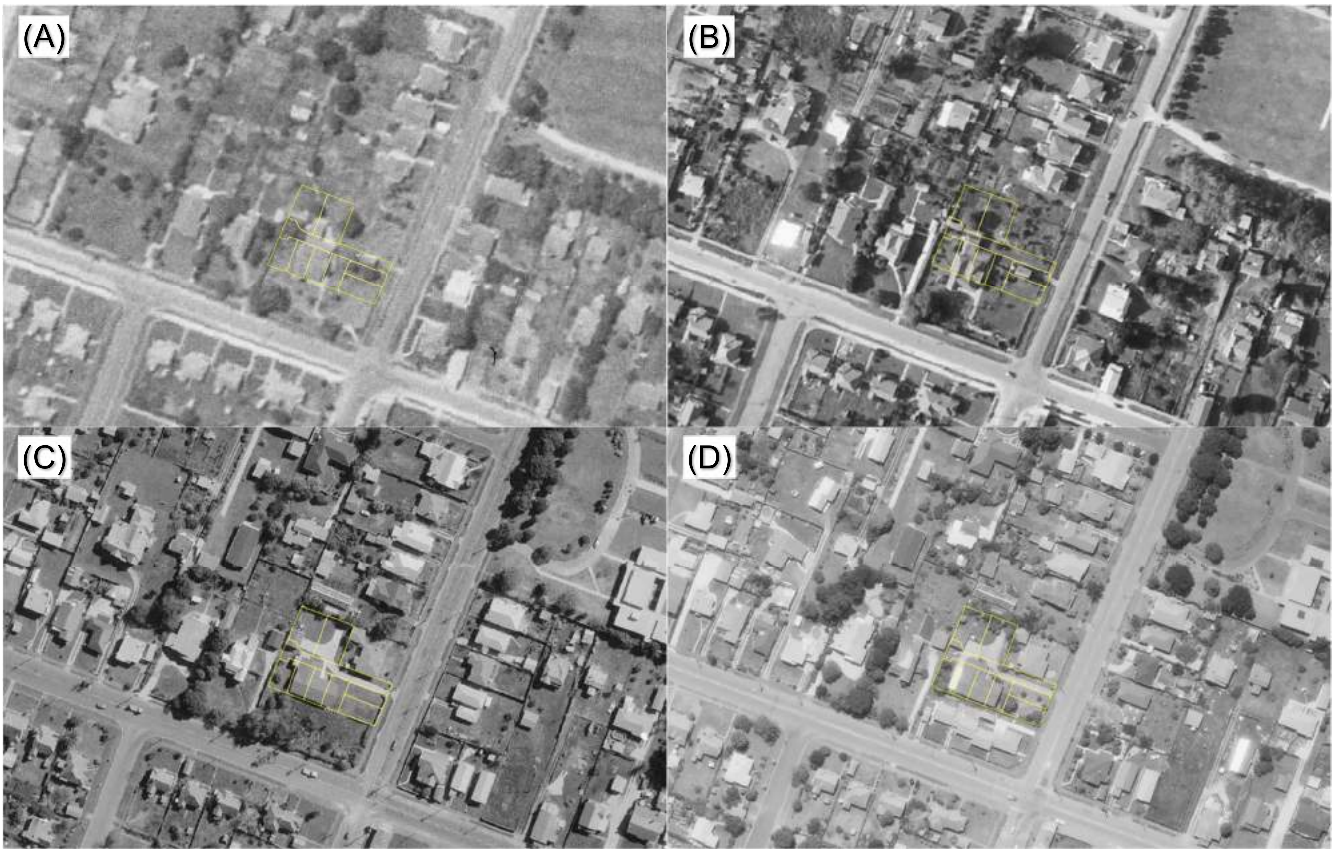


Figure 3: Historical aerial imagery of the Stanley Road subdivision (Source: (Retrolens.co.nz)), with the location of the individual lots marked in yellow. (a) Aerial imagery from 1942, (b) 1951, (c) 1977, (d) 1986.

# 4 GEOTECHNICAL INVESTIGATION

## 4.1 Development wide Investigation Scope

Our investigation of the entire site included the following scope of work:

- A walkover assessment of the site and immediate surrounding area to assess its geomorphology and identify any features which may influence our engineering recommendations, or the long-term performance of the ground.
- Twelve, 50mm diameter, hand auger boreholes to refusal or 2.5m target depth at the proposed building locations and associated Dynamic Cone Penetrometer (DCP) tests to the 2.5m target depth.
- Two cone penetrometer tests (CPTs) driven to between 17.9m and 20.15m depths, at either end of the proposed site.

## 4.2 Lot 5 and Lot 6 Investigation Scope

The investigation of the site, completed on 14 September 2023, included the following work:

- A walkover assessment of the site and immediate surrounding area to identify its geomorphology and features which may influence our engineering recommendations or the long-term performance of the ground.
- Two, 50mm diameter, hand-auger boreholes (HA11 and HA12), which refused at 2.2m below ground level (bgl). Associated DCP tests were carried out at each test location to the 2.5m target depth.

The test locations are shown on the Geotechnical Investigation Plan (Figure 4) and is included as Appendix A. Logs with details of the relevant testing completed are presented as Appendices B and C.

Figure 4: Geotechnical Investigation Plan for proposed development, Lot 5 and 6 highlighted in white.

# 5 GROUND CONDITIONS

This section addresses the ground conditions encountered during our investigations.

## 5.1 Site Stratigraphy

### 5.1.1 Development Wide

Ground conditions are reasonably consistent across the site. Typically, the property is underlain by topsoil and/or fill to a depth between 0.25m and 0.7m below ground level (bgl), which overlies sand/ silt mixtures to a depth of 1.0m. Underlying this, medium dense to dense sand was encountered to around 8.5m to 9.0m.

Deposits of firm clay were encountered from around 8.5m to 9.0m to 13m depth followed by interbedded stiff silt/clay mixtures and silty sand, sandy silt extending to at least 20m depth.

### 5.1.2 Lot 5 & Lot 6 Site Specific

Topsoil was encountered in each hand auger borehole from the existing ground surface to depths of 0.7m and 0.6m in HA11 and HA12 respectively. It is noted that an existing building is located over the proposed footprint of Lots 5 and 6 and that thicker layers of topsoil and uncontrolled fill may be present other than that encountered or from future demolition of the existing structure.

The topsoil was underlain by Holocene Beach Deposits, comprising a layer of very loose to dense sand to the refusal depth of 2.2m bgl, due to saturated sand flowing into the borehole. Dynamic penetrometer testing in within the sand subgrade ranged between 0.5 and 7 blows per 50mm, between underside of topsoil and 2.5m depth.

## 5.2 Groundwater

The groundwater was encountered at depths of between 1.3m and 1.8m in hand auger boreholes across the site. The groundwater was not measured in CPTs due to hole collapse but is inferred to be a short way beneath the depths of hole collapse.

A groundwater level of 1.3m bgl was adopted in our assessments. Given that testing was completed in the wettest year on record for Gisborne, the groundwater level adopted is considered significantly elevated from typical levels and no further allowance has been applied for seasonal variations.

# 6 NATURAL HAZARDS

## 6.1 Definition & Legislation

This section summarises our assessment of the natural hazards that might affect the site including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding, that might affect the property, as generally defined in Section 106 of the Resource Management Act., including erosion (including coastal erosion, bank erosion, and sheet erosion), falling debris (including soil, rock, snow and ice), subsidence, inundation (including flooding, overland flow, storm surge, tidal effects and ponding), and slippage.

## 6.2 Seismic Hazard

### 6.2.1 Surface Fault Rupture

The GNS NZ Geology Web-map and Active Faults Database (GNS Science, 2020) do not show any faults passing beneath the subject site. There also does not appear to be any surface expressions which would indicate the presence of an active fault beneath or within close proximity to the site. We therefore consider the surface fault rupture risk to be low.

### 6.2.2 Site Subsoil Class

Based on the published geological information for the region discussed in Section 3.2 and obtained CPTs data, we consider that the site classification of  D- "Deep or Soft Soil" Site is appropriate as defined by NZS 1170.5 (2004).

### 6.2.3 Seismic Actions

In accordance with the NZ Building Code and NZS 1170.5 (2004):The structure proposed is considered Importance Level 2 (IL2) with a design working life of 50 years, and therefore;

- The Serviceability Limit State (SLS) design earthquake has an annual exceedance probability of 1/25, and;
- The Ultimate Limit State (ULS) design earthquake has an annual exceedance probability of 1/500.
- Furthermore, an intermediate state event (ILS) has been considered in accordance with Module 1 recommendations (2021) for an annual exceedance probability of 1/100.

The modules of the Earthquake Geotechnical Engineering Practice series jointly published by Ministry of Business Innovation and Employment (MBIE) and the New Zealand Geotechnical Society (NZGS) (2021) provides guidance under Section 175 of the Building Act (2004), to assist with ensuring compliance with the Act. We have adopted the ground motions published within Module 1 (2021) for geotechnical design which are summarised in Table 1 below.

Table 1 Summary of adopted seismic parameters.

| Seismic Parameters | SLS | ILS | ULS |
|---|---|---|---|
| **Horizontal Peak Ground Accelerations (PGA), g** | 0.12 | 0.28 | 0.65 |
| **Effective magnitude, Mw** | 6.3 | 6.8 | 7.5 |

## 6.3 Liquefaction and Cyclic Softening Assessments

### 6.3.1 Liquefaction

Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground, and structure settlement, and in lateral (spreading) displacement of the ground.

The liquefaction potential was assessed with site-specific CPT data using specialist geotechnical software (CLiq Ver.3.3.1.13) in general accordance with NZGS/ MBIE Module 3 Guidance (2021). Liquefaction triggering was assessed using the method proposed by Boulanger and Idriss (2014).Liquefaction-induced, free-field, vertical, volumetric strains were estimated using the method proposed by Zhang et al (2002). A groundwater level of 1.3m bgl was adopted as discussed in Section 5.2.

### 6.3.2 Cyclic-Softening

Cyclic softening is a phenomenon that occurs when the strength and stiffness of a soil decreases due to repeated cyclic loading such as that resulting from strong seismic shaking. Relatively soft clay soils are commonly susceptible to this phenomenon, which can be accentuated where these soils are sensitive i.e., there is a significant difference between the soil's peak and residual shear strength.

Due to the presence of the clay rich estuarine soils at this site, we have undertaken a cyclic softening analysis for the ULS design case. The Gisborne 2007 earthquake was of comparable magnitude and PGA to the ILS design case. No liquefaction or induced settlements were identified within the proximity of the subject site because of this earthquake. Accordingly, cyclic softening has been assessed for the ULS design case only.

Our assessments assumed:

- An $N_{kt}$ value of 14 for the clay-like soils, based on previous work undertaken proximally by LDE within the estuarine deposits.
- An estimate of the maximum, post-liquefaction, volumetric strain based on the work by Robertson and Cabal (Robertson & Cabal, 2014) which recommends a default value of 0.5% for clay-like soils.

### 6.3.3 Liquefaction and Cyclic Softening Results

The results of the analysis are summarised below in Table 2 and detailed outputs are provided as Appendix D.

The Liquefaction Potential Index (LPI) and Liquefaction Severity Number (LSN) are indices used to assess the general performance level of liquefied deposits in accordance with the NZGS/MBIE Module 3 Guidance (2021).

Our analyses indicate that liquefaction-induced settlements are likely to be negligible (<5mm) in a design SLS seismic event.

Under the ILS design case, liquefaction-induced settlements are estimated to be between 45mm and 50mm. As discussed in Section 6.3.2 , no liquefaction, or liquefaction-induced settlements were identified within the proximity of the subject site as a result of the Gisborne 2007 earthquake, which had almost identical ground motions. Accordingly, we consider it unlikely that liquefaction would be realised under ILS seismic shaking and conclude that the software is likely to be over-estimating liquefaction potential.

Table 2 Summary of Seismic Site Performance

| Limit State / Return Period | CPT ID | LPI | LSN | Estimated Seismic Volumetric Settlements (mm) [Limited to 10m] (3) | | | Effects of Liquefaction |
|---|---|---|---|---|---|---|---|
| | | | | Liquefaction | Cyclic Softening | Total Seismic Settlement | |
| **SLS 1/25 year** | CPT-01 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | **L0** |
| | CPT-02 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | |
| **ILS 1/100 year** | CPT-01 | 4 | 6 | ~45 [~45] | - | **~45 [~45]** | **L2** |
| | CPT-02 | 5 | 7 | ~50 [~50] | - | **~50 [~50]** | |
| **ULS 1/500 year** | CPT-01 | 17 | 15 | ~80 [~75] | ~30 | **~110 [~75]** | **L3** |
| | CPT-02 | 18 | 17 | ~85 [~80] | ~35 | **~120 [~80]** | |
| **Effects of liquefaction Key** | | **L0: Insignificant** | **L1: Mild** | **L2 Moderate** | **L3: High** | **L4 Severe** | **L5: Very Severe** |

**Notes:**

- Liquefaction triggering Boulanger and Idriss (2014) methodology limited to upper 15m. Limited to 10m of soil profile shown in [brackets].
- Settlements are free-field estimated settlements and do not include any building induced settlements.
- Effects of Liquefaction based on NZGS Module 3 (New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE), 2021)

Under design ULS seismic shaking, 110mm to 120mm of settlement is estimated. However, given the rationalisation to the Gisborne 2007 earthquake, discussed above, we consider that total, free-field, seismic settlements are likely to less than 100mm.

## 6.4 Lateral Spreading

The site is generally level and the nearest free face is associated with an unnamed tributary to the Waikanae Creek, approximately 700m south of the proposed building area. Given that there are no significant slopes within influencing distance of the proposed dwelling, and grades on site are very low, we consider the risk of lateral spreading in the event of a significant earthquake to be low.

## 6.5 Liquefied Bearing

Liquefaction may lead to foundation bearing failure, by either 'punch through' failure or a reduction in bearing capacity when liquefaction occurs within the zone of influence of load bearing foundations.

A preferred foundation option has not been identified for the proposed structures at the time of writing and we have completed liquefied bearing assessments for both raft-type surface structures and piled foundations.

A unit weight of 17kN/m$^3$ was adopted for both the non-liquefied and liquefied soil layers. An angle of internal friction of 34 degrees was adopted for the non-liquefied material.

The tau/sigma ratio for these assessments was based on site-specific CPT data and taken as 0.075 for the liquefied material within the zone of influence of the foundations.

Groundwater level was taken as 1.3m, as discussed in Section 5.2.

A reduction factor of 0.75 was applied to the ultimate capacities calculated for the proposed, two-storey, duplex buildings, in accordance with MBIE Module 5 (2021) for moderately loaded structures.

### 6.5.1 Pile Foundation Assessment

Our assessment of pile foundations assumed:

- Ordinary piles embedded to a minimum depth of 0.7m at 0.3m diameter (including concrete cover),
- Anchor piles embedded to a minimum depth of 0.9m at 0.4m diameter (including concrete cover), and
- A 100kPa design load.

Both projected area and 'punch-through' failure mechanisms were assessed.

#### 6.5.1.1 Results

The design load exceeded capacity in both design cases with the 'punch-through' failure mechanism governing. Maximum design loads were calculated as follows:

<u>Ordinary piles</u>

75kPa for the single-storey structures and 55kPa for the two-storey duplex buildings.

<u>Anchor Piles</u>

45kPa for the single-storey structures and 30kPa for the two-storey duplex buildings.

### 6.5.2 Raft type Surface Structure Foundation Assessment

For the raft-type surface structures assessments were completed for the single-storey and two-storey buildings assuming:

- Foundation widths as presented in the 15% architectural drawings, and
- An embedment depth of 0.2m.

#### 6.5.2.1 Results

Liquefied bearing capacities were calculated to be 14.5kPa for the proposed single-story buildings and 11kPa for the proposed two-storey duplex structures.

The values presented above are dependent on the assumptions listed. Should the foundation breadth, embedment depth or design loads change, the liquefied bearing capacities will need to be reassessed.

## 6.6 Equivalent MBIE Technical Category

Considering the rationalisation provided in Section 6.3, we consider that seismic ground performance at this site would be equivalent to a TC2 classification in accordance with Table 15.6 of the MBIE Guidance (2015).

## 6.7 Slope Stability

The site is generally flat-lying and there are no significant slopes within, or near the site. Therefore, we do not consider slope stability to be a geotechnical constraint.

## 6.8 Flood Hazard

The site is not located in a mapped flood hazard zone.

## 6.9 Tsunami

The Gisborne / East Cape coastline is classified as being at the highest risk in the country of being affected by tsunami. Modelling for the Gisborne region (GNS Science Te Pū Ao, 2016) indicates that the site is sufficiently elevated and is unlikely to be inundated in 1:100, 1:500, and 1:2500-year return period tsunami events, respectively. Civil defence tsunami inundation maps show that the site mapped as a yellow zone, which may be subject to tsunami hazard in the case of a severe (i.e. M8.9) local earthquake on the Hikurangi subduction margin (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2019) .

## 6.10 Expansive Soils

No laboratory testing of the soil properties was completed. Based on field tests, the surficial soils below the topsoil are granular in nature and therefore not subject to expansivity.

## 6.11 Natural Hazards Summary

From our assessment of the natural hazards and ground deformation risks presented to the proposed development we consider that the proposed structures can be safely located on the site, provided that the recommendations given in Section 7 are adopted.

# 7 ENGINEERING RECOMMENDATIONS

## 7.1 Site Contouring and Topsoiling

The finished ground level should be graded so that water cannot pond against, beneath or around the buildings for the economic life of structure. To achieve this, it will be important that the building platform beneath the topsoil grades away from the site. Contouring should avoid the potential for concentration and discharge of surface water over point locations which could result in soil erosion or instability.

## 7.2 Access Road Construction

Access is proposed from Stanley Road. No major/ significant earthworks are anticipated to form access to the proposed dwellings.

## 7.3 Foundation Recommendations

### 7.3.1 Foundation Type

Based on the site investigation and analysis, we consider that foundations comprising pile foundations or raft-type surface structures are suitable for the site conditions providing the recommendations and limitations presented within this section are addressed in design.

### 7.3.2 Design Considerations

Based on the scope of work completed, the following aspects need to be considered in detailed design:

- Site Class - Class D - Deep or soft soil
- Liquefaction-induced vertical settlements - TC2 equivalent
- Relatively high groundwater level
- Liquefied bearing capacity
- Potential for consolidation settlement

### 7.3.3 Bearing Capacity and Founding Depth

Foundations must extend beneath any topsoil, uncontrolled fill, organic and/ or otherwise unsuitable material. It is noted that an existing building is located over the proposed footprint of Lots 5 and 6 and that thicker layers of topsoil and uncontrolled fill may be present other than that encountered or from future demolition of the existing structure.

For the Lot 5/6 duplex structure we anticipate that a static geotechnical ultimate bearing capacity (GUBC) of 210kPa will be available from 0.6m depth. Some localised deepening of foundations is anticipated in the vicinity of HA11. A reduction factor of 0.45 should be applied to the GUBC given above to give the design bearing strength ($q_{dbs}$).

A short-term, post-seismic (static), liquefied bearing capacity, equivalent to the values presented in Section 6.5, should be assessed in structural design. Note that these liquefied bearing capacities are contingent on the assumptions listed within Section 6.5. Should these assumptions change in design, the liquefied bearing capacities will need to be reassessed. This may require some iterative design between the geotechnical and structural engineers.

## 7.4 Surface Water

The site is proposed to be connected to the council stormwater system. On-site disposal is not proposed.

The stormwater system for the buildings should be operational as soon as the roof is in place. This is to ensure that the ground within the vicinity of the building is not compromised by the negative effects and potential consequences of soil saturation.

### 7.4.1 Service Pipes

All service pipes, stormwater structures should be designed and constructed to ensure adequate capacity, strength, and water tightness to prevent leakage into the platform through blockage, running under pressure, or structural failure.

All service pipes installed within any fill should be flexible, or flexibly joined, so that they may deflect without breaking if the ground settles.

A record should be kept of the position, type, and size of all subsoil drains, and in particular of their outlets.

## 7.5 Trees and Shrubs

There are multiple trees on the property, within the vicinity of the structure proposed dwellings. Trees can cause damage through heaving as a result of root growth and / or settlement resulting from soil shrinkage from the moisture uptake of the roots. Preliminary landscaping plans show that most of onsite trees and shrubs will be removed, we recommend one of the following options:

- The plant and its major root structure should be removed.
- A root barrier should be designed and installed between the offending plant and the structure.
- Foundations should be taken to a depth no less than 1.0m where damage from the roots of the plant is unlikely.

If new trees, shrubs or gardens are established, or the lemon tree relocated on site, care should be taken to ensure:

- The vegetation does not interfere with any subfloor ventilation or services to the structure.
- Over-watering of the vegetation does not saturate the ground near the foundations.
- Trees or shrubs with the potential to develop significant root systems should be planted a minimum distance equal to the mature height of the plant away from the foundations.

# 8 SUSTAINABILITY

Considering sustainability as early as possible in a project's development, could lead to significant project opportunities and wider positive outcomes. Geotechnical opportunities for increased sustainability for this project include:

- Striping and stocking topsoil for reuse (dependant on presence/ levels of contaminants).
- Designing for cut and fill balance where possible.
- Reuse of site won materials, or using materials won from other sites including use of recycled crushed concrete aggregate for hard fill.
- Contributing site investigation data to the New Zealand Geotechnical Database (NZGD) to help reduce the site investigations needed in the future.
- Using local consultants and contractors to reduce transport related emissions.

# 9 CONCLUSIONS

Following development of the site in accordance with our recommendations, we consider that:

a) The land in respect of which a consent is sought, or any structure on the land built in accordance with our recommendations, is unlikely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and

b) Any subsequent use that is likely to be made of the land is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; and

c) Sufficient provision has been made for physical access to each allotment to be created by the subdivision.

# 10 PLAN REVIEW

Prior to an application for Building Consent, it is important we are given the opportunity to review the final development drawings to ensure the recommendations contained within this report have been followed and interpreted correctly. Following successful review of the development drawings, we will update this report to support applications for Resource Consent and Building Consent.

# 11 VERIFICATION

Verification requirements will be provided once the form of the foundations has been determined.

# 12 LIMITATIONS

This report should be read and reproduced in its entirety including the limitations to understand the context of the opinions and recommendations given.

This report has been prepared exclusively for NZHG Gisborne Limited in accordance with the brief given to us or the agreed scope and they will be deemed the exclusive owner on full and final payment of the invoice. Information, opinions, and recommendations contained within this report can only be used for the purposes with which it was intended. LDE accepts no liability or responsibility whatsoever for any use or reliance on the report by any party other than the owner or parties working for or on behalf of the owner, such as local authorities, and for purposes beyond those for which it was intended.

This report was prepared in general accordance with current standards, codes and best practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods and subsurface investigations at discrete locations designed to the constraints of the project scope to provide the best assessment of the environment. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from those described in this report.

# 13 REFERENCES

Ambraseys, N., & Srbulov, M. (1995). Earthquake induced displacements of slopes. *Soil Dynamics and Earthquake Engineering*, 14(1), 59-71.

Boulanger, R., & Idriss, I. (2014). *CPT and SPT based liquefaction triggering proceedures.* Report No. UCD/CGM-14, 1.

Bray, J. D., & Travasarou, T. (2007). Simplified procedure for estimating earthquake-induced deviatoric slope displacement. *Journal of geotechnical and geoenvironmental engineering*, 133(4), 381-392.

Cetin, K., Bilge, H. T., Wu, J., Kammerer, A. M., & Seed, R. B. (2009). Probabilistic model for assessment of cyclically induced reconsolidation (volumetric) strains. *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, 387-398.

Chu, D. B., Stewart, J. P., Youd, T. L., & Chu, B. L. (2006). Liquefaction-Induced Lateral Spreading in Near-Fault Regions during 1999 Chi-Chi, Taiwan Earthquake. *Journal of Geotechnical & Geoenvironmental Engineering*, 1549-1565.

Gisborne District Council. (2022). Bearing Capacity and Geotechnical Investigation Requirements for Buildings.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2019). Tsunami inundation and evacuation maps.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2021). Minimum Requirements for Geotechnical Reports.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2023). Tairāwhiti Maps. Retrieved 2022, from https://maps.gdc.govt.nz/H5V2_12/

GNS Science. (2020). New Zealand Active Faults Database.

GNS Science. (2022, November 5). *New Zealand Active Faults Database*. Retrieved from https://data.gns.cri.nz/af/

GNS Science Te Pū Ao. (2016). *Probabilitistic Mapping of Tsunami Hazard and Risk for Gisborne City and Wainui Beach.* Wellington: GNS.

Jibson, R. W. (2007). Regression models for estimating coseismic landslide displacement. *Engineering geology*, 91(2-4), 209-218.

Mazengarb & Speden. (2000). Geology of the Raukumara area. *Institute of Geological and Nuclear Sciences 1:250,000 geological map 6*.

Ministry of Business Innovation and Employment Hīkina Whakatutuki. (2015). *Repairing and rebuilding houses affected by the Canterbury earthquakes - Part C Technical Guidance.* Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 1. Overview of the Guidelines, Rev 1. Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 3. Identfication, assessment and mitigation of liquefaction hazards Rev1. Wellington.

*Retrolens.co.nz*. (n.d.). Retrieved from retrolens.co.nz.

Robertson, P. K., & Cabal, K. L. (2014). *Guide to Cone Penetration Testing for Geotechnical Engineering. 6th Edition.* Gregg Drilling & Testing Inc.

Standards New Zealand Te Mana Tautikanga O Aotearoa. (2004). *NZS1170.5 Structural Design Actions: Part 5: Earthquake Actions- New Zealand.* Wellington: Standards New Zealand.

Tonkin & Taylor. (2015). *Liquefaction vulnerability and Geotechnical Assessment - Guidance for Gisborne District Council.*

Zhang, G., Robertson, P., & Brachman, R. (2002). Estimating liquefaction-induced groundsettlements from CPT for level ground. *Canadian Geotechnical Journal, 39*(5), 1168-1180.

Zhang, G., Robertson, P., & Brachman, R. (2004). Estimating liquefaction-induced lateral displacements using the standard penetration test or cone penetration test. *Journal of Geotechnical and Geoenvironmental Engineering, 130*(8), 861-871.

# 14 GLOSSARY

| | |
|---|---|
| **Compressible Soils:** | Compressible soils are those that will undergo a reduction in volume under an imposed load, such as the weight of fill or a structure. This occurs firstly as a result of the expulsion of air and water from the soil void spaces (primary settlement) and secondly due to a restructuring of the soil skeleton to take the load (secondary settlement). |
| **Cyclic Softening:** | Cyclic-softening is a related condition to liquefaction can also affect clay soils when subjected to cyclic-loading. Clay soils may significantly soften and led to bearing capacity failure, in addition to post-earthquake consolidation settlements may occur as a result of the earthquake shaking. |
| **Expansive Soils:** | Cohesive soils containing significant proportions of certain clay minerals can be subject to appreciable volume change caused by variations in soil moisture content, most notably between seasons or from the uptake of water through the root systems of trees and shrubs. This is also often referred to as soil reactivity or shrink-swell behaviour. |
| **Lateral Spread:** | Lateral spread of liquefied soils is the lateral displacement of blocks of land moving laterally towards a free edge (for example a riverbank) or within sloping ground. More lateral movement tends to occur closest to the edge with less movement further back. Lateral spreading may result in large permanent ground displacements including cracks, fissures, vertical offsets, and overall settlement of the ground. |
| **Lateral Stretch:** | Lateral stretch is the amount of differential extension that a portion of land may experience during an episode of lateral spreading. The lateral stretch across a foundation is a main factor in foundation damage due to liquefaction and lateral spreading because of a large earthquake. |
| **LiDAR** | Light Detection and Ranging (LiDAR) is a method of remote sensing topographical survey. |
| **Limit States:** | Seismic design criteria for performance-based design. SLS, SLS2 & ULS are prescribed in NZS1170.5 (Standards New Zealand Te Mana Tautikanga O Aotearoa, 2004)<br>• **Serviceability Limit State (SLS):** Functional requirements for the serviceability limit state are assumed to be met if the structure or part can continue to be used as originally intended without the need for repair (SLS1) or can remain operational or continue to be occupied as appropriate (SLS2). SLS earthquakes are considered highly likely to occur during the lifetime of the structure.<br>• **Ultimate Limit State (ULS):** Functional requirements for the ultimate limit state are assumed to be met if:<br>a) People within, and adjacent to the structure are not endangered by the structure or part. |

| | |
|---|---|
| | b) Displacements of the structure are such that there is no contact between any parts of a structure for which contact is not intended, or between separate structures on the same site, if such contact would damage the structures or parts to the extent that persons would be endangered, or detrimentally alter the response of the structure(s) or parts, or reduce the strength of structural elements below the required strength.<br>c) The structure does not deflect beyond a site boundary adjacent to which other structures can be built or collision between the structure and any adjacent existing structures cannot occur.<br>d) There is no loss of structural integrity in either the structure or part.<br>• **Intermediate Limit State (ILS):** ILS is an intermediate seismic event between SLS & ULS although is not a code requirement. The behaviour of soils and geotechnical systems under earthquake shaking may be highly non-linear and even exhibit a pronounced 'step change' in performance with increasing intensity of shaking. For such cases, only considering performance at the SLS and ULS levels of shaking would fail to identify potentially poor and unacceptable performance at intermediate return periods of shaking. |
| **Liquefaction:** | Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground and structure settlement, and in lateral (spreading) displacement of the ground. |
| **LPI** | Liquefaction potential index is a liquefaction damage index. LPI ranges between 0 and 100 and sites with an LPI of 5 indicate a high liquefaction risk and sites with LPI greater than 15 indicate very high risk (Iwasaki et al, 1982). Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. |
| **LSN** | Liquefaction Severity Number is a liquefaction damage index. LSN varies from 0 (representing no liquefaction vulnerability) to more than 100 (representing very high liquefaction vulnerability (van Ballegooy et al, 2013). LSN places greater importance (than LPI) on the thickness of the non-liquefied crust when the groundwater table is close to the ground surface. Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. LNS was developed based on the observations/ investigations from the Canterbury earthquake sequence |
| **PGA:** | Peak Ground Acceleration (PGA) is the maximum ground acceleration during an earthquake as a proportion of gravity. |
| **Punch Through Failure:** | Punch through failure occurs when a foundation punches through a crust of non-liquefiable material due to underlying liquefaction occurring and can lead to potential damage to foundations and/ or large settlements. |

**Technical Category:** Following the 2010 -2011 Canterbury earthquake sequence the Ministry of Business Innovation and Employment (MBIE) assigned three technical categories (TC1, TC2, TC3) across the residential 'green zone' for foundation investigation and design guidance focusing on one and two storey timber-framed dwellings. These categories are broadly defined as below:

- **TC1:** Liquefaction damage is unlikely in future large earthquakes. Standard residential foundation assessment and construction is appropriate.
- **TC2:** Liquefaction damage is possible in future large earthquakes. Standard enhanced foundation repair and rebuild options in accordance with MBIE guidance are suitable to mitigate against this possibility.
- **TC3:** Liquefaction damage is possible in future large earthquakes. Individual engineering assessment is required to select the appropriate foundation repair or rebuild option.
- **TC2/ TC3 Hybrid:** A site that straddles liquefaction settlement limits of TC2 and TC3 where the SLS settlements are assessed as being less than 50 mm but the ULS settlements are assessed at greater than 100mm.

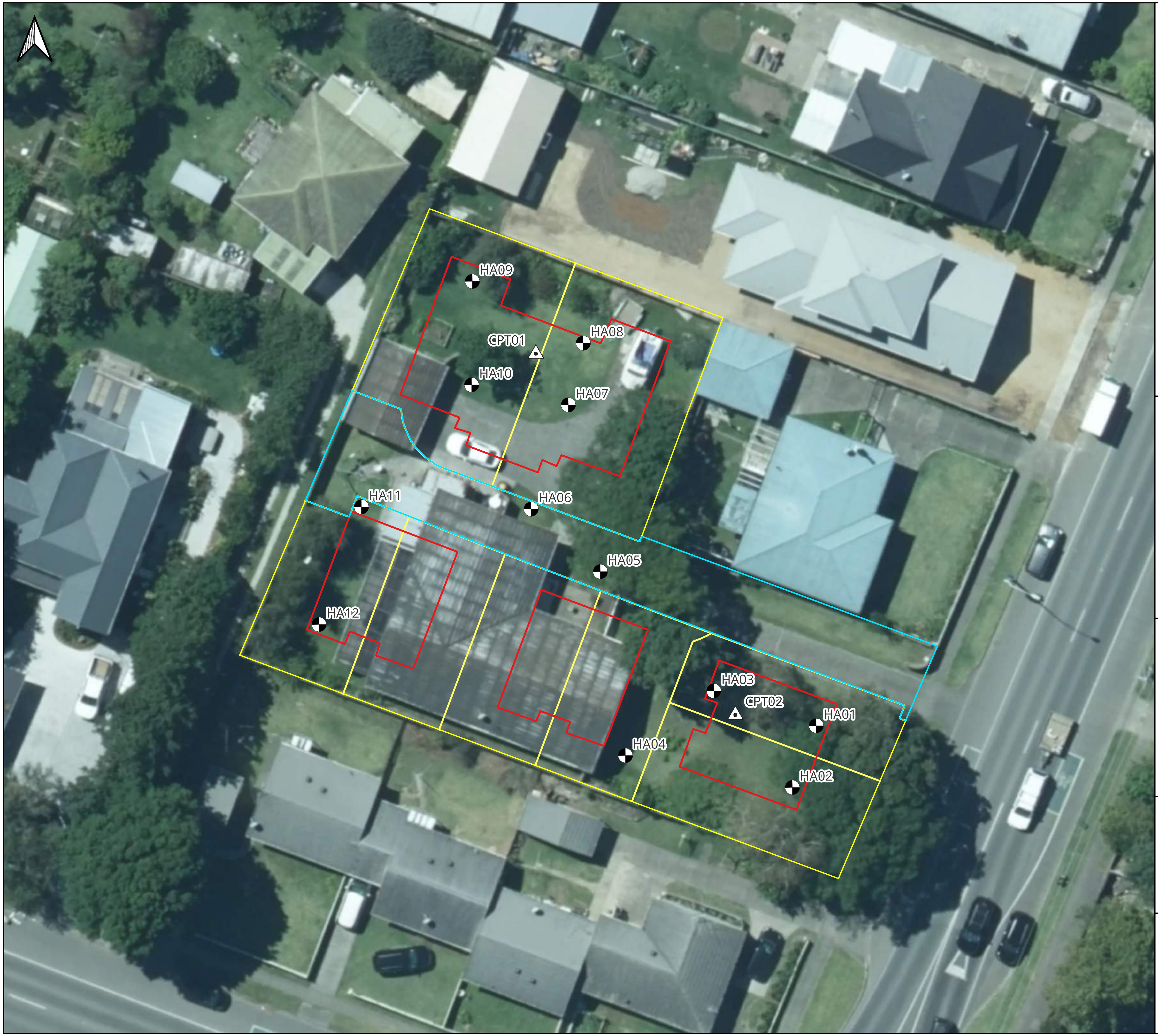
Whilst this guidance is intended for residential buildings in the Canterbury region, they have been widely adopted to convey liquefaction vulnerability across New Zealand.

**The Modules:** The New Zealand Geotechnical Society (NZGS) and MBIE jointly published a series of guidelines for Earthquake Geotechnical Engineering Practice. Revision 1 of the Modules was published in November 2021, and they provide guidance under section 175 of the Building Act 2004 to assist parties to comply with their obligations under the Building Act 2004. The following modules currently form the collection:

- **Module 1:** Overview of the guidelines
- **Module 2:** Geotechnical investigation for earthquake engineering
- **Module 3:** Identification, assessment, and mitigation of liquefaction hazards
- **Module 4:** Earthquake resistant foundation design
- **Module 5:** Ground improvement
- **Module 5A:** Specification of ground improvement for residential properties in the Canterbury region
- **Module 6:** Retaining walls

# APPENDIX A

# SITE PLAN



## LEGEND

Project Data

| | |
|---|---|
| ▭ | Proposed Lots Boundary |
| ▭ | Proposed Building Platform |
| — | Proposed Access Way |
| ◐ | Hand Auger + DCP |
| △ | Cone Penetrometer Test (CPT) |

0 5 10 15 20 m

SCALE A3: 1:300

NOTES

1. Aerial basemap and property boundaries sourced from LINZ Data Service (CC-BY 4.0).
2. Investigation locations shown approximately only.

CLIENT
NZHG Gisborne Limited

PROJECT
Geotechnical Investigation for proposed subdivision
99A Stanley Road, Te Hapara
Gisborne

DRAWING TITLE
Geotechnical Investigation Plan

LAND DEVELOPMENT & ENGINEERING

| PROJECT REF | DRAWING REF | REVISION |
|---|---|---|
| 24729 | GIP | A |
| DATE | PREPARED BY | CHECKED BY |
| 13/10/2023 | SS | RH |

FILE PATH
M-FILES\LDE - Project\76038-24729 Trans to 9602\Geo QGIS Zip Folder (ID 79084)\24729-QGIS Site Maps\24729- 99A Stanley Rd.qgz

# APPENDIX B

# HAND AUGER TEST LOGS

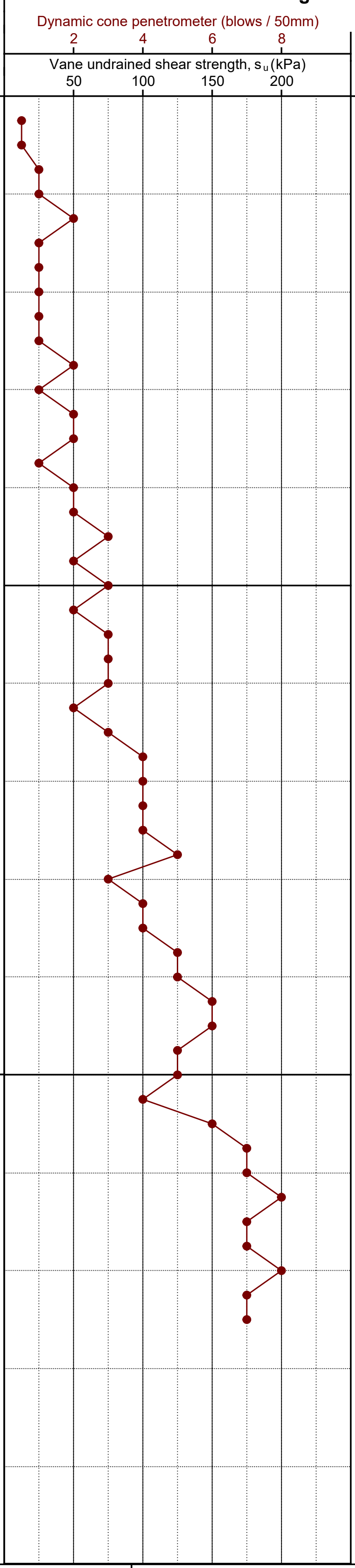
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA01** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709080mN, 2035843mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0 | Topsoil | SAND, with trace rootlets and silt; dark brown. Very loose; moist; sand, fine to medium. | | |
| 0.40 | | 0.40m: With trace rootlets; brown. | | |
| 0.5 | | | | 4.5 |
| 0.70 | Holocene Beach Deposits | SAND; light brown. Medium dense; moist; sand, fine to coarse. | | |
| 1.0 | | | | 4.0 |
| 1.30 | | 1.30m: Wet. | | |
| 1.35 | | 1.35m: Dense. | | |
| 1.5 | | | | 3.5 |
| 1.60 | | 1.60m: Saturated. | ▼ | |
| 1.80 | | 1.80m: Poor recovery > 30%. | | |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



**Values**

Vane ID: N/A
peak / residual
(sensitivity)

| | | | |
|---|---|---|---|
| **Hole Depth:** 2.00m | **Termination:** HOLE COLLAPSE | ● Vane peak | ▼ Standing water level |
| **Remarks:** Hole collapse in saturated sands.. | | ○ Vane residual | ◁ Groundwater inflow |
| | | ◆ Vane UTP | ▷ Groundwater outflow |

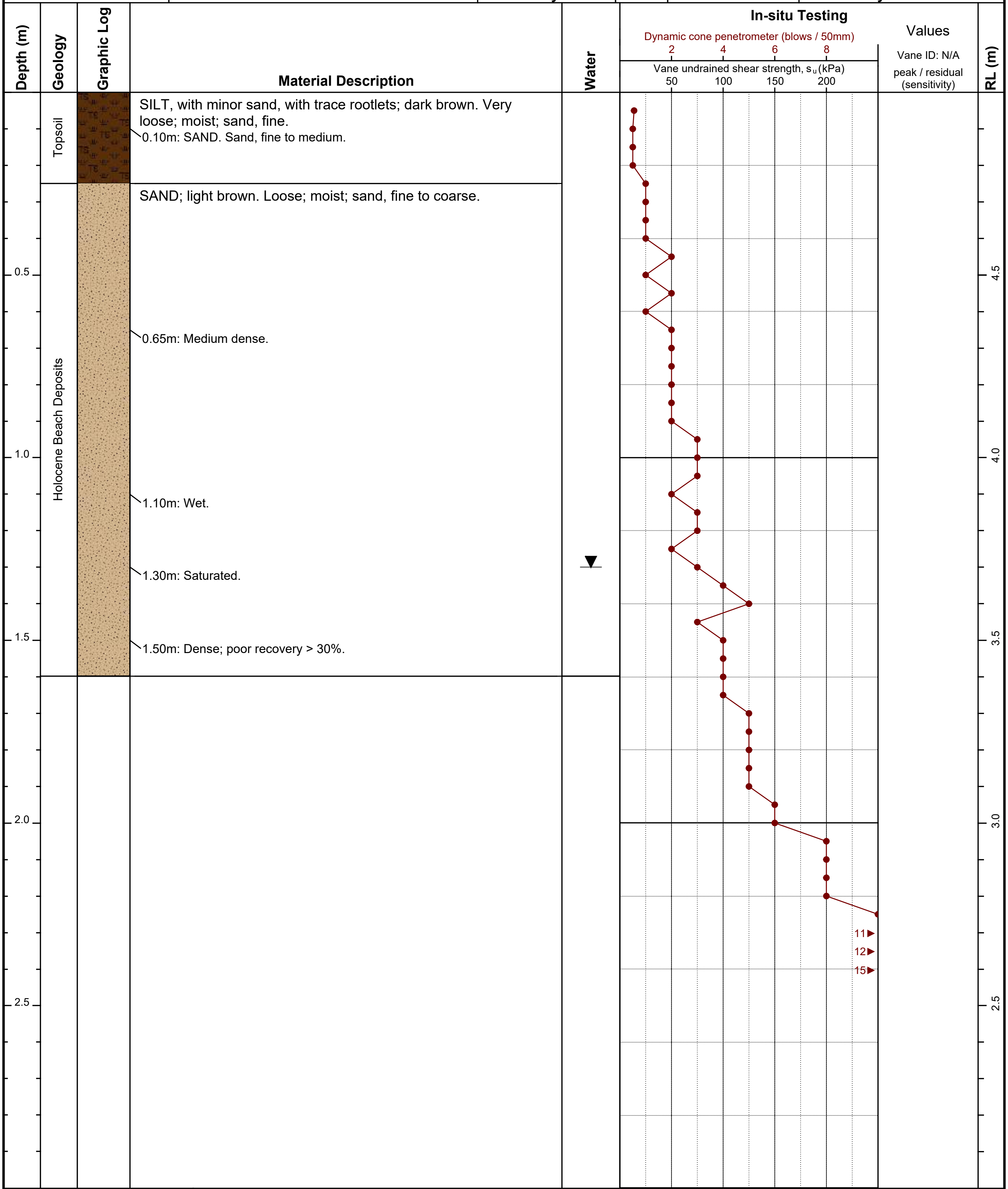
UTP = Unable to Penetrate

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

# Hand Auger Borehole Log

**Test ID:** HA02
**Project ID:** 24729
**Sheet:** 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709075mN, 2035841mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



SILT, with minor sand, with trace rootlets; dark brown. Very loose; moist; sand, fine.
0.10m: SAND. Sand, fine to medium.

SAND; light brown. Loose; moist; sand, fine to coarse.
0.65m: Medium dense.
1.10m: Wet.
1.30m: Saturated.
1.50m: Dense; poor recovery > 30%.

**Hole Depth:** 1.60m
**Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

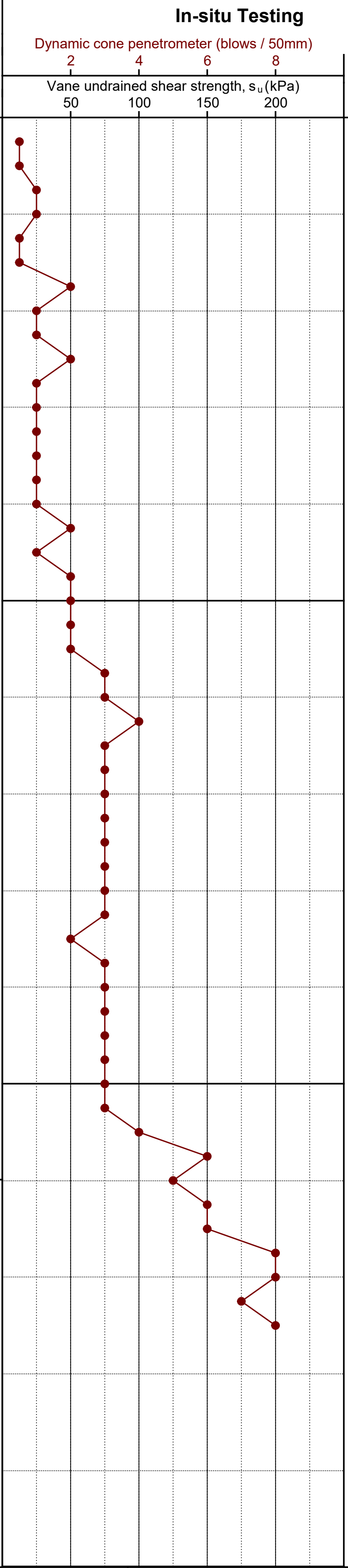
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA03** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709084mN, 2035835mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.40 | Topsoil | SAND, with minor silt, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium. | | |
| 0.40–2.20 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | | |
| 0.5 | | | | 4.5 |
| 0.95 | | 0.95m: Medium dense. | | |
| 1.0 | | | | 4.0 |
| 1.10 | | 1.10m: Light brown. | | |
| 1.5 | | 1.50m: Wet. | | 3.5 |
| 1.80 | | 1.80m: Saturated. | ▼ | |
| 2.0 | | | | 3.0 |
| 2.10 | | 2.10m: Dense; poor recovery > 50%. | | |
| 2.5 | | | | 2.5 |

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.20m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA04** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

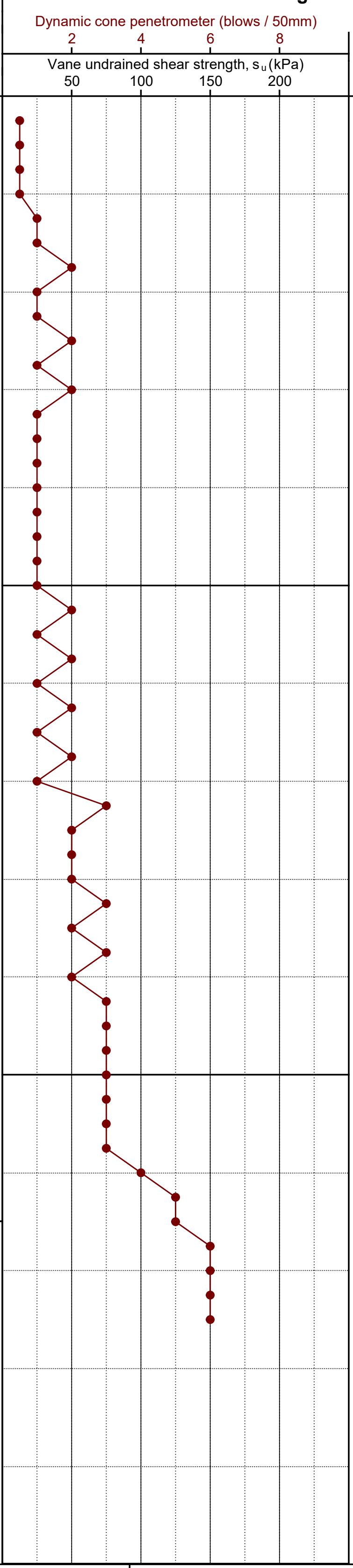
| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709077mN, 2035830mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.4 | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | | |
| 0.4–2.3 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.45m: Medium dense.<br>1.60m: Wet.<br>1.90m: Saturated.<br>2.10m: Poor recovery>50%.<br>2.20m: Dense. | ▼ 1.90 | |

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.30m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:42 pm

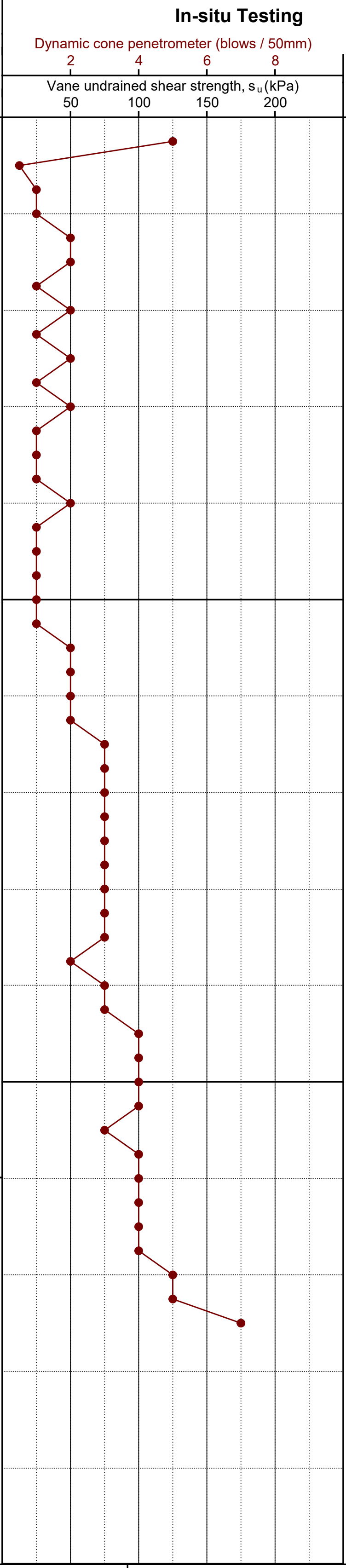
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA05** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709093mN, 2035825mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water | RL (m) |
|---|---|---|---|---|---|
| | Uncontrolled Fill / Topsoil | TS | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium; trace rock fragments. | | |
| 0.5<br>1.0<br>1.5<br>2.0 | Holocene Beach Deposits | | SAND; brownish orange. Medium dense; moist; sand, fine to medium.<br>1.00m: Light brown.<br>1.50m: Wet.<br>1.80m: Saturated.<br>1.90m: Dense.<br>2.00m: Poor recovery > 50%. | ▼ (1.80m) | 4.5<br>4.0<br>3.5<br>3.0 |
| 2.5 | | | | | 2.5 |

**In-situ Testing**



| | |
|---|---|
| 0.05 | 5 |
| 0.10 | 0.5 |
| 0.15 | 1 |
| 0.20 | 1 |
| 0.25 | 2 |
| 0.30 | 2 |
| 0.35 | 1 |
| 0.40 | 2 |
| 0.45 | 1 |
| 0.50 | 2 |
| 0.55 | 1 |
| 0.60 | 2 |
| 0.65 | 1 |
| 0.70 | 1 |
| 0.75 | 1 |
| 0.80 | 2 |
| 0.85 | 1 |
| 0.90 | 1 |
| 0.95 | 1 |
| 1.00 | 1 |
| 1.05 | 1 |
| 1.10 | 2 |
| 1.15 | 2 |
| 1.20 | 2 |
| 1.25 | 2 |
| 1.30 | 3 |
| 1.35 | 3 |
| 1.40 | 3 |
| 1.45 | 3 |
| 1.50 | 3 |
| 1.55 | 3 |
| 1.60 | 3 |
| 1.65 | 3 |
| 1.70 | 3 |
| 1.75 | 2 |
| 1.80 | 3 |
| 1.85 | 3 |
| 1.90 | 4 |
| 1.95 | 4 |
| 2.00 | 4 |
| 2.05 | 4 |
| 2.10 | 3 |
| 2.15 | 4 |
| 2.20 | 4 |
| 2.25 | 4 |
| 2.30 | 4 |
| 2.35 | 4 |
| 2.40 | 5 |
| 2.45 | 5 |
| 2.50 | 7 |

Values

Vane ID: N/A

peak / residual (sensitivity)

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

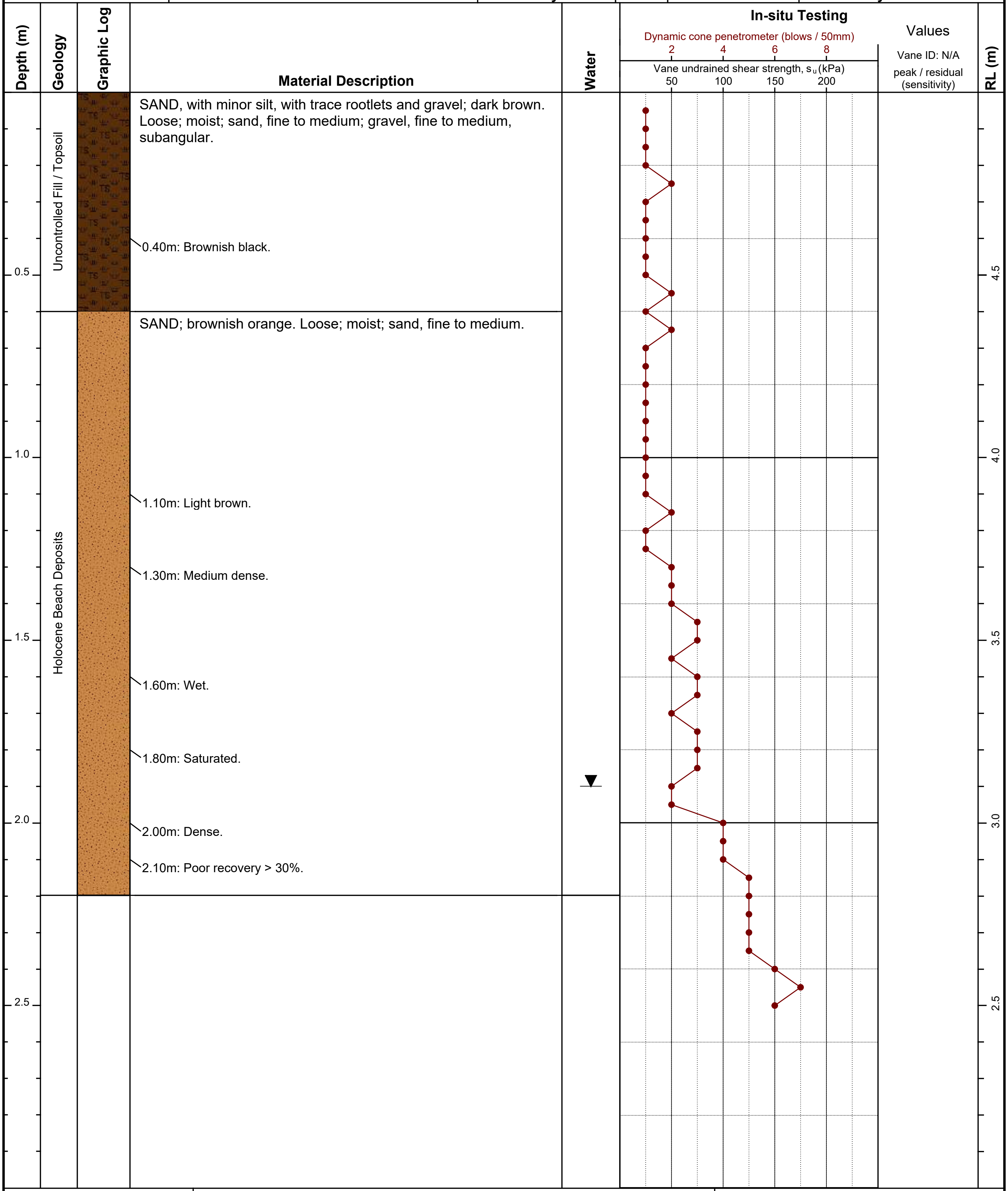
| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA06** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035819mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



SAND, with minor silt, with trace rootlets and gravel; dark brown. Loose; moist; sand, fine to medium; gravel, fine to medium, subangular.

0.40m: Brownish black.

SAND; brownish orange. Loose; moist; sand, fine to medium.

1.10m: Light brown.

1.30m: Medium dense.

1.60m: Wet.

1.80m: Saturated.

2.00m: Dense.

2.10m: Poor recovery > 30%.

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:45 pm

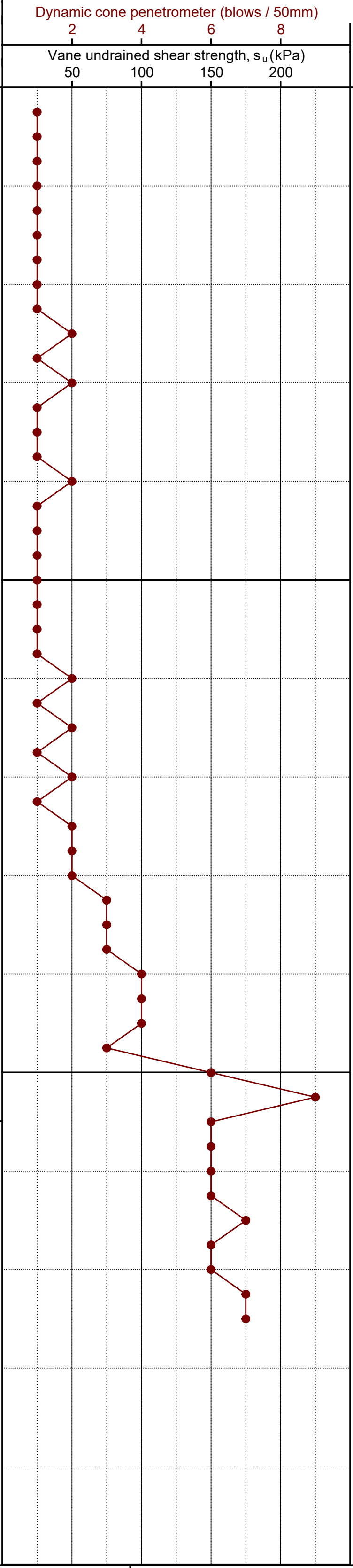
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | HA07 |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709106mN, 2035822mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.0 – 0.3 | Topsoil | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium. | |
| 0.3 – 2.1 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.20m: Medium dense.<br>1.30m: Wet.<br>1.60m: Saturated.<br>1.80m: Dense; poor recovery > 50%. | ▼ 1.6 |

**In-situ Testing**



Values
Vane ID: N/A
peak / residual
(sensitivity)

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5
RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.10m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

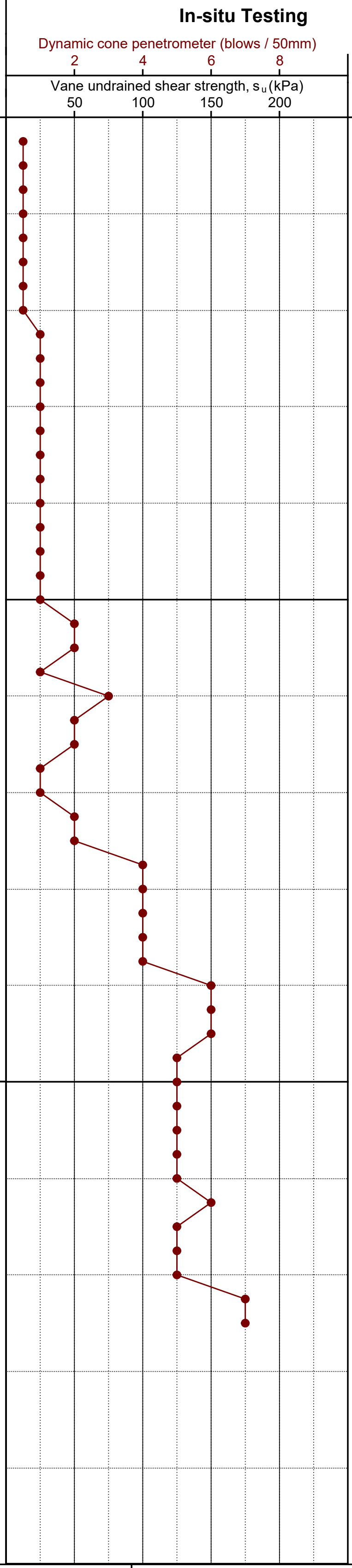
UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA08** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709111mN, 2035824mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.00 | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | |
| 0.20 | | 0.20m: SAND, with minor silt. Sand, fine to medium. | |
| 0.50 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | |
| 1.05 | | 1.05m: Medium dense. | |
| 1.10 | | 1.10m: Light brown. | |
| 1.40 | | 1.40m: Wet. | |
| 1.55 | | 1.55m: Dense. | |
| 1.60 | | 1.60m: Saturated. | ▼ |
| 1.80 | | 1.80m: Poor recovery > 30%. | |



Values
Vane ID: N/A
peak / residual
(sensitivity)

RL (m): 4.5 (0.5 m), 4.0 (1.0 m), 3.5 (1.5 m), 3.0 (2.0 m), 2.5 (2.5 m)

**Hole Depth:** 2.00m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:47 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA09** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

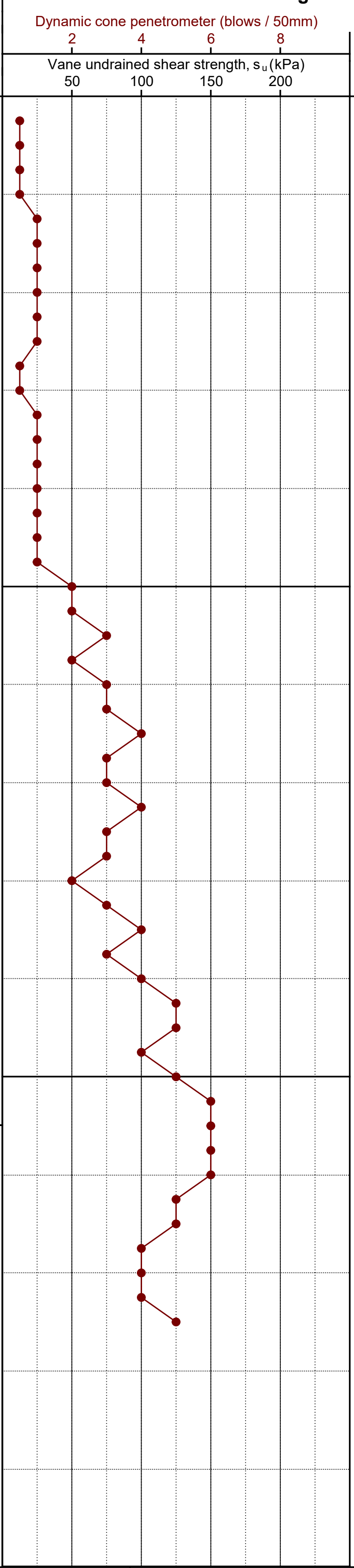
| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709117mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.0 – 0.4 | Uncontrolled Fill / Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine; trace glass fragments. | |
| 0.4 – 2.10 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.00m: Medium dense.<br>1.10m: SAND; light brown. Sand, fine to coarse.<br>1.50m: Wet.<br>1.70m: Dense; saturated. | ▼ |

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

| **Hole Depth:** 2.10m | **Termination:** HOLE COLLAPSE |
|---|---|

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

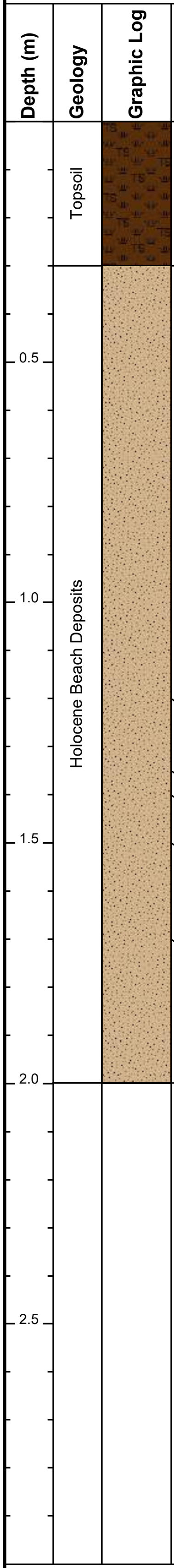
| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA10** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709108mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



**Material Description**

SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine.

SAND; light brown. Loose; moist; sand, fine to medium.

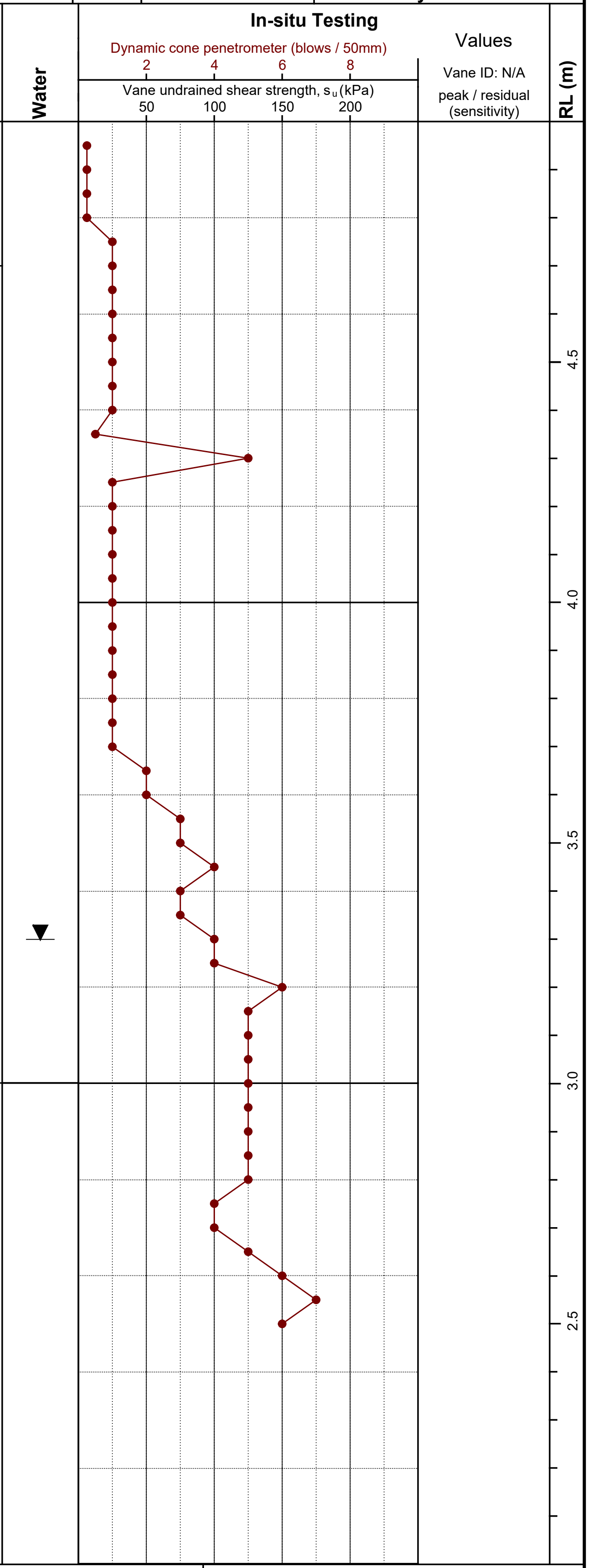
1.20m: With minor silt.

1.35m: Medium dense.

1.40m: SAND. Sand, fine to coarse.

1.50m: Wet.

1.70m: Dense; saturated.



| | |
|---|---|
| **Hole Depth:** 2.00m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

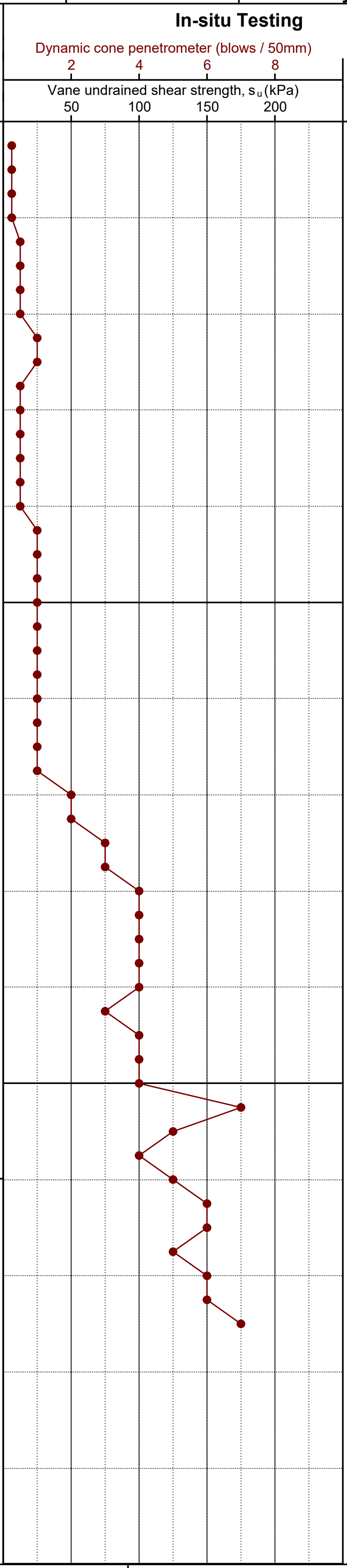
UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA11** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035805mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.00 | Topsoil | Silty SAND, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium. | |
| 0.20 | | 0.20m: With trace silt. | |
| 0.50 | | 0.50m: Brownish black. | |
| 0.70 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | |
| 1.10 | | 1.10m: Light brown. | |
| 1.40 | | 1.40m: Medium dense. | |
| 1.50 | | 1.50m: Wet. | |
| 1.60 | | 1.60m: Dense. | |
| 1.80 | | 1.80m: Saturated. | ▼ |
| 2.10 | | 2.10m: Poor recovery > 30%. | |



| Values | RL (m) |
|---|---|
| Vane ID: N/A<br>peak / residual<br>(sensitivity) | 4.5<br>4.0<br>3.5<br>3.0<br>2.5 |

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

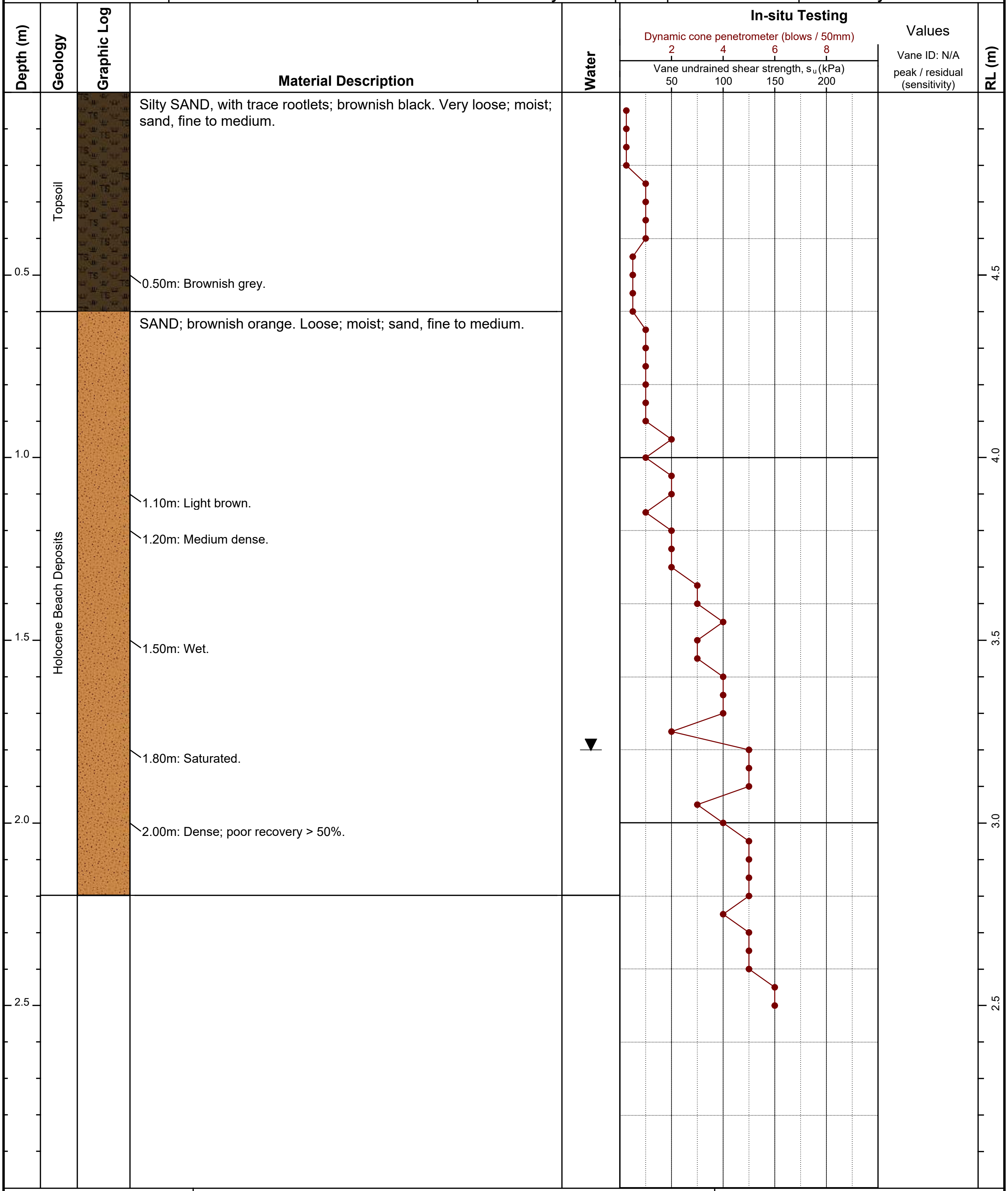
| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA12** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709088mN, 2035801mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



Silty SAND, with trace rootlets; brownish black. Very loose; moist; sand, fine to medium.

0.50m: Brownish grey.

SAND; brownish orange. Loose; moist; sand, fine to medium.

1.10m: Light brown.

1.20m: Medium dense.

1.50m: Wet.

1.80m: Saturated.

2.00m: Dense; poor recovery > 50%.

**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

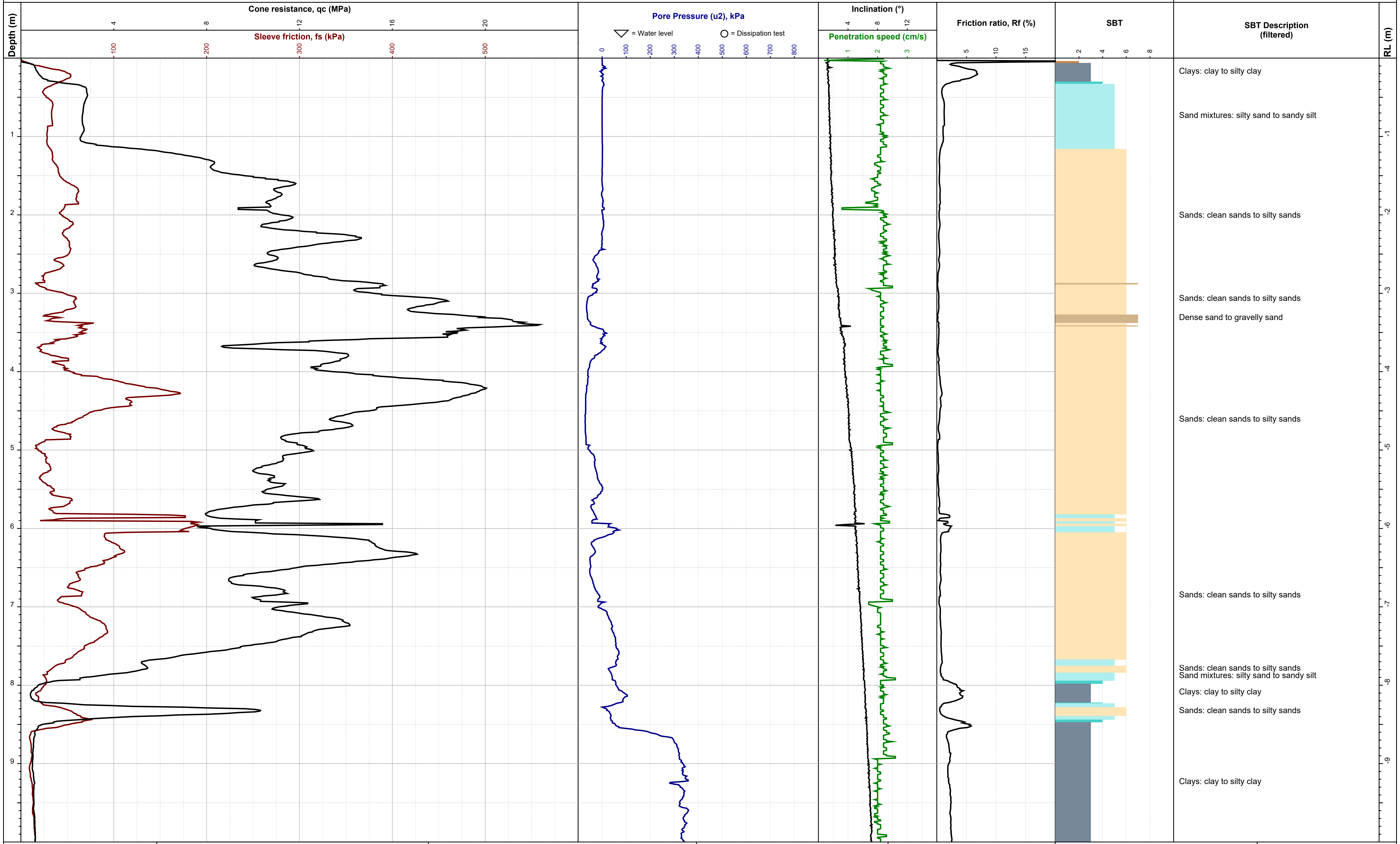
UTP = Unable to Penetrate

# APPENDIX C

# CONE PENETROMETER TEST LOGS

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT01



LAND DEVELOPMENT & ENGINEERING

| | |
|---|---|
| **Client:** | TW Property Holdings Limited |
| **Project:** | Geotechnical Investigation for Proposed Subdivision |
| **Location:** | 99A Stanley Road, Gisborne |

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

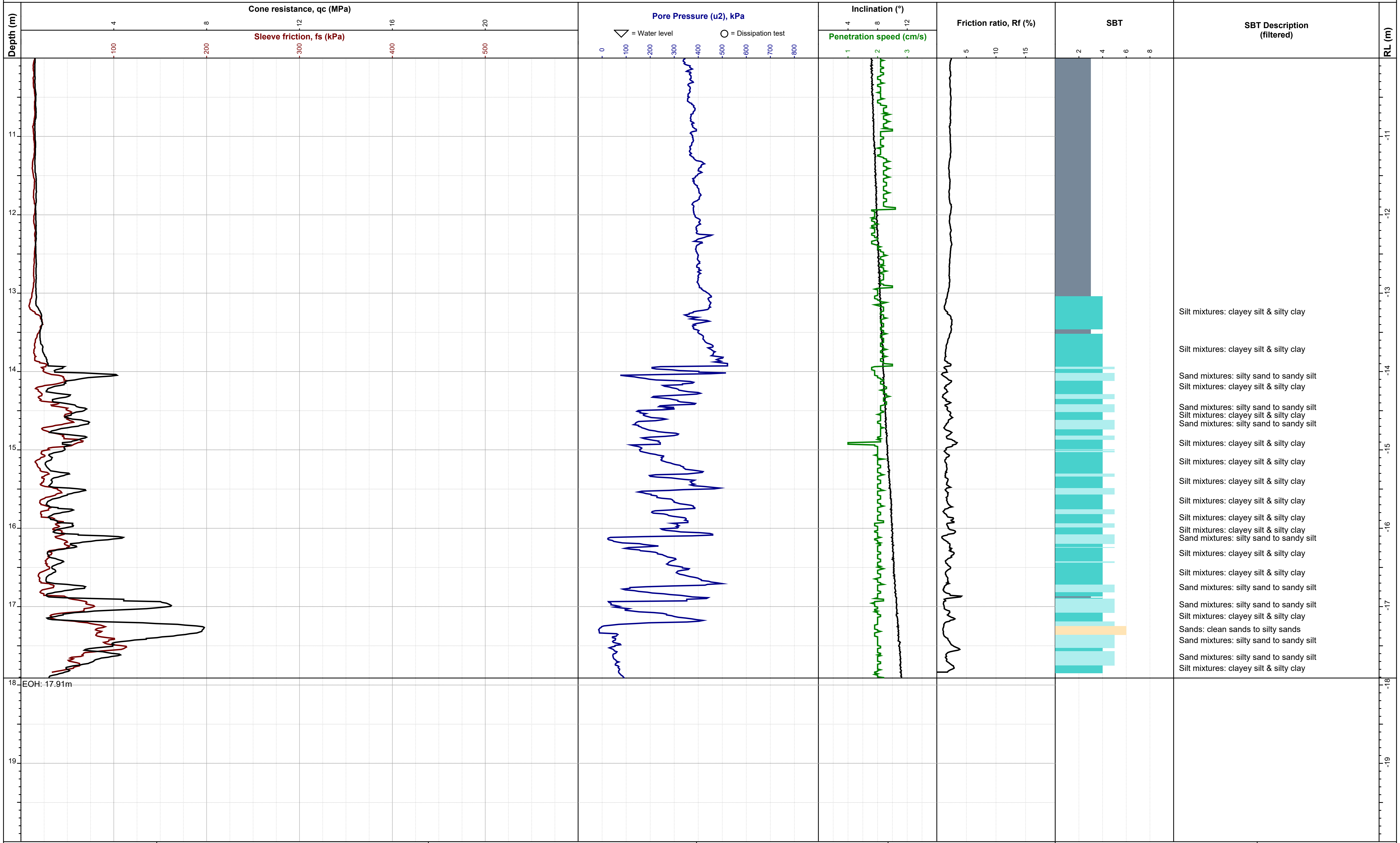
**Test ID:** CPT01

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 1 of 2 |
| **Date:** | 03/10/2023 |

Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:08 am

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT01**



Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:09 am

LAND DEVELOPMENT & ENGINEERING

| | |
|---|---|
| **Client:** | TW Property Holdings Limited |
| **Project:** | Geotechnical Investigation for Proposed Subdivision |
| **Location:** | 99A Stanley Road, Gisborne |

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 1986**

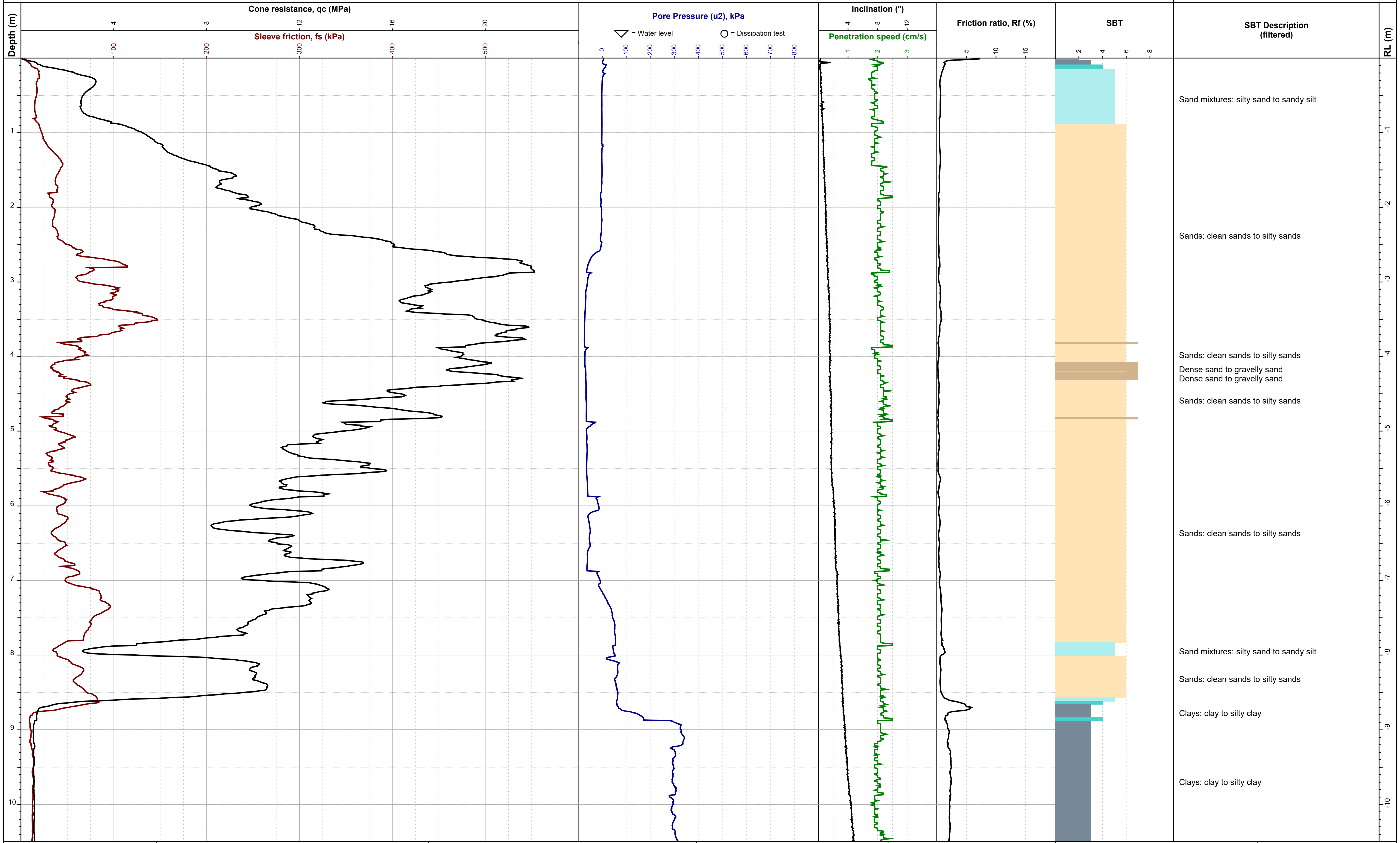
| | | | |
|---|---|---|---|
| 0 | Undefined | 5 | Sand mixtures: silty sand to sandy silt |
| 1 | Sensitive fine-grained | 6 | Sands: clean sands to silty sands |
| 2 | Clay - organic soil | 7 | Dense sand to gravelly sand |
| 3 | Clays: clay to silty clay | 8 | Stiff sand to clayey sand |
| 4 | Silt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

**Test ID:**
**CPT01**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 2 of 2 |
| **Date:** | 03/10/2023 |

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT02



LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

**Northing:** 5709081mN
**Easting:** 2035837mE
**System:** NZTM
**Elevation:** Ground
**Located By:** Phone GPS
**Location:** As per GIP

**Operator:** JC
**Rig:** Pagani TG63-150
**Cone ID:** 1042
**Type:** Comp. piezo cone
**Cone Area:** 10 cm²
**Sleeve Area:** 150 cm²
**Area Ratio:** 0.8

**Soil Behaviour Type - Robertson 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 |

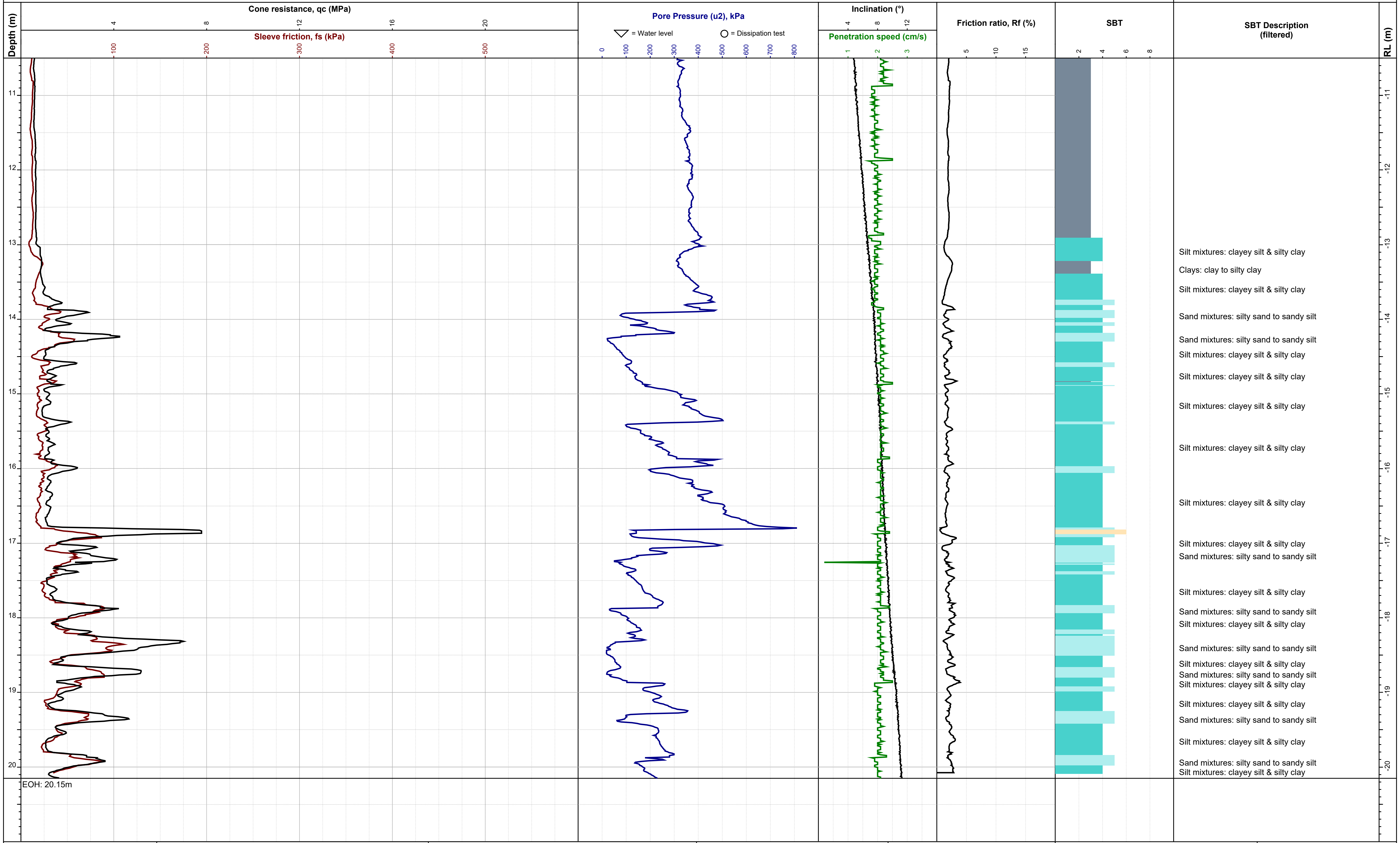
**Test ID:** CPT02

**Project ID:** 24729
**Depth:** 20.15m
**Sheet:** 1 of 2
**Date:** 14/09/2023

Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 2/10/2023 11:42:11 am

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT02



**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

**Test ID:**

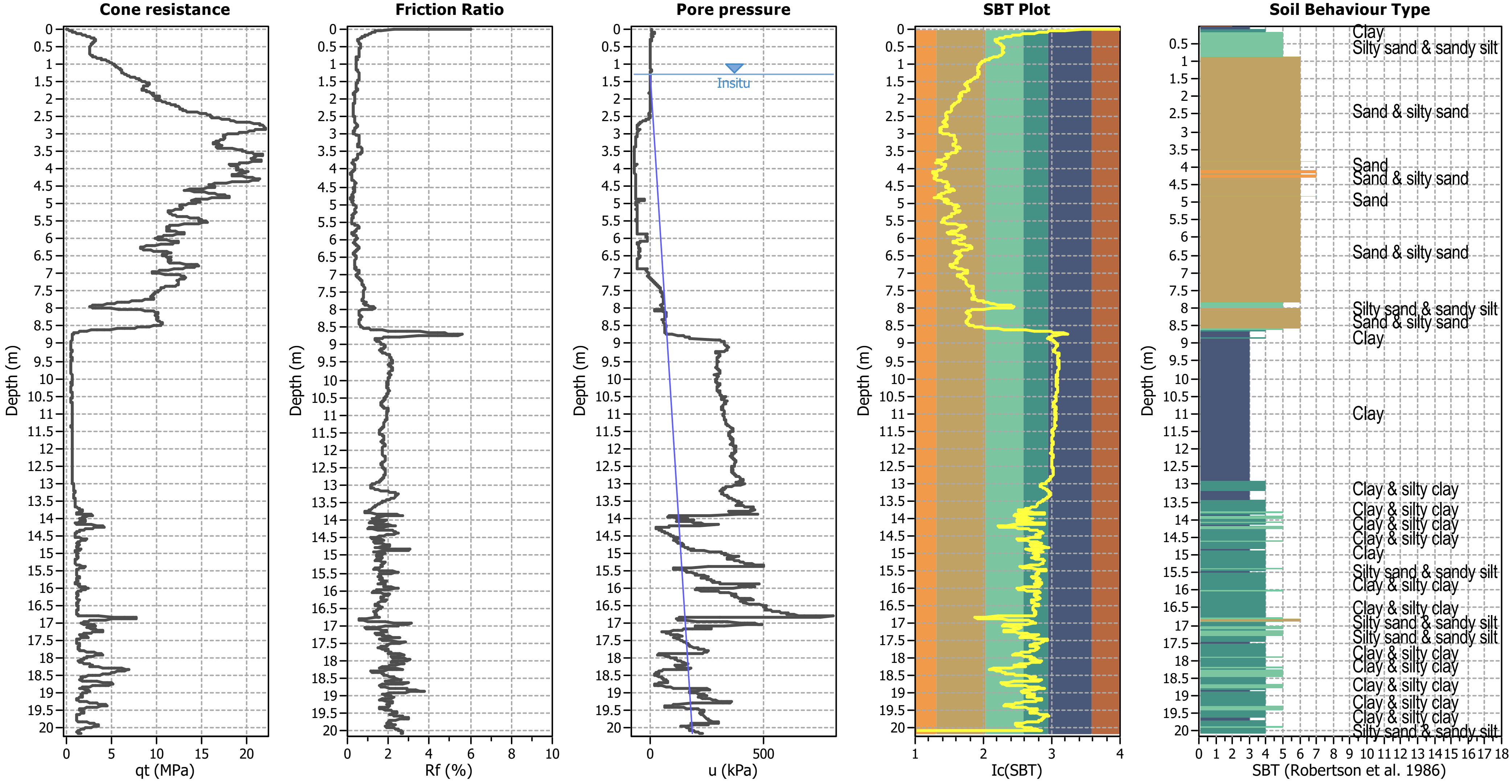
**CPT02**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 2 of 2 |
| **Date:** | 14/09/2023 |

# APPENDIX D

# LIQUEFACTION ANALYSIS RESULTS

# CPT basic interpretation plots



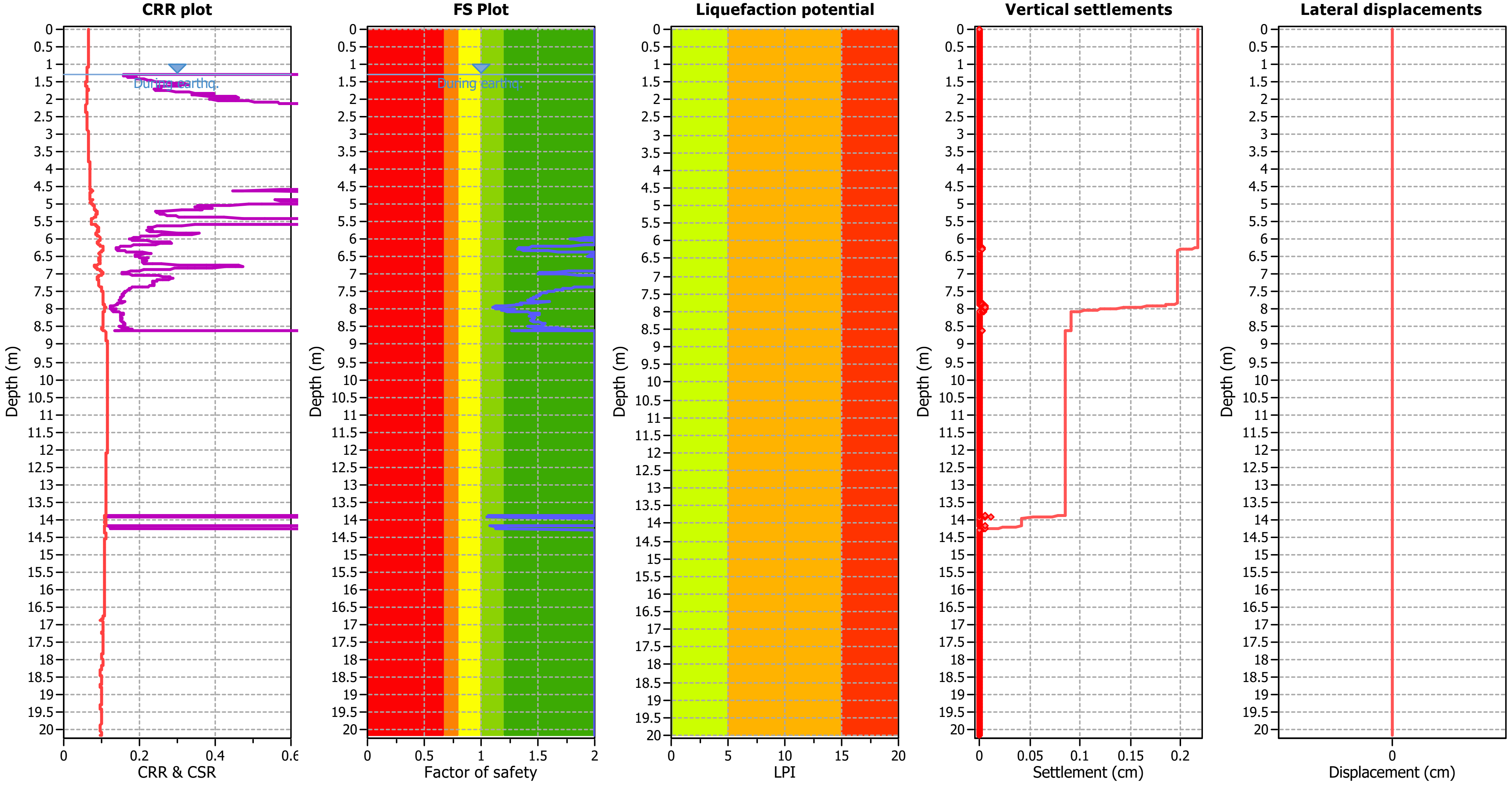
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

## SBT legend

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬜ 8. Very stiff sand to |
| 🟦 3. Clay to silty clay | 🟫 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.30
Peak ground acceleration: 0.12
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 15.00 m

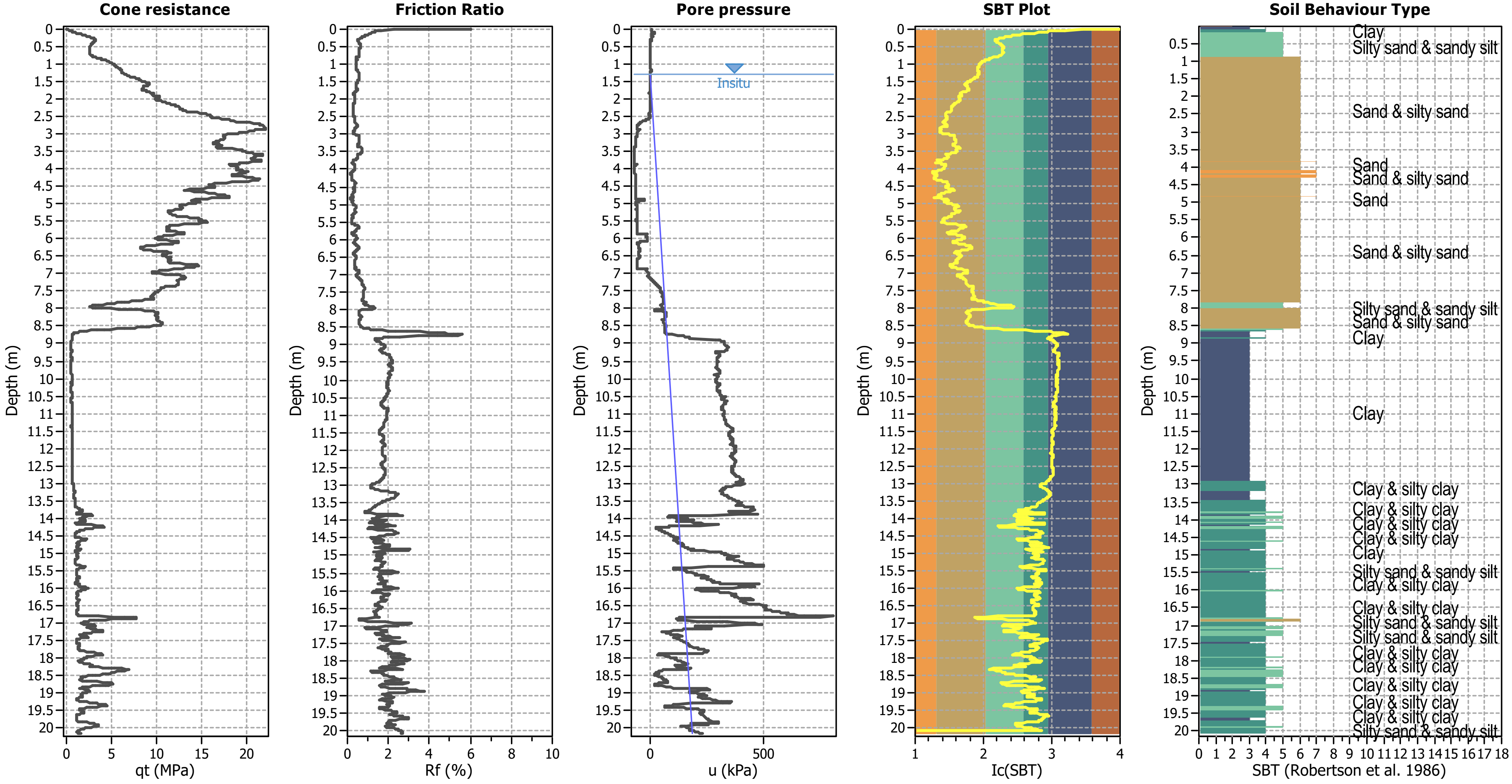
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟩 Low risk

# CPT basic interpretation plots



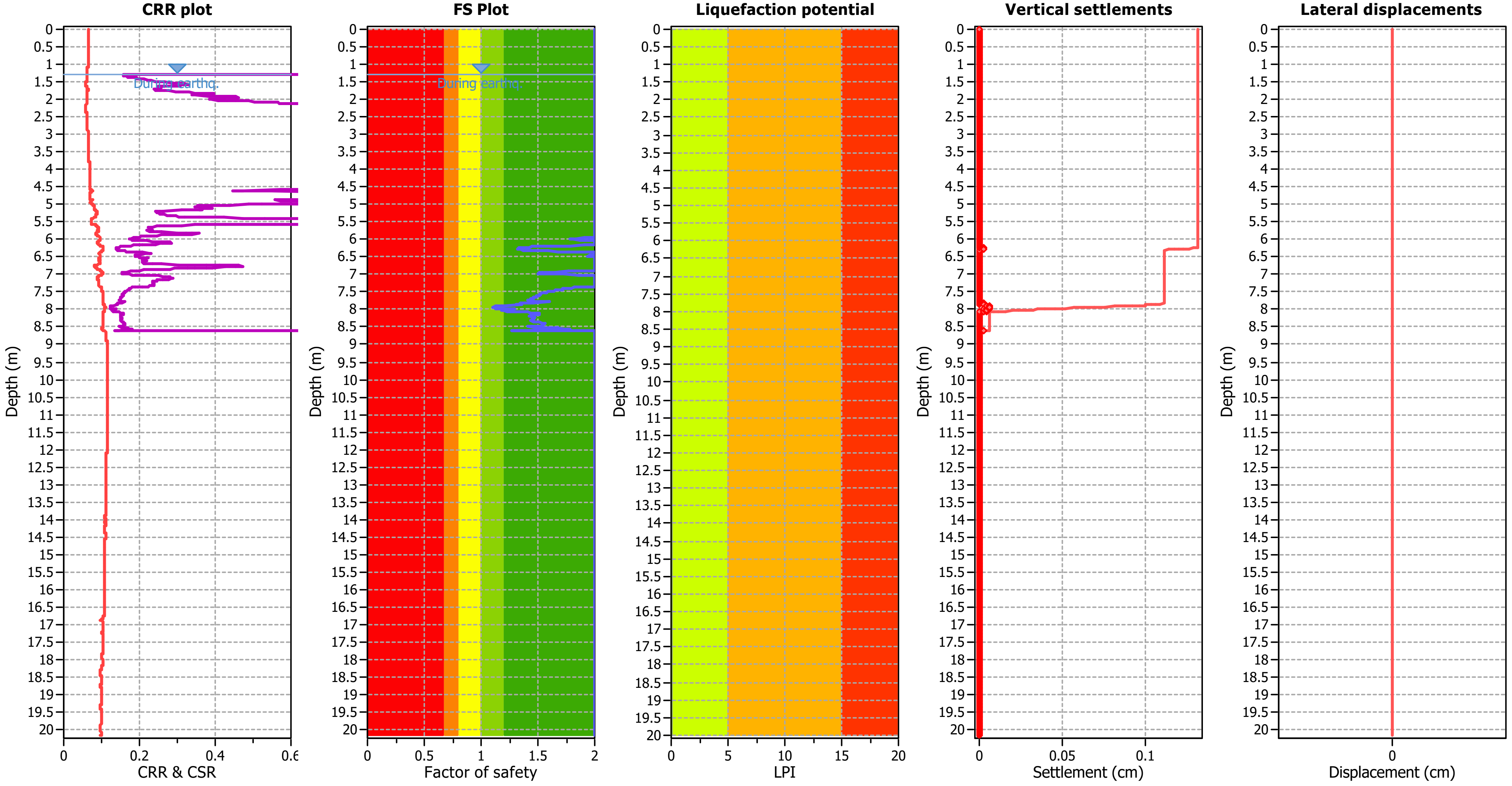
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

## SBT legend

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

## Liquefaction analysis overall plots



### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

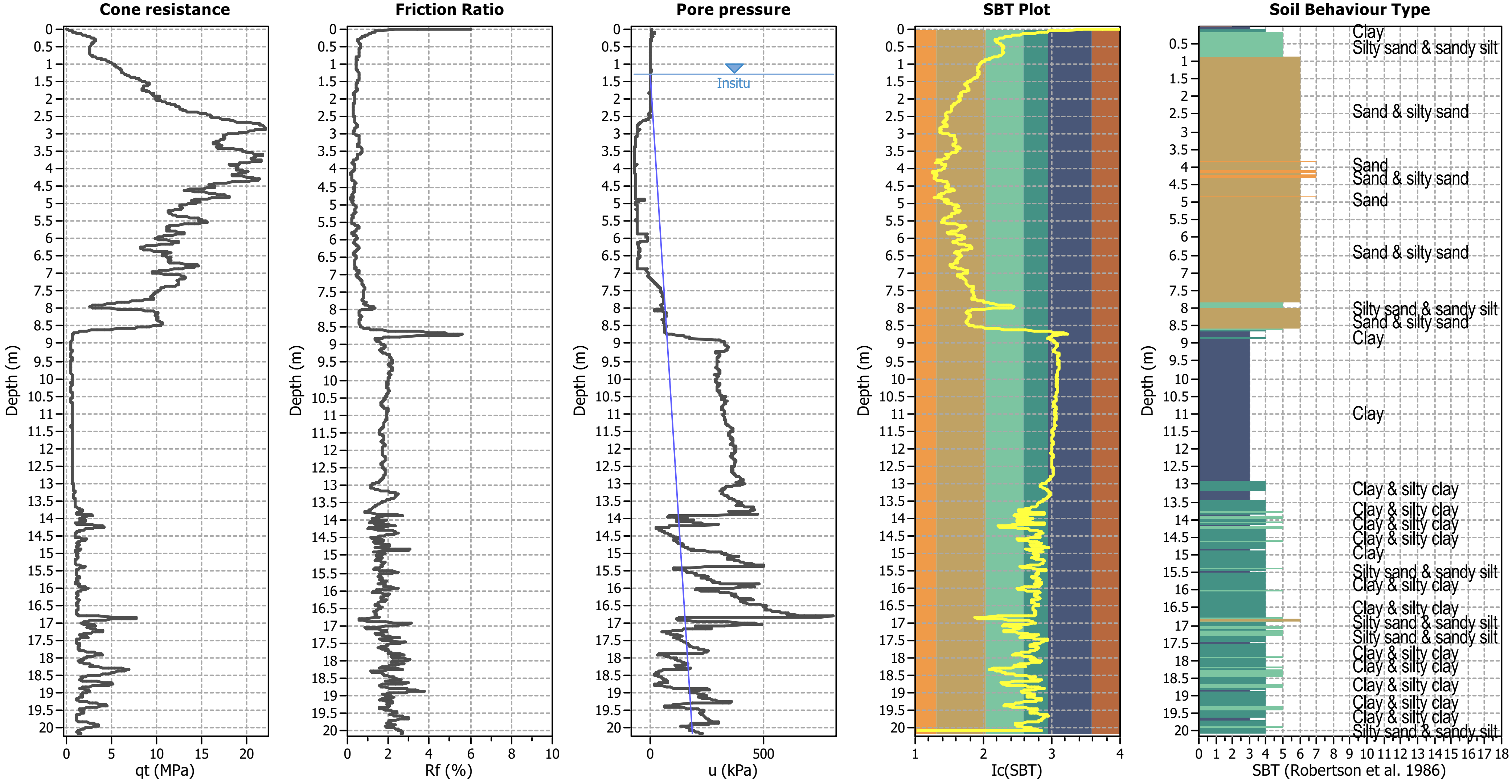
### F.S. color scheme

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

### LPI color scheme

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

# CPT basic interpretation plots



**Input parameters and analysis data**

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.80
Peak ground acceleration: 0.28
Depth to water table (insitu): 1.30 m

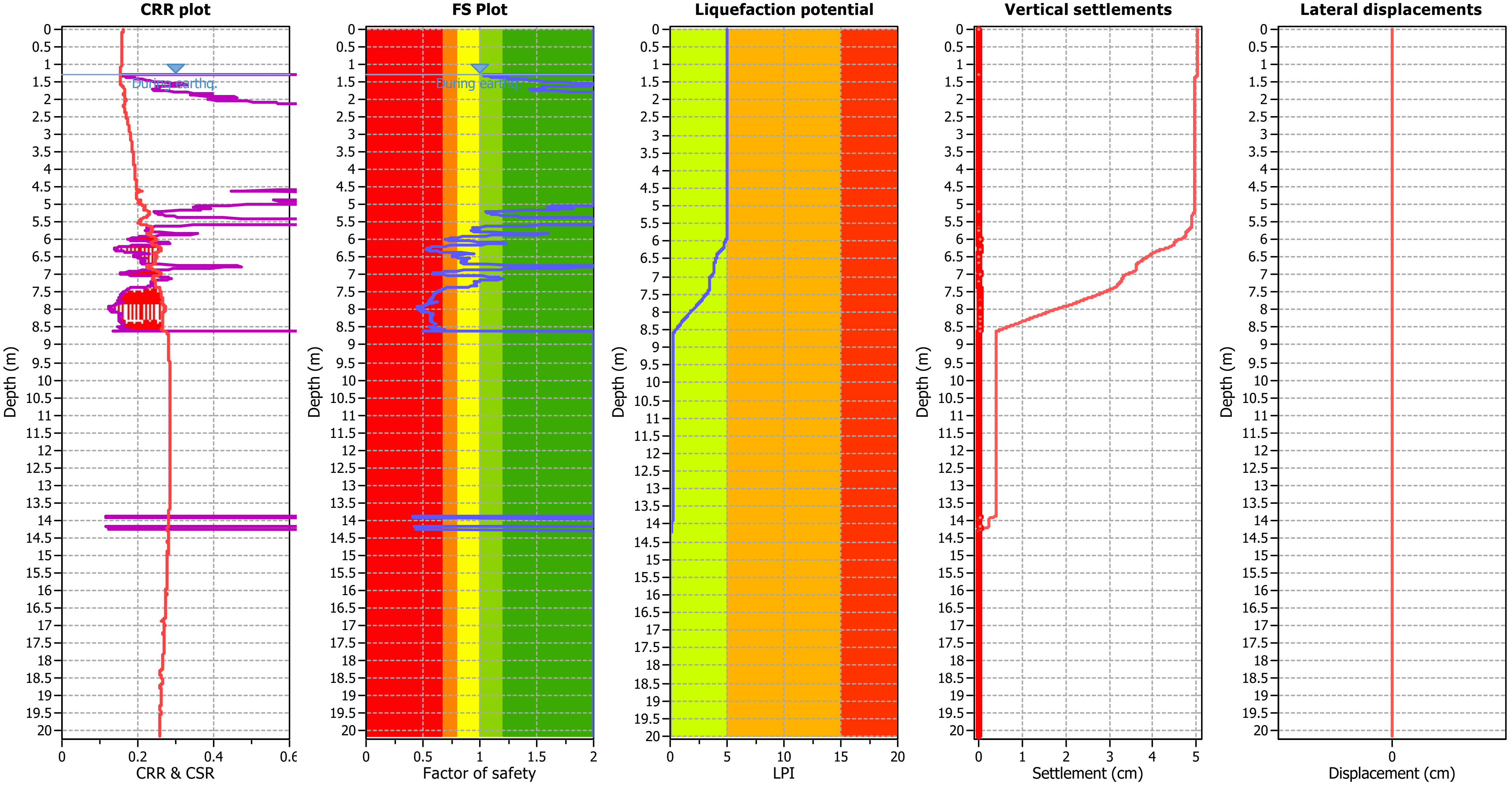
Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 15.00 m

**SBT legend**

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟨 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

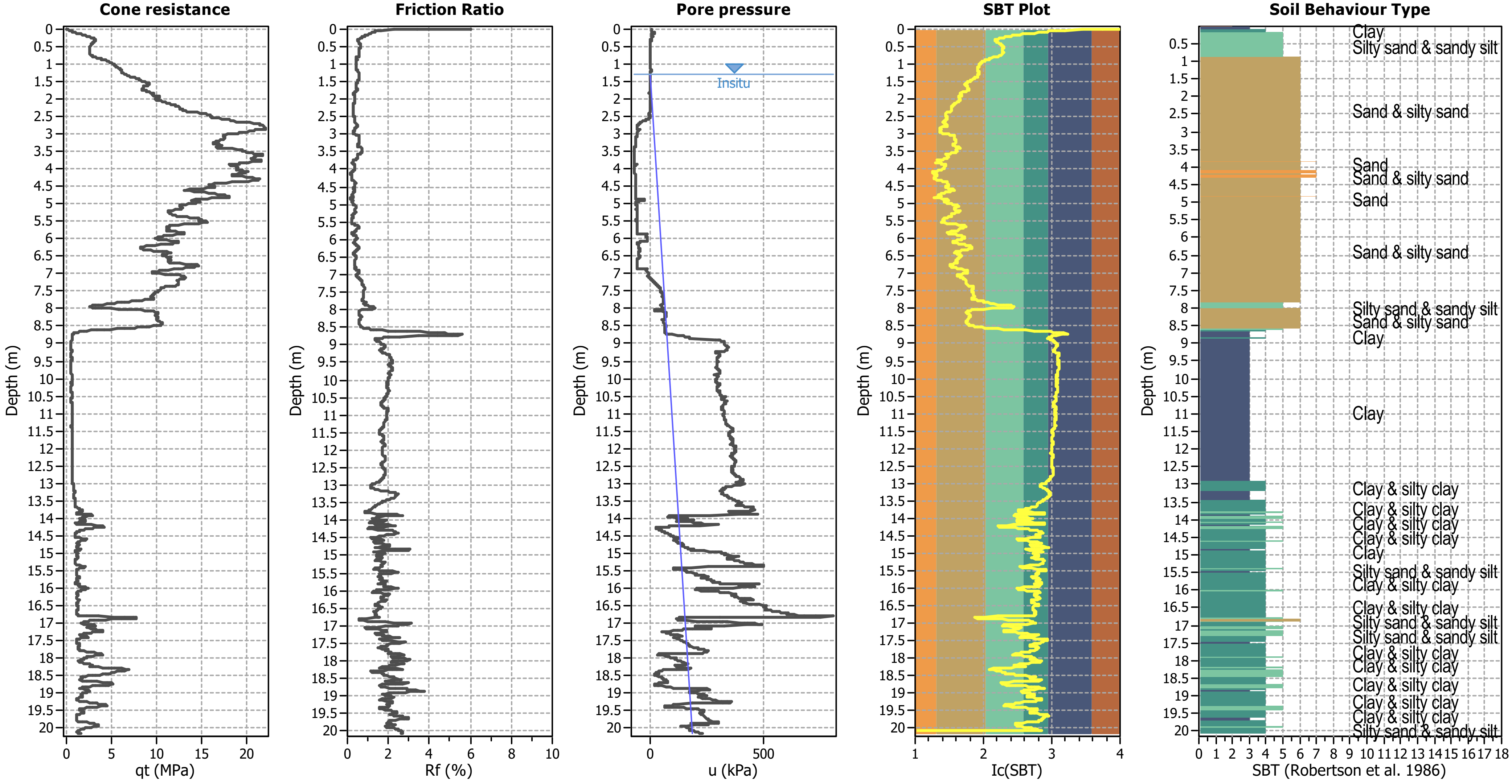
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟩 Low risk

# CPT basic interpretation plots



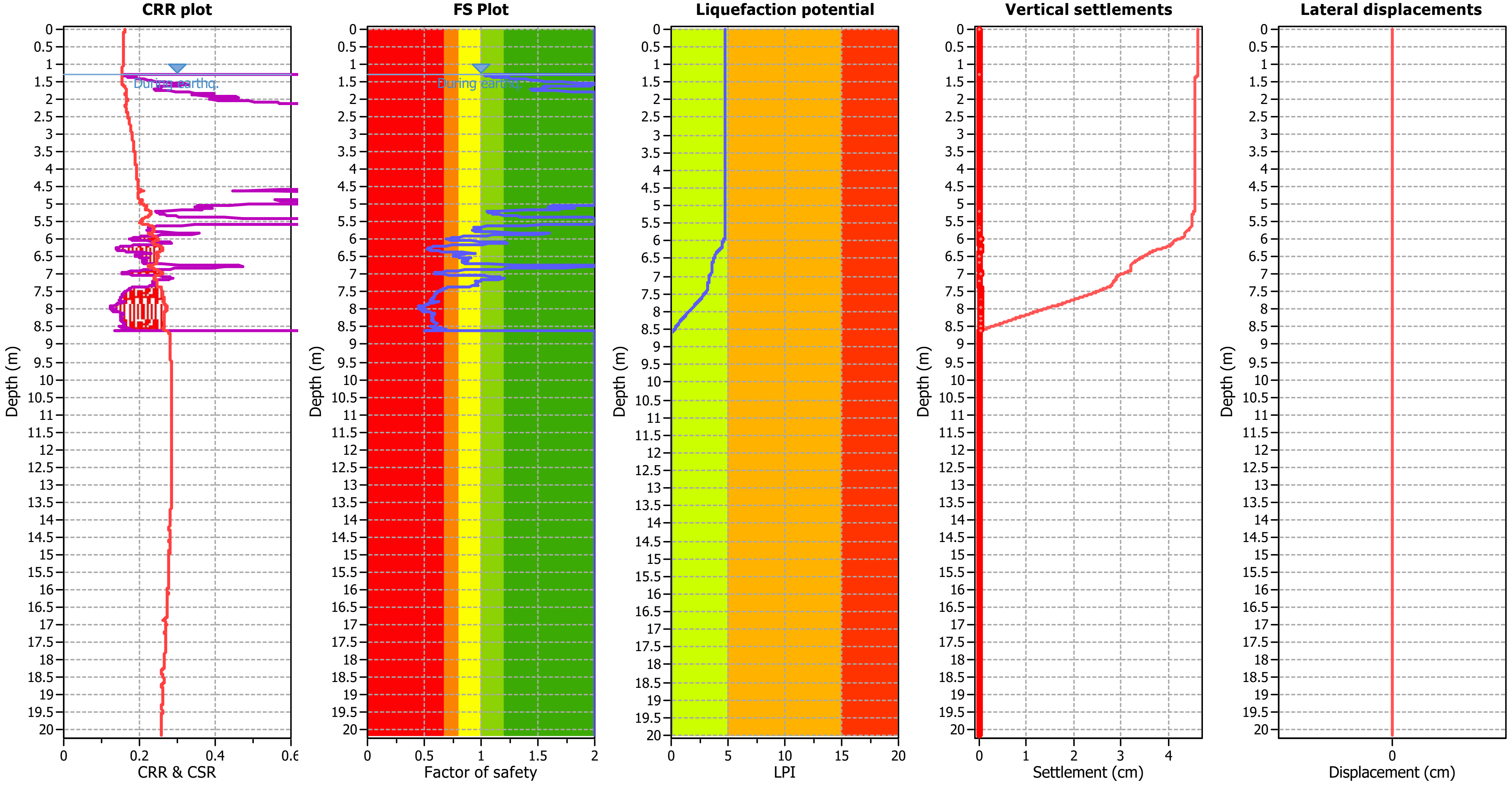
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

🟥 1. Sensitive fine grained
🟫 2. Organic material
🟦 3. Clay to silty clay
🟩 4. Clayey silt to silty
🟩 5. Silty sand to sandy silt
🟫 6. Clean sand to silty sand
🟧 7. Gravely sand to sand
⬜ 8. Very stiff sand to
⬜ 9. Very stiff fine grained

## Liquefaction analysis overall plots



### Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.80
Peak ground acceleration: 0.28
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

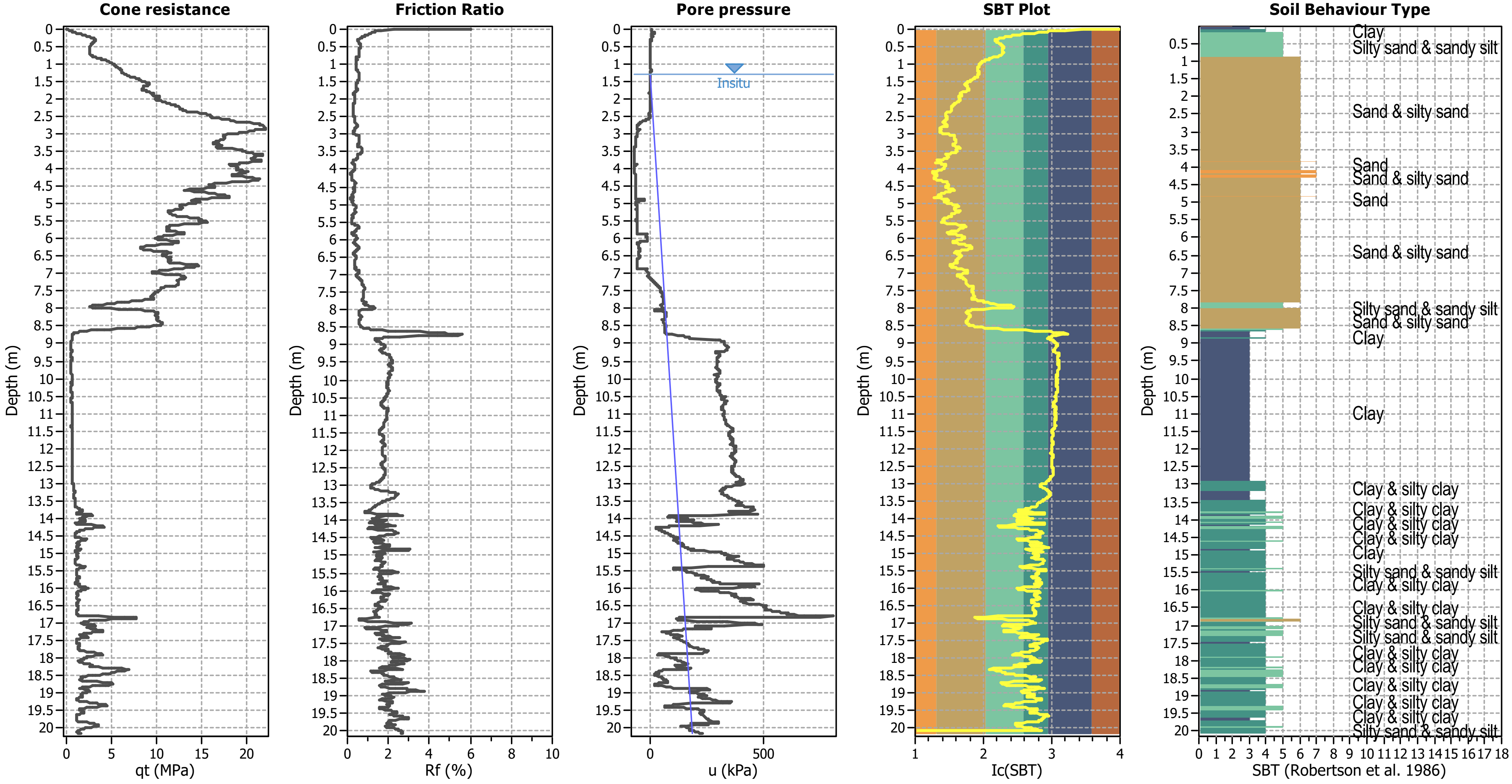
### F.S. color scheme

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

### LPI color scheme

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

# CPT basic interpretation plots



## Input parameters and analysis data

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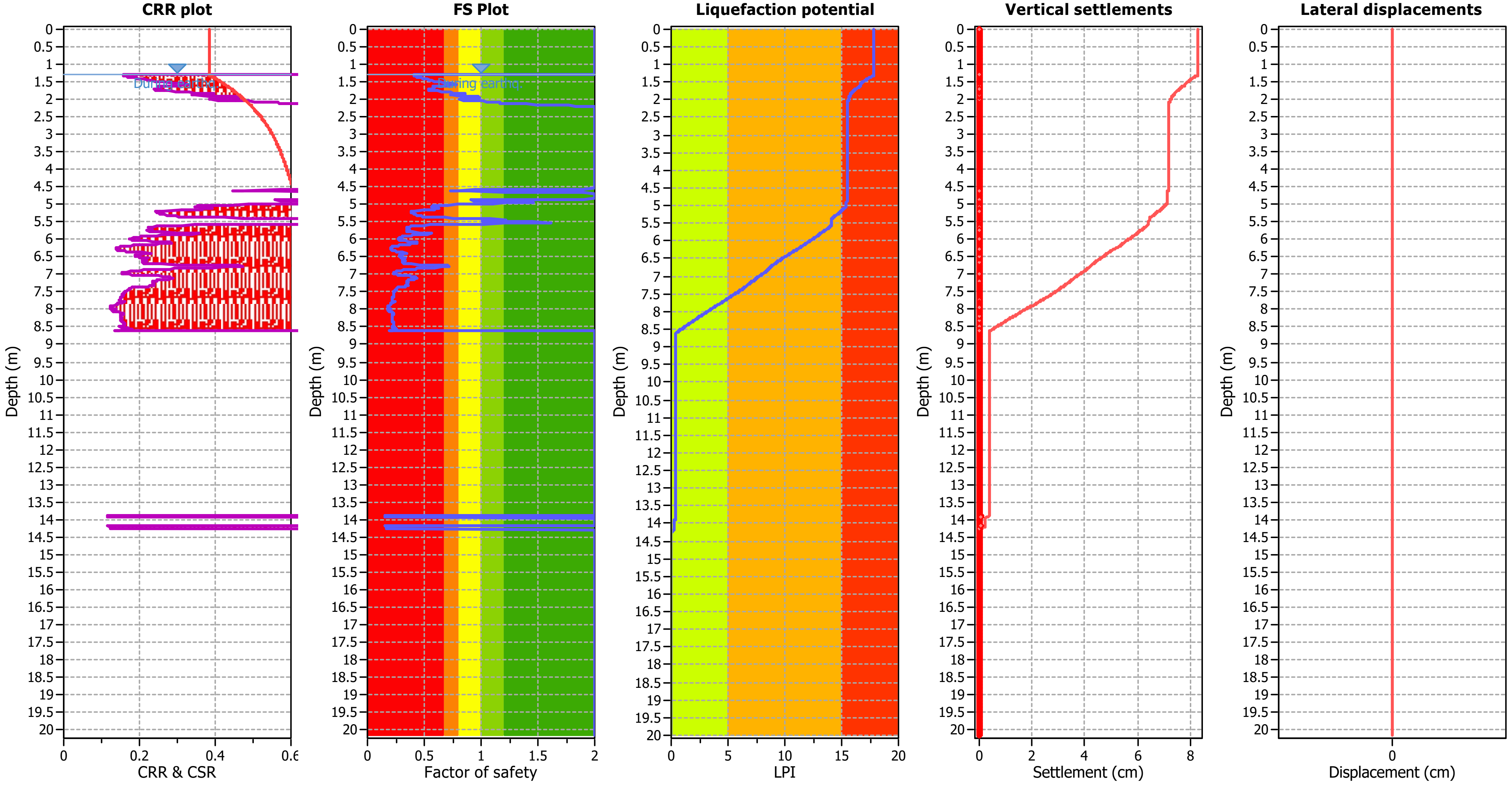
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.65 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟫 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

## Liquefaction analysis overall plots



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| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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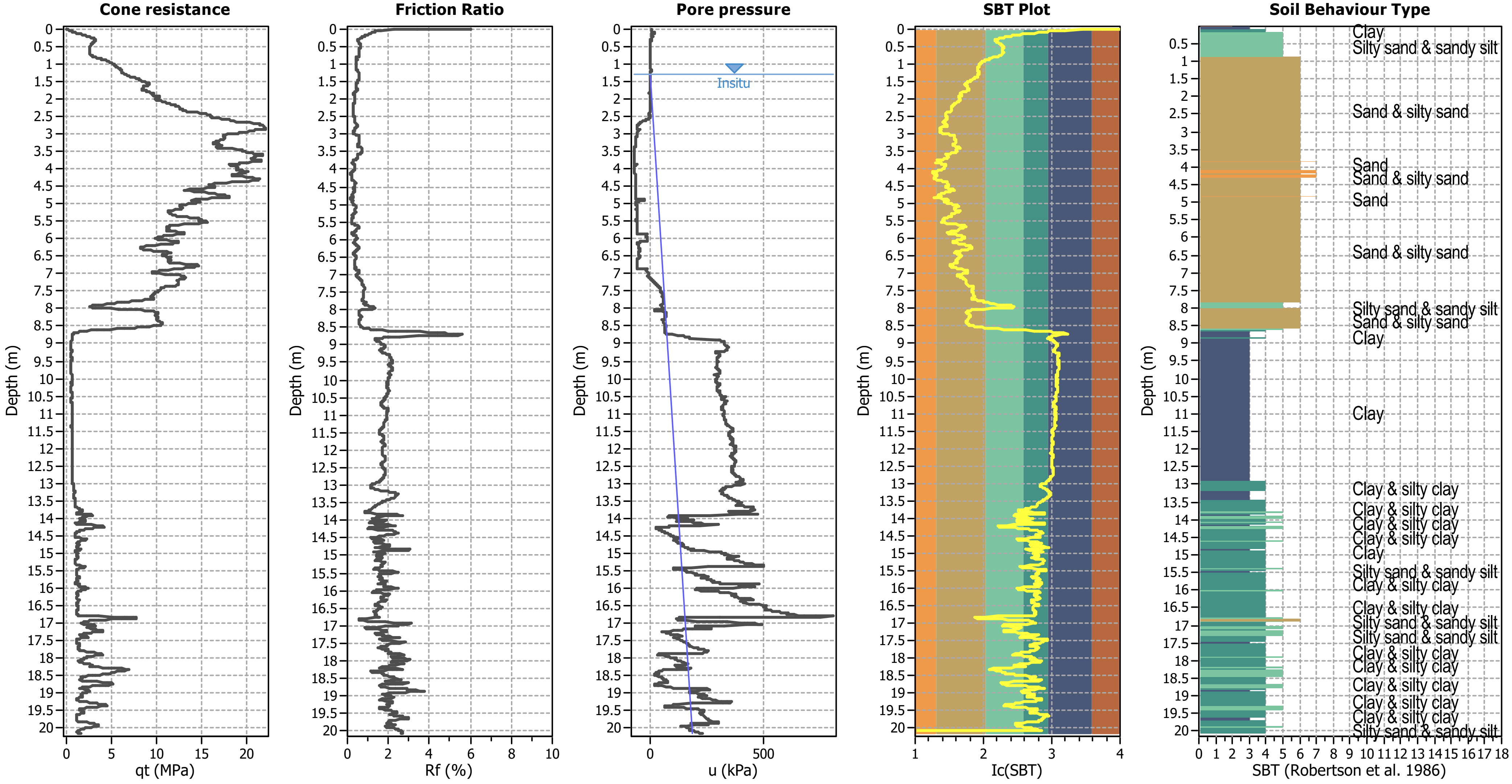
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

# CPT basic interpretation plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 7.50
Peak ground acceleration: 0.65
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

## SBT legend

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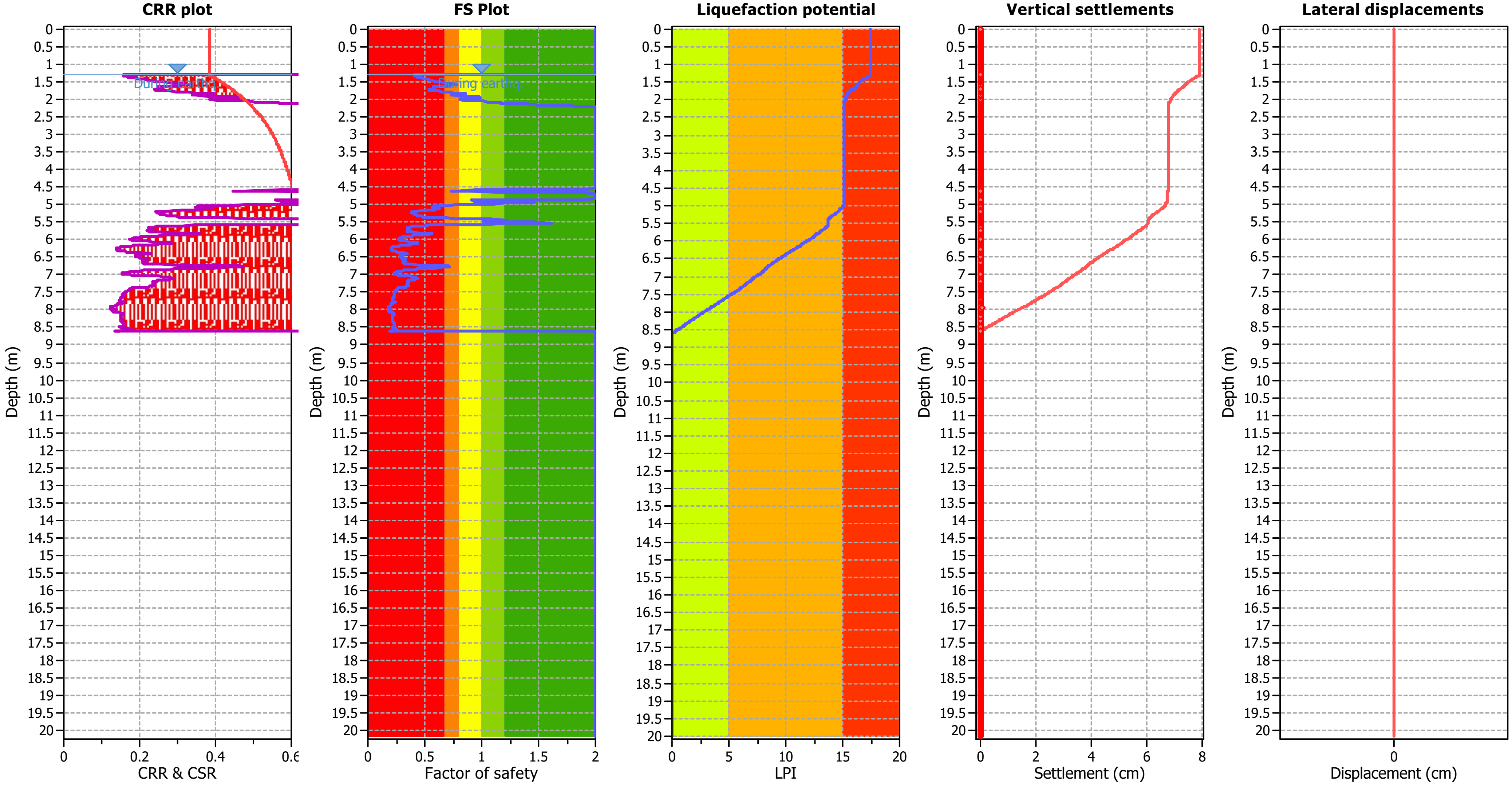
⬜ 9. Very stiff fine grained

## Liquefaction analysis overall plots



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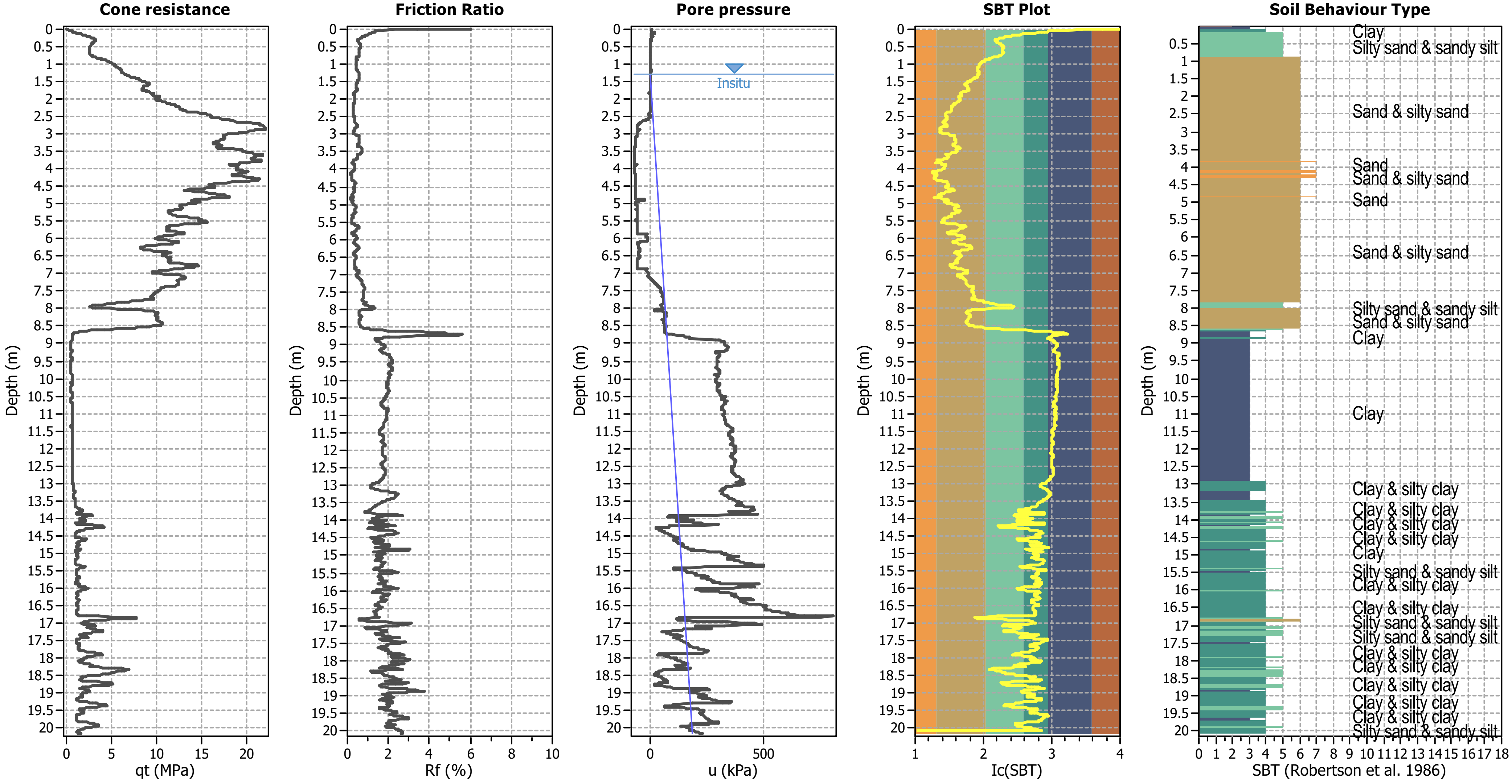

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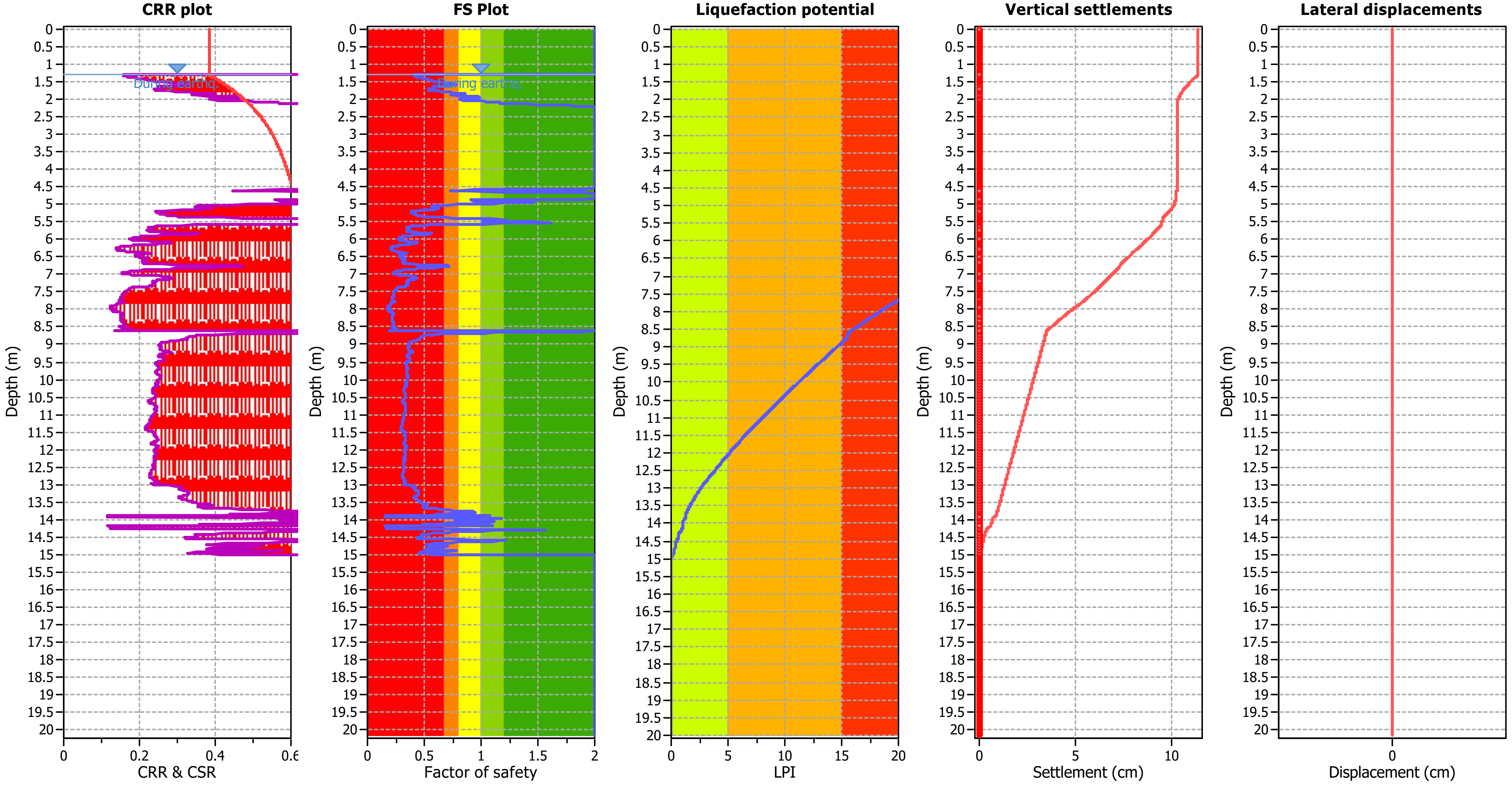

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NZHG Gisborne Limited

# SITE SPECIFIC GEOTECHNICAL REPORT FOR PROPOSED RESIDENTIAL DWELLING, LOT 7 AND 8

99A Stanley Road, Gisborne

**Project Reference: 24729**
**October 17, 2023**

# DOCUMENT CONTROL

| Version | Date | Comments |
|---|---|---|
| 01 | 17/10/2023 | Issued for Resource Consent. Plan review required prior to submission for Building Consent. |

| Version | Issued For | Date | Prepared By | Reviewed & Authorised By |
|---|---|---|---|---|
| 01 | Issued for Resource Consent | 17/10/2023 | Sahil Sathwara<br>*B.Tech (Civil), MEngNZ*<br>Geotechnical Engineer | Daniel S.B.<br>Dan Bond<br>*CMEngNZ, PEngGeol.*<br>*Associate Engineering Geologist* |

# CONTENTS

# 1 INTRODUCTION

Land Development & Engineering Ltd (LDE) was engaged by NZHG Gisborne Limited to undertake geotechnical investigations of a site located at 99A Stanley Street, Te Hapara, Gisborne (Figure 1), with legal description Lot 1 DP 5799. The 1,590m$^2$ site is proposed to be subdivided into 8 Lots for residential development (Figure 1). This geotechnical report pertains to proposed **Lot 7 and 8**, 99A Stanley Road, Gisborne.

Figure 1: Site location outlined in blue, with the proposed subdivision outlined in yellow, Lot 7 and 8 highlighted in white. Image source: Tairāwhiti Maps (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2023) Accessed: September 2023.

The purpose of this investigation was to determine and assess the nature of the ground beneath the building site to inform our geotechnical recommendations for site development and design of the building's foundations. The investigation was completed to satisfy the Gisborne District Council (2022) for Resource and Building Consent.

# 2 PROPOSED DEVELOPMENT

An 8-lot subdivision is proposed at 99A Stanley Road. Demolition and removal of existing structures is proposed, with the development consists of 4 structures formed of three double-storey duplex buildings and one single-storey duplex building (Figure 1).

The proposed driveway is located centrally in the site to provide access to the lots from Stanley Road. Proposed access and building platform locations are shown in Figure 1 and Appendix A.

A 226.5m$^2$ single storey building is proposed across Lot 7 and 8 (Figure 2), with timber framing in accordance with NZS3604 (2011), with weatherboard and sheet wall cladding, profiled metal roofing and either concrete floor or suspended timber floor, which has yet to be determined.

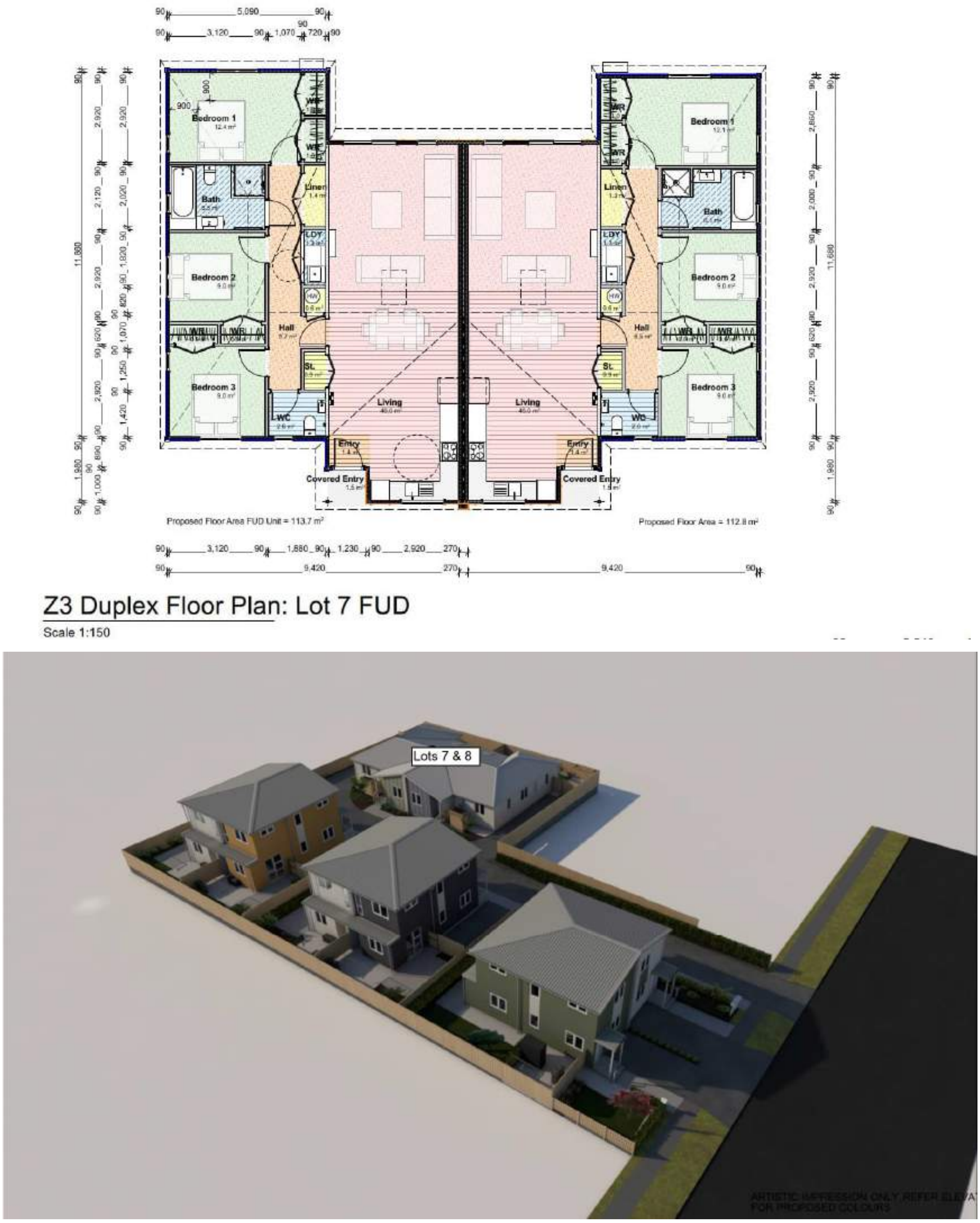


Figure 2: (From top to bottom): Floor plan for proposed duplex building across Lot 7 and 8, alongside the architect's drawing (Lot 7 and 8 are labelled) Image source: Client supplied.

# 3 SITE STUDY

## 3.1 Description

The site is located within the established suburb of Te Hapara, Gisborne, approximately 1.7km northwest of the Gisborne CBD. The site is generally flat and is elevated approximately 5m (New Zealand Vertical Datum (NZVD) 2016).

The site is within a General Residential zoning based on the Tairāwhiti Resource Manage Plan (2023) and recent aerials show the site to be developed has an existing dwelling and ancillary structure. The site does not contain any open drainage pathways or watercourses and we did not identify any significant geomorphological features nearby.

## 3.2 Published Geology

The 1:250,000 geological map of the region (Mazengarb & Speden, 2000) indicates the site is underlain by Holocene aged beach deposits which consist predominantly of sand.

## 3.3 Geotechnical Risks

Our review of Gisborne District Council's (GDC) GIS viewer, Tairāwhiti Maps (Gisborne District Council, 2022), and GNS Science's Active Faults Database (GNS Science, 2022) revealed following:

- The site is mapped as being within an area of moderate liquefaction risk.
- The nearest active fault is the Repongaere Fault, located approximately 16km north-west of the property.
- The site is mapped as yellow tsunami evacuation zone.

## 3.4 Historic Site Imagery

Historical aerial imagery was also reviewed as part of the investigation using Retrolens and Google Earth aerial photography, which revealed the following:

- Early images indicate that the site was developed prior to 1942, with a dwelling placed over the southwestern corner of Lot 1 DP 5799, occupying the corner of Stanley Road and Childers Road. These images also indicate the site to be within relic dune forms.
- The historic dwelling on the corner of Stanley Road and Childers Road was demolished between 1966 and 1972.
- The current, existing dwelling and a carport first appear in 1977 imagery.
- The surrounding developments on Childers Road are constructed by 1986.

After which the site appears to remain largely unchanged through to the present day.

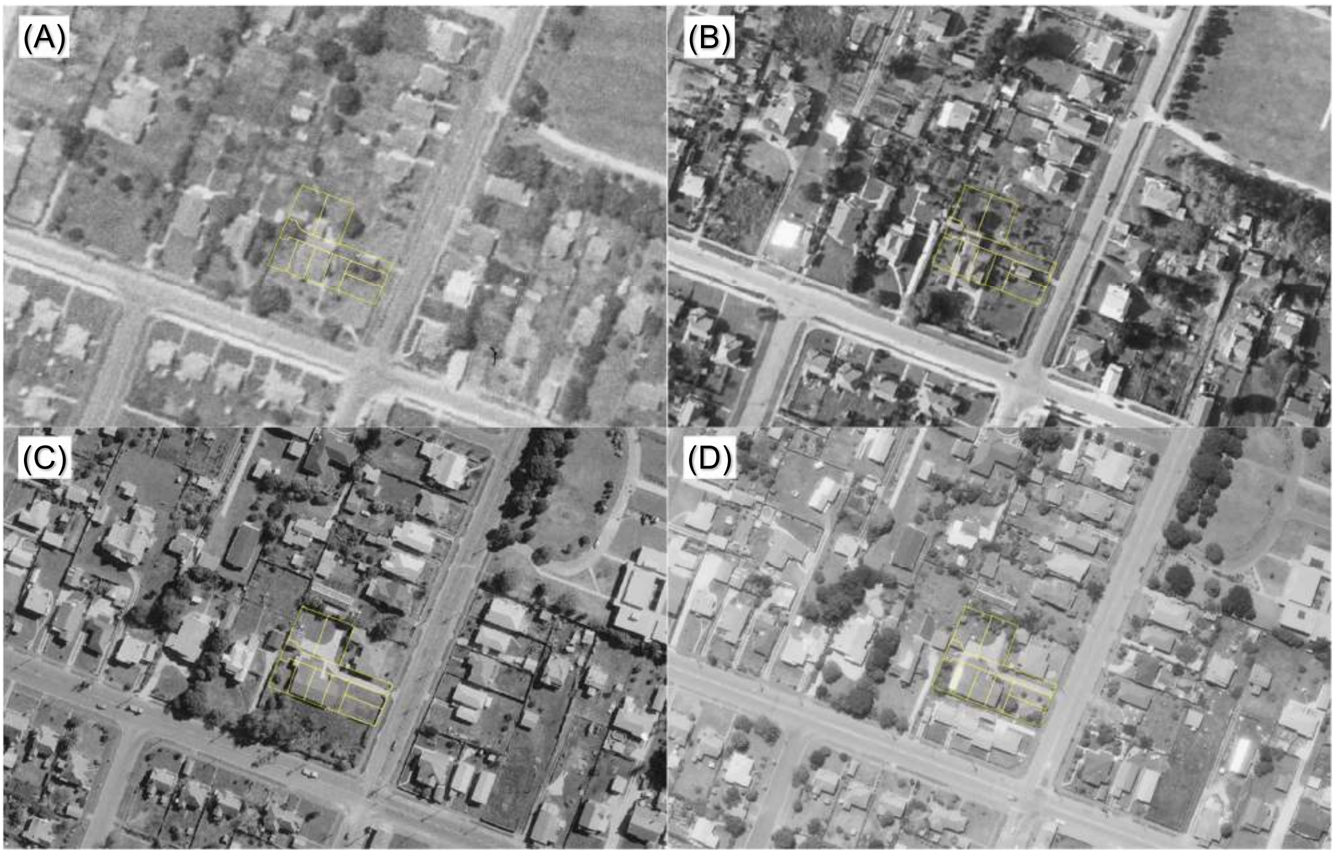


Figure 3: Historical aerial imagery of the Stanley Road subdivision (Source: (Retrolens.co.nz)), with the location of the individual lots marked in yellow. (a) Aerial imagery from 1942, (b) 1951, (c) 1977, (d) 1986.

# 4 GEOTECHNICAL INVESTIGATION

## 4.1 Development wide Investigation Scope

Our investigation of the entire site included the following scope of work:

- A walkover assessment of the site and immediate surrounding area to assess its geomorphology and identify any features which may influence our engineering recommendations, or the long-term performance of the ground.
- Twelve, 50mm diameter, hand auger boreholes to refusal or 2.5m target depth at the proposed building locations and associated Dynamic Cone Penetrometer (DCP) tests to the 2.5m target depth.
- Two cone penetrometer tests (CPTs) driven to between 17.9m and 20.15m depths, at either end of the proposed site.

## 4.2 Lot 7 and Lot 8 Investigation Scope

The investigation of the site, completed on 14 September 2023, included the following work:

- A walkover assessment of the site and immediate surrounding area to identify its geomorphology and features which may influence our engineering recommendations or the long-term performance of the ground.
- One cone penetrometer test (CPT01) to the refusal depth of 17.90m.
- Four, 50mm diameter, hand-auger boreholes (HA07, HA08, HA09 and HA10), which refused between depths of 2.0m and 2.1m below ground level (bgl). Associated DCP tests were carried out at each test location to the 2.5m target depth.

The test locations are shown on the Geotechnical Investigation Plan (Figure 4) and is included as Appendix A. Logs with details of the relevant testing completed are presented as Appendices B and C.

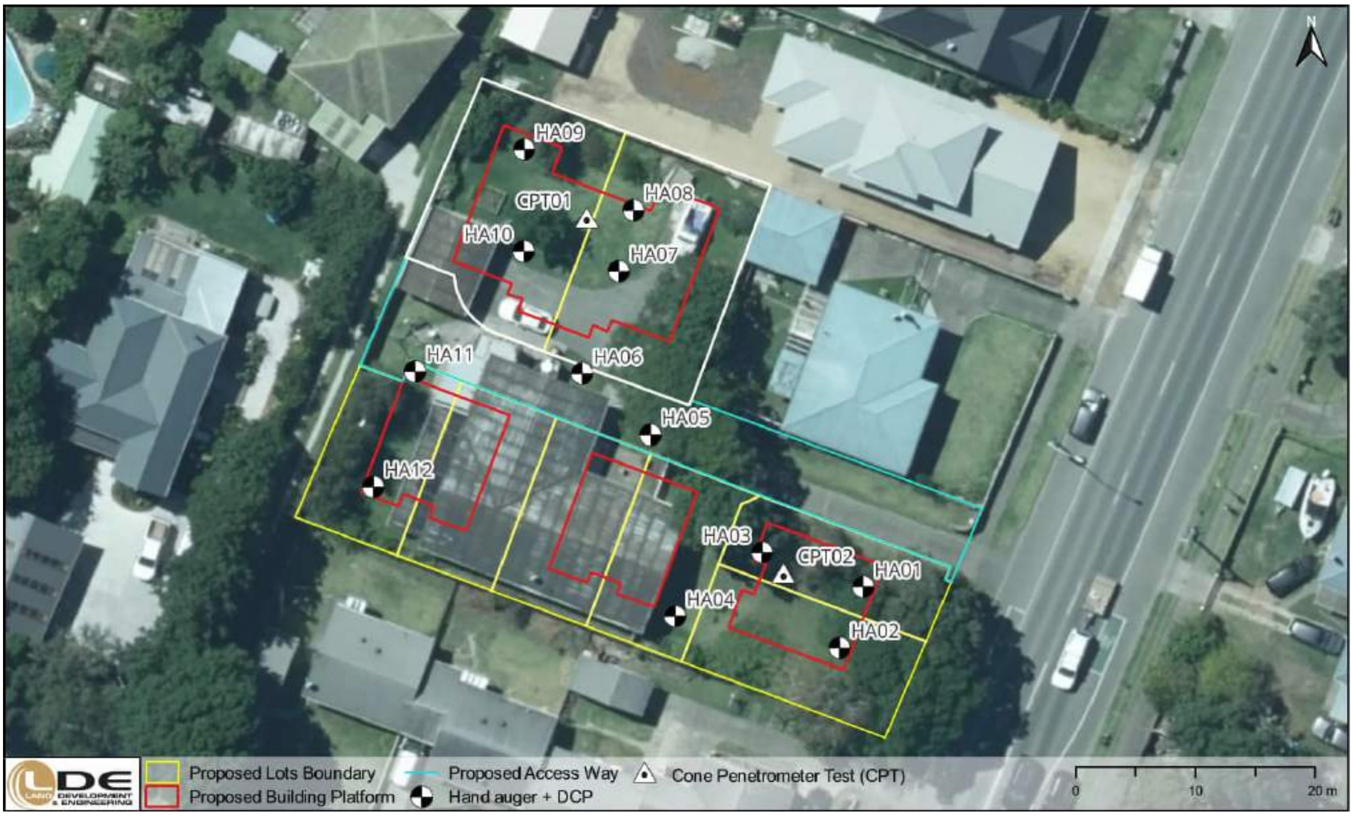


Figure 4: Geotechnical Investigation Plan for proposed development, Lot 7 and 8 highlighted in white.

# 5 GROUND CONDITIONS

This section addresses the ground conditions encountered during our investigations.

## 5.1 Site Stratigraphy

### 5.1.1 Development Wide

Ground conditions are reasonably consistent across the site. Typically, the property is underlain by topsoil and/or fill to a depth between 0.25m and 0.7m below ground level (bgl), which overlies sand/ silt mixtures to a depth of 1.0m. Underlying this, medium dense to dense sand was encountered to around 8.5m to 9.0m.

Deposits of firm clay were encountered from around 8.5m to 9.0m to 13m depth followed by interbedded stiff silt/clay mixtures and silty sand, sandy silt extending to at least 20m depth.

### 5.1.2 Lot 7 & Lot 8 Site Specific

Topsoil/Fill was encountered in hand auger boreholes from the existing ground surface to depths of between 0.3m and 0.5m.

This was underlain by Holocene Beach Deposits, comprising a layer of very loose to dense sand to the refusal depths of between 2.0m and 2.1m bgl, due to saturated sand flowing into the borehole. Dynamic penetrometer testing in within the sand subgrade ranged between 0.5 and 9 blows per 50mm, between underside of topsoil and 2.5m depth.

## 5.2 Groundwater

The groundwater was encountered at depths of between 1.3m and 1.8m in hand auger boreholes across the site. The groundwater was not measured in CPTs due to hole collapse but is inferred to be a short way beneath the depths of hole collapse.

A groundwater level of 1.3m bgl was adopted in our assessments. Given that testing was completed in the wettest year on record for Gisborne, the groundwater level adopted is considered significantly elevated from typical levels and no further allowance has been applied for seasonal variations.

# 6 NATURAL HAZARDS

## 6.1 Definition & Legislation

This section summarises our assessment of the natural hazards that might affect the site including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding, that might affect the property, as generally defined in Section 106 of the Resource Management Act., including erosion (including coastal erosion, bank erosion, and sheet erosion), falling debris (including soil, rock, snow and ice), subsidence, inundation (including flooding, overland flow, storm surge, tidal effects and ponding), and slippage.

## 6.2 Seismic Hazard

### 6.2.1 Surface Fault Rupture

The GNS NZ Geology Web-map and Active Faults Database (GNS Science, 2020) do not show any faults passing beneath the subject site. There also does not appear to be any surface expressions which would indicate the presence of an active fault beneath or within close proximity to the site. We therefore consider the surface fault rupture risk to be low.

### 6.2.2 Site Subsoil Class

Based on the published geological information for the region discussed in Section 3.2 and obtained CPTs data, we consider that the site classification of D- "Deep or Soft Soil" Site is appropriate as defined by NZS 1170.5 (2004).

### 6.2.3 Seismic Actions

In accordance with the NZ Building Code and NZS 1170.5 (2004):

- The structure proposed is considered Importance Level 2 (IL2) with a design working life of 50 years, and therefore;
- The Serviceability Limit State (SLS) design earthquake has an annual exceedance probability of 1/25, and;
- The Ultimate Limit State (ULS) design earthquake has an annual exceedance probability of 1/500.
- Furthermore, an intermediate state event (ILS) has been considered in accordance with Module 1 recommendations (2021) for an annual exceedance probability of 1/100.

The modules of the Earthquake Geotechnical Engineering Practice series jointly published by Ministry of Business Innovation and Employment (MBIE) and the New Zealand Geotechnical Society (NZGS) (2021) provides guidance under Section 175 of the Building Act (2004), to assist with ensuring compliance with the Act. We have adopted the ground motions published within Module 1 (2021) for geotechnical design which are summarised in Table 1 below.

Table 1 Summary of adopted seismic parameters.

| Seismic Parameters | SLS | ILS | ULS |
|---|---|---|---|
| **Horizontal Peak Ground Accelerations (PGA), g** | 0.12 | 0.28 | 0.65 |
| **Effective magnitude, Mw** | 6.3 | 6.8 | 7.5 |

## 6.3 Liquefaction and Cyclic Softening Assessments

### 6.3.1 Liquefaction

Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground, and structure settlement, and in lateral (spreading) displacement of the ground.

The liquefaction potential was assessed with site-specific CPT data using specialist geotechnical software (CLiq Ver.3.3.1.13) in general accordance with NZGS/ MBIE Module 3 Guidance (2021). Liquefaction triggering was assessed using the method proposed by Boulanger and Idriss (2014). Liquefaction-induced, free-field, vertical, volumetric strains were estimated using the method proposed by Zhang et al (2002). A groundwater level of 1.3m bgl was adopted as discussed in Section 5.2.

### 6.3.2 Cyclic-Softening

Cyclic softening is a phenomenon that occurs when the strength and stiffness of a soil decreases due to repeated cyclic loading such as that resulting from strong seismic shaking. Relatively soft clay soils are commonly susceptible to this phenomenon, which can be accentuated where these soils are sensitive i.e., there is a significant difference between the soil's peak and residual shear strength.

Due to the presence of the clay rich estuarine soils at this site, we have undertaken a cyclic softening analysis for the ULS design case. The Gisborne 2007 earthquake was of comparable magnitude and PGA to the ILS design case. No liquefaction or induced settlements were identified within the proximity of the subject site because of this earthquake. Accordingly, cyclic softening has been assessed for the ULS design case only.

Our assessments assumed:

- An $N_{kt}$ value of 14 for the clay-like soils, based on previous work undertaken proximally by LDE within the estuarine deposits.
- An estimate of the maximum, post-liquefaction, volumetric strain based on the work by Robertson and Cabal (Robertson & Cabal, 2014) which recommends a default value of 0.5% for clay-like soils.

### 6.3.3 Liquefaction and Cyclic Softening Results

The results of the analysis are summarised below in Table 2 and detailed outputs are provided as Appendix D.

The Liquefaction Potential Index (LPI) and Liquefaction Severity Number (LSN) are indices used to assess the general performance level of liquefied deposits in accordance with the NZGS/MBIE Module 3 Guidance (2021).

Our analyses indicate that liquefaction-induced settlements are likely to be negligible (<5mm) in a design SLS seismic event.

Under the ILS design case, liquefaction-induced settlements are estimated to be between 45mm and 50mm. As discussed in Section 6.3.2 , no liquefaction, or liquefaction-induced settlements were identified within the proximity of the subject site as a result of the Gisborne 2007 earthquake, which had almost identical ground motions. Accordingly, we consider it unlikely that liquefaction would be realised under ILS seismic shaking and conclude that the software is likely to be over-estimating liquefaction potential.

Table 2 Summary of Seismic Site Performance

| Limit State / Return Period | CPT ID | LPI | LSN | Estimated Seismic Volumetric Settlements (mm) [Limited to 10m] (3) | | | Effects of Liquefaction |
|---|---|---|---|---|---|---|---|
| | | | | Liquefaction | Cyclic Softening | Total Seismic Settlement | |
| **SLS 1/25 year** | CPT-01 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | **L0** |
| | CPT-02 | 0 | 0 | <5 [<5] | - | **<5 [<5]** | |
| **ILS 1/100 year** | CPT-01 | 4 | 6 | ~45 [~45] | - | **~45 [~45]** | **L2** |
| | CPT-02 | 5 | 7 | ~50 [~50] | - | **~50 [~50]** | |
| **ULS 1/500 year** | CPT-01 | 17 | 15 | ~80 [~75] | ~30 | **~110 [~75]** | **L3** |
| | CPT-02 | 18 | 17 | ~85 [~80] | ~35 | **~120 [~80]** | |
| **Effects of liquefaction Key** | | **L0: Insignificant** | **L1: Mild** | **L2 Moderate** | **L3: High** | **L4 Severe** | **L5: Very Severe** |

**Notes:**

- Liquefaction triggering Boulanger and Idriss (2014) methodology limited to upper 15m. Limited to 10m of soil profile shown in [brackets].
- Settlements are free-field estimated settlements and do not include any building induced settlements.
- Effects of Liquefaction based on NZGS Module 3 (New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE), 2021)

Under design ULS seismic shaking, 110mm to 120mm of settlement is estimated. However, given the rationalisation to the Gisborne 2007 earthquake, discussed above, we consider that total, free-field, seismic settlements are likely to less than 100mm.

## 6.4 Lateral Spreading

The site is generally level and the nearest free face is associated with an unnamed tributary to the Waikanae Creek, approximately 700m south of the proposed building area. Given that there are no significant slopes within influencing distance of the proposed dwelling, and grades on site are very low, we consider the risk of lateral spreading in the event of a significant earthquake to be low.

## 6.5 Liquefied Bearing

Liquefaction may lead to foundation bearing failure, by either 'punch through' failure or a reduction in bearing capacity when liquefaction occurs within the zone of influence of load bearing foundations.

A preferred foundation option has not been identified for the proposed structures at the time of writing and we have completed liquefied bearing assessments for both raft-type surface structures and piled foundations.

A unit weight of 17kN/m$^3$ was adopted for both the non-liquefied and liquefied soil layers. An angle of internal friction of 34 degrees was adopted for the non-liquefied material.

The tau/sigma ratio for these assessments was based on site-specific CPT data and taken as 0.075 for the liquefied material within the zone of influence of the foundations.

Groundwater level was taken as 1.3m, as discussed in Section 5.2.

A reduction factor of 0.75 was applied to the ultimate capacities calculated for the proposed, two-storey, duplex buildings, in accordance with MBIE Module 5 (2021) for moderately loaded structures.

### 6.5.1 Pile Foundation Assessment

Our assessment of pile foundations assumed:

- Ordinary piles embedded to a minimum depth of 0.7m at 0.3m diameter (including concrete cover),
- Anchor piles embedded to a minimum depth of 0.9m at 0.4m diameter (including concrete cover), and
- A 100kPa design load.

Both projected area and 'punch-through' failure mechanisms were assessed.

#### 6.5.1.1 Results

The design load exceeded capacity in both design cases with the 'punch-through' failure mechanism governing. Maximum design loads were calculated as follows:

Ordinary piles

75kPa for the single-storey structures and 55kPa for the two-storey duplex buildings.

Anchor Piles

45kPa for the single-storey structures and 30kPa for the two-storey duplex buildings.

### 6.5.2 Raft type Surface Structure Foundation Assessment

For the raft-type surface structures assessments were completed for the single-storey and two-storey buildings assuming:

- Foundation widths as presented in the 15% architectural drawings, and
- An embedment depth of 0.2m.

#### 6.5.2.1 Results

Liquefied bearing capacities were calculated to be 14.5kPa for the proposed single-story buildings and 11kPa for the proposed two-storey duplex structures.

The values presented above are dependent on the assumptions listed. Should the foundation breadth, embedment depth or design loads change, the liquefied bearing capacities will need to be reassessed.

## 6.6 Equivalent MBIE Technical Category

Considering the rationalisation provided in Section 6.3, we consider that seismic ground performance at this site would be equivalent to a TC2 classification in accordance with Table 15.6 of the MBIE Guidance (2015).

## 6.7 Slope Stability

The site is generally flat-lying and there are no significant slopes within, or near the site. Therefore, we do not consider slope stability to be a geotechnical constraint.

## 6.8 Flood Hazard

The site is not located in a mapped flood hazard zone.

## 6.9 Tsunami

The Gisborne / East Cape coastline is classified as being at the highest risk in the country of being affected by tsunami. Modelling for the Gisborne region (GNS Science Te Pū Ao, 2016) indicates that the site is sufficiently elevated and is unlikely to be inundated in 1:100, 1:500, and 1:2500-year return period tsunami events, respectively. Civil defence tsunami inundation maps show that the site mapped as a yellow zone, which may be subject to tsunami hazard in the case of a severe (i.e. M8.9) local earthquake on the Hikurangi subduction margin (Gisborne District Council Te Kaunihera o Te Tairāwhiti, 2019) .

## 6.10 Expansive Soils

No laboratory testing of the soil properties was completed. Based on field tests, the surficial soils below the topsoil are granular in nature and therefore not subject to expansivity.

## 6.11 Natural Hazards Summary

From our assessment of the natural hazards and ground deformation risks presented to the proposed development we consider that the proposed structures can be safely located on the site, provided that the recommendations given in Section 7 are adopted.

# 7 ENGINEERING RECOMMENDATIONS

## 7.1 Site Contouring and Topsoiling

The finished ground level should be graded so that water cannot pond against, beneath or around the buildings for the economic life of structure. To achieve this, it will be important that the building platform beneath the topsoil grades away from the site. Contouring should avoid the potential for concentration and discharge of surface water over point locations which could result in soil erosion or instability.

## 7.2 Access Road Construction

Access is proposed from Stanley Road. No major/ significant earthworks are anticipated to form access to the proposed dwellings.

## 7.3 Foundation Recommendations

### 7.3.1 Foundation Type

Based on the site investigation and analysis, we consider that foundations comprising pile foundations or raft-type surface structures are suitable for the site conditions providing the recommendations and limitations presented within this section are addressed in design.

### 7.3.2 Design Considerations

Based on the scope of work completed, the following aspects need to be considered in detailed design:

- Site Class - Class D - Deep or soft soil
- Liquefaction-induced vertical settlements - TC2 equivalent
- Relatively high groundwater level

- Liquefied bearing capacity
- Potential for consolidation settlement

### 7.3.3 Bearing Capacity and Founding Depth

Foundations must extend beneath any topsoil, uncontrolled fill, organic and/ or otherwise unsuitable material.

For the Lot 7/8 duplex structure we anticipate that a static geotechnical ultimate bearing capacity (GUBC) of 210kPa will be available from 0.3m depth. Some localised deepening of foundations is anticipated in the vicinity of HA06 and HA08. A reduction factor of 0.45 should be applied to the GUBC given above to give the design bearing strength ($q_{dbs}$).

A short-term, post-seismic (static), liquefied bearing capacity, equivalent to the values presented in Section 6.5, should be assessed in structural design. Note that these liquefied bearing capacities are contingent on the assumptions listed within Section 6.5. Should these assumptions change in design, the liquefied bearing capacities will need to be reassessed. This may require some iterative design between the geotechnical and structural engineers.

## 7.4 Surface Water

The site is proposed to be connected to the council stormwater system. On-site disposal is not proposed.

The stormwater system for the buildings should be operational as soon as the roof is in place. This is to ensure that the ground within the vicinity of the building is not compromised by the negative effects and potential consequences of soil saturation.

### 7.4.1 Service Pipes

All service pipes, stormwater structures should be designed and constructed to ensure adequate capacity, strength, and water tightness to prevent leakage into the platform through blockage, running under pressure, or structural failure.

All service pipes installed within any fill should be flexible, or flexibly joined, so that they may deflect without breaking if the ground settles.

A record should be kept of the position, type, and size of all subsoil drains, and in particular of their outlets.

## 7.5 Trees and Shrubs

There are multiple trees on the property, within the vicinity of the structure proposed dwellings. Trees can cause damage through heaving as a result of root growth and / or settlement resulting from soil shrinkage from the moisture uptake of the roots. Preliminary landscaping plans show that most of onsite trees and shrubs will be removed, we recommend one of the following options:

- The plant and its major root structure should be removed.
- A root barrier should be designed and installed between the offending plant and the structure.
- Foundations should be taken to a depth no less than 1.0m where damage from the roots of the plant is unlikely.

If new trees, shrubs or gardens are established, or the lemon tree relocated on site, care should be taken to ensure:

- The vegetation does not interfere with any subfloor ventilation or services to the structure.
- Over-watering of the vegetation does not saturate the ground near the foundations.
- Trees or shrubs with the potential to develop significant root systems should be planted a minimum distance equal to the mature height of the plant away from the foundations.

# 8 SUSTAINABILITY

Considering sustainability as early as possible in a project's development, could lead to significant project opportunities and wider positive outcomes. Geotechnical opportunities for increased sustainability for this project include:

- Striping and stocking topsoil for reuse (dependant on presence/ levels of contaminants).
- Designing for cut and fill balance where possible.
- Reuse of site won materials, or using materials won from other sites including use of recycled crushed concrete aggregate for hard fill.
- Contributing site investigation data to the New Zealand Geotechnical Database (NZGD) to help reduce the site investigations needed in the future.
- Using local consultants and contractors to reduce transport related emissions.

# 9 CONCLUSIONS

Following development of the site in accordance with our recommendations, we consider that:

a) The land in respect of which a consent is sought, or any structure on the land built in accordance with our recommendations, is unlikely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source; and

b) Any subsequent use that is likely to be made of the land is unlikely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; and

c) Sufficient provision has been made for physical access to each allotment to be created by the subdivision.

# 10 PLAN REVIEW

Prior to an application for Building Consent, it is important we are given the opportunity to review the final development drawings to ensure the recommendations contained within this report have been followed and interpreted correctly. Following successful review of the development drawings, we will update this report to support applications for Resource Consent and Building Consent.

# 11 VERIFICATION

Verification requirements will be provided once the form of the foundations has been determined.

# 12 LIMITATIONS

This report should be read and reproduced in its entirety including the limitations to understand the context of the opinions and recommendations given.

This report has been prepared exclusively for NZHG Gisborne Limited in accordance with the brief given to us or the agreed scope and they will be deemed the exclusive owner on full and final payment of the invoice. Information, opinions, and recommendations contained within this report can only be used for the purposes with which it was intended. LDE accepts no liability or responsibility whatsoever for any use or reliance on the report by any party other than the owner or parties working for or on behalf of the owner, such as local authorities, and for purposes beyond those for which it was intended.

This report was prepared in general accordance with current standards, codes and best practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods and subsurface investigations at discrete locations designed to the constraints of the project scope to provide the best assessment of the environment. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from those described in this report.

# 13 REFERENCES

Ambraseys, N., & Srbulov, M. (1995). Earthquake induced displacements of slopes. *Soil Dynamics and Earthquake Engineering*, 14(1), 59-71.

Boulanger, R., & Idriss, I. (2014). *CPT and SPT based liquefaction triggering proceedures.* Report No. UCD/CGM-14, 1.

Bray, J. D., & Travasarou, T. (2007). Simplified procedure for estimating earthquake-induced deviatoric slope displacement. *Journal of geotechnical and geoenvironmental engineering*, 133(4), 381-392.

Cetin, K., Bilge, H. T., Wu, J., Kammerer, A. M., & Seed, R. B. (2009). Probabilistic model for assessment of cyclically induced reconsolidation (volumetric) strains. *ASCE Journal of Geotechnical and Geoenvironmental Engineering*, 387-398.

Chu, D. B., Stewart, J. P., Youd, T. L., & Chu, B. L. (2006). Liquefaction-Induced Lateral Spreading in Near-Fault Regions during 1999 Chi-Chi, Taiwan Earthquake. *Journal of Geotechnical & Geoenvironmental Engineering*, 1549-1565.

Gisborne District Council. (2022). Bearing Capacity and Geotechnical Investigation Requirements for Buildings.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2019). Tsunami inundation and evacuation maps.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2021). Minimum Requirements for Geotechnical Reports.

Gisborne District Council Te Kaunihera o Te Tairāwhiti. (2023). Tairāwhiti Maps. Retrieved 2022, from https://maps.gdc.govt.nz/H5V2_12/

GNS Science. (2020). New Zealand Active Faults Database.

GNS Science. (2022, November 5). *New Zealand Active Faults Database*. Retrieved from https://data.gns.cri.nz/af/

GNS Science Te Pū Ao. (2016). *Probabilitistic Mapping of Tsunami Hazard and Risk for Gisborne City and Wainui Beach.* Wellington: GNS.

Jibson, R. W. (2007). Regression models for estimating coseismic landslide displacement. *Engineering geology*, 91(2-4), 209-218.

Mazengarb & Speden. (2000). Geology of the Raukumara area. *Institute of Geological and Nuclear Sciences 1:250,000 geological map 6*.

Ministry of Business Innovation and Employment Hīkina Whakatutuki. (2015). *Repairing and rebuilding houses affected by the Canterbury earthquakes - Part C Technical Guidance.* Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 1. Overview of the Guidelines, Rev 1. Wellington.

New Zealand Geotechnical Society (NZGS) & Ministry of Business, Innovation and Employment (MBIE). (2021, November). Earthquake Geotechnical Engineering Practice Module 3. Identfication, assessment and mitigation of liquefaction hazards Rev1. Wellington.

*Retrolens.co.nz*. (n.d.). Retrieved from retrolens.co.nz.

Robertson, P. K., & Cabal, K. L. (2014). *Guide to Cone Penetration Testing for Geotechnical Engineering. 6th Edition.* Gregg Drilling & Testing Inc.

Standards New Zealand Te Mana Tautikanga O Aotearoa. (2004). *NZS1170.5 Structural Design Actions: Part 5: Earthquake Actions- New Zealand.* Wellington: Standards New Zealand.

Tonkin & Taylor. (2015). *Liquefaction vulnerability and Geotechnical Assessment - Guidance for Gisborne District Council.*

Zhang, G., Robertson, P., & Brachman, R. (2002). Estimating liquefaction-induced groundsettlements from CPT for level ground. *Canadian Geotechnical Journal, 39*(5), 1168-1180.

Zhang, G., Robertson, P., & Brachman, R. (2004). Estimating liquefaction-induced lateral displacements using the standard penetration test or cone penetration test. *Journal of Geotechnical and Geoenvironmental Engineering, 130*(8), 861-871.

# 14 GLOSSARY

| | |
|---|---|
| **Compressible Soils:** | Compressible soils are those that will undergo a reduction in volume under an imposed load, such as the weight of fill or a structure. This occurs firstly as a result of the expulsion of air and water from the soil void spaces (primary settlement) and secondly due to a restructuring of the soil skeleton to take the load (secondary settlement). |
| **Cyclic Softening:** | Cyclic-softening is a related condition to liquefaction can also affect clay soils when subjected to cyclic-loading. Clay soils may significantly soften and led to bearing capacity failure, in addition to post-earthquake consolidation settlements may occur as a result of the earthquake shaking. |
| **Expansive Soils:** | Cohesive soils containing significant proportions of certain clay minerals can be subject to appreciable volume change caused by variations in soil moisture content, most notably between seasons or from the uptake of water through the root systems of trees and shrubs. This is also often referred to as soil reactivity or shrink-swell behaviour. |
| **Lateral Spread:** | Lateral spread of liquefied soils is the lateral displacement of blocks of land moving laterally towards a free edge (for example a riverbank) or within sloping ground. More lateral movement tends to occur closest to the edge with less movement further back. Lateral spreading may result in large permanent ground displacements including cracks, fissures, vertical offsets, and overall settlement of the ground. |
| **Lateral Stretch:** | Lateral stretch is the amount of differential extension that a portion of land may experience during an episode of lateral spreading. The lateral stretch across a foundation is a main factor in foundation damage due to liquefaction and lateral spreading because of a large earthquake. |
| **LiDAR** | Light Detection and Ranging (LiDAR) is a method of remote sensing topographical survey. |
| **Limit States:** | Seismic design criteria for performance-based design. SLS, SLS2 & ULS are prescribed in NZS1170.5 (Standards New Zealand Te Mana Tautikanga O Aotearoa, 2004)<br>• **Serviceability Limit State (SLS):** Functional requirements for the serviceability limit state are assumed to be met if the structure or part can continue to be used as originally intended without the need for repair (SLS1) or can remain operational or continue to be occupied as appropriate (SLS2). SLS earthquakes are considered highly likely to occur during the lifetime of the structure.<br>• **Ultimate Limit State (ULS):** Functional requirements for the ultimate limit state are assumed to be met if:<br>a) People within, and adjacent to the structure are not endangered by the structure or part. |

| | |
|---|---|
| | b) Displacements of the structure are such that there is no contact between any parts of a structure for which contact is not intended, or between separate structures on the same site, if such contact would damage the structures or parts to the extent that persons would be endangered, or detrimentally alter the response of the structure(s) or parts, or reduce the strength of structural elements below the required strength.<br>c) The structure does not deflect beyond a site boundary adjacent to which other structures can be built or collision between the structure and any adjacent existing structures cannot occur.<br>d) There is no loss of structural integrity in either the structure or part.<br>• **Intermediate Limit State (ILS):** ILS is an intermediate seismic event between SLS & ULS although is not a code requirement. The behaviour of soils and geotechnical systems under earthquake shaking may be highly non-linear and even exhibit a pronounced ‘step change’ in performance with increasing intensity of shaking. For such cases, only considering performance at the SLS and ULS levels of shaking would fail to identify potentially poor and unacceptable performance at intermediate return periods of shaking. |
| **Liquefaction:** | Liquefaction is the term used to describe the temporary, but substantial, loss of strength and stiffness which can occur in saturated, unconsolidated soils that are subjected to strong shaking. In addition to near-total strength loss, liquefaction may also result in the expulsion of sediment and water at the surface, ground and structure settlement, and in lateral (spreading) displacement of the ground. |
| **LPI** | Liquefaction potential index is a liquefaction damage index. LPI ranges between 0 and 100 and sites with an LPI of 5 indicate a high liquefaction risk and sites with LPI greater than 15 indicate very high risk (Iwasaki et al, 1982). Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. |
| **LSN** | Liquefaction Severity Number is a liquefaction damage index. LSN varies from 0 (representing no liquefaction vulnerability) to more than 100 (representing very high liquefaction vulnerability (van Ballegooy et al, 2013). LSN places greater importance (than LPI) on the thickness of the non-liquefied crust when the groundwater table is close to the ground surface. Not to be used as a precise measure of liquefaction-induced ground damage but as an indicator of the general level of liquefaction severity. LNS was developed based on the observations/ investigations from the Canterbury earthquake sequence |
| **PGA:** | Peak Ground Acceleration (PGA) is the maximum ground acceleration during an earthquake as a proportion of gravity. |
| **Punch Through Failure:** | Punch through failure occurs when a foundation punches through a crust of non-liquefiable material due to underlying liquefaction occurring and can lead to potential damage to foundations and/ or large settlements. |

**Technical Category:** Following the 2010 -2011 Canterbury earthquake sequence the Ministry of Business Innovation and Employment (MBIE) assigned three technical categories (TC1, TC2, TC3) across the residential 'green zone' for foundation investigation and design guidance focusing on one and two storey timber-framed dwellings. These categories are broadly defined as below:

- **TC1:** Liquefaction damage is unlikely in future large earthquakes. Standard residential foundation assessment and construction is appropriate.
- **TC2:** Liquefaction damage is possible in future large earthquakes. Standard enhanced foundation repair and rebuild options in accordance with MBIE guidance are suitable to mitigate against this possibility.
- **TC3:** Liquefaction damage is possible in future large earthquakes. Individual engineering assessment is required to select the appropriate foundation repair or rebuild option.
- **TC2/ TC3 Hybrid:** A site that straddles liquefaction settlement limits of TC2 and TC3 where the SLS settlements are assessed as being less than 50 mm but the ULS settlements are assessed at greater than 100mm.

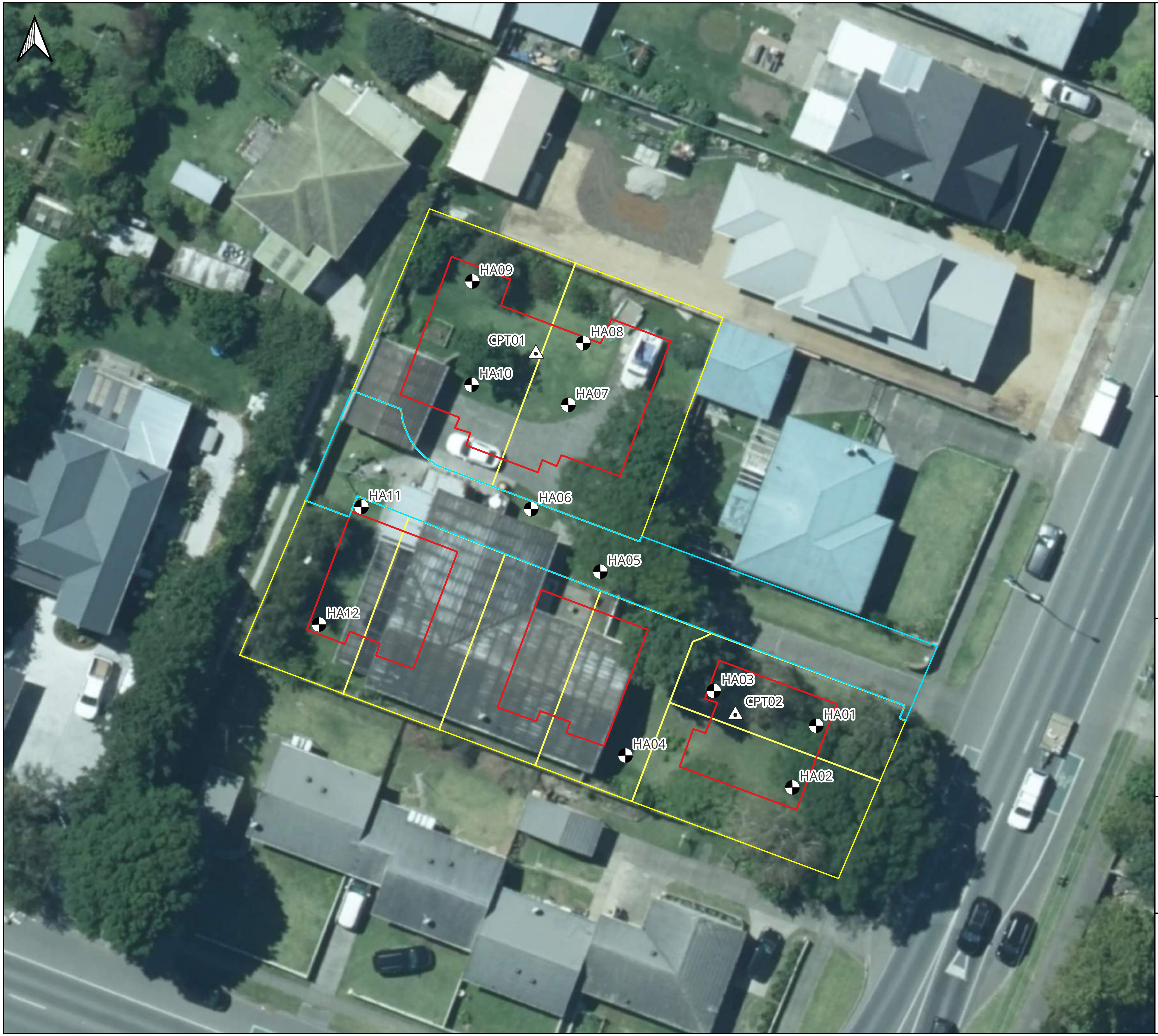
Whilst this guidance is intended for residential buildings in the Canterbury region, they have been widely adopted to convey liquefaction vulnerability across New Zealand.

**The Modules:** The New Zealand Geotechnical Society (NZGS) and MBIE jointly published a series of guidelines for Earthquake Geotechnical Engineering Practice. Revision 1 of the Modules was published in November 2021, and they provide guidance under section 175 of the Building Act 2004 to assist parties to comply with their obligations under the Building Act 2004. The following modules currently form the collection:

- **Module 1:** Overview of the guidelines
- **Module 2:** Geotechnical investigation for earthquake engineering
- **Module 3:** Identification, assessment, and mitigation of liquefaction hazards
- **Module 4:** Earthquake resistant foundation design
- **Module 5:** Ground improvement
- **Module 5A:** Specification of ground improvement for residential properties in the Canterbury region
- **Module 6:** Retaining walls

# APPENDIX A

# SITE PLAN



## LEGEND

Project Data

| | |
|---|---|
| 🟨 | Proposed Lots Boundary |
| 🟥 | Proposed Building Platform |
| — | Proposed Access Way |
| ◐ | Hand Auger + DCP |
| △ | Cone Penetrometer Test (CPT) |

0 5 10 15 20 m

SCALE A3: 1:300

NOTES

1. Aerial basemap and property boundaries sourced from LINZ Data Service (CC-BY 4.0).
2. Investigation locations shown approximately only.

CLIENT
NZHG Gisborne Limited

PROJECT
Geotechnical Investigation for proposed subdivision
99A Stanley Road, Te Hapara
Gisborne

DRAWING TITLE
Geotechnical Investigation Plan

LDE
LAND DEVELOPMENT & ENGINEERING

| PROJECT REF | DRAWING REF | REVISION |
|---|---|---|
| 24729 | GIP | A |
| DATE | PREPARED BY | CHECKED BY |
| 13/10/2023 | SS | RH |

FILE PATH
M-FILES\LDE - Project\76038-24729 Trans to 9602\Geo QGIS Zip Folder (ID 79084)\24729-QGIS Site Maps\24729- 99A Stanley Rd.qgz

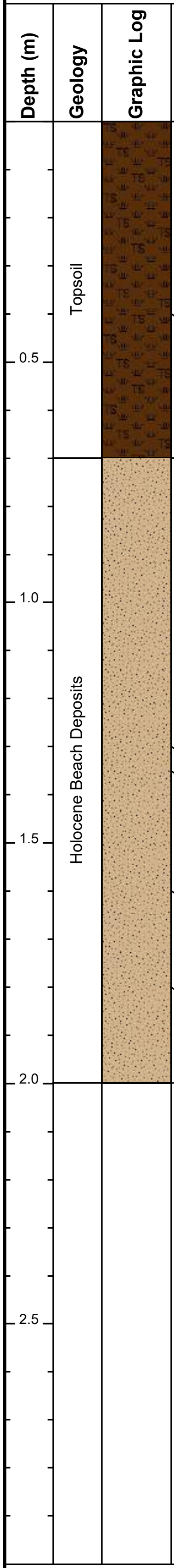
# APPENDIX B

# HAND AUGER TEST LOGS

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA01** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709080mN, 2035843mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |



**Material Description**

SAND, with trace rootlets and silt; dark brown. Very loose; moist; sand, fine to medium.

0.40m: With trace rootlets; brown.

SAND; light brown. Medium dense; moist; sand, fine to coarse.

1.30m: Wet.

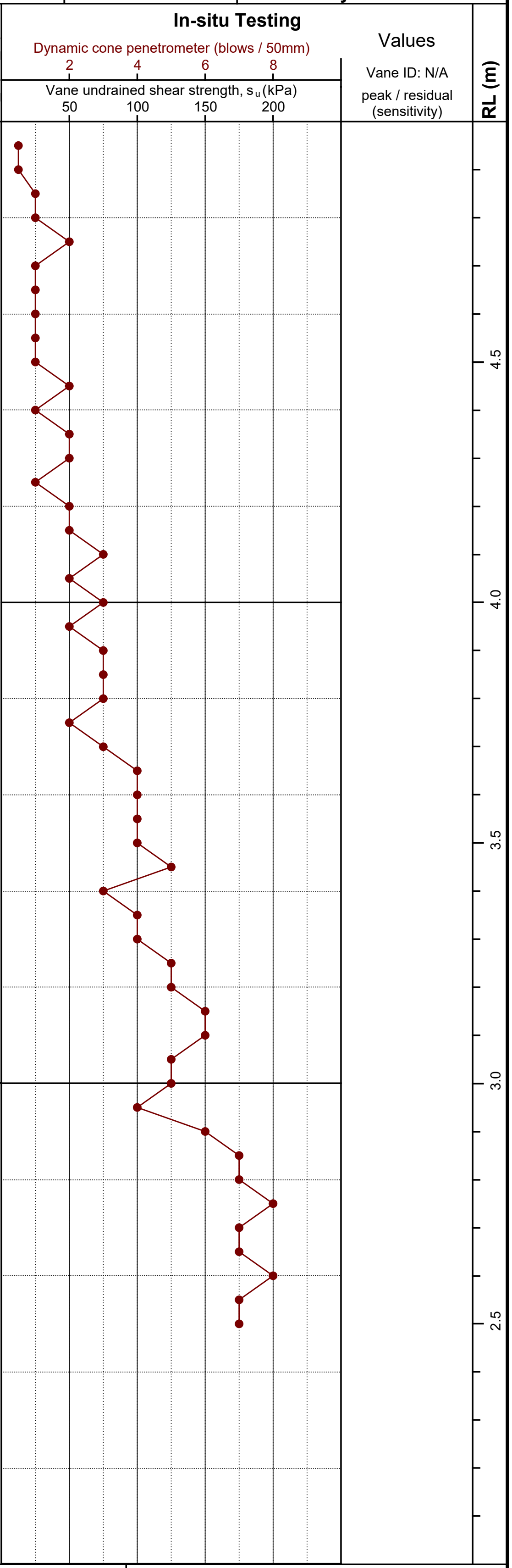
1.35m: Dense.

1.60m: Saturated.

1.80m: Poor recovery > 30%.

**Water**

▼



| | |
|---|---|
| **Hole Depth:** 2.00m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

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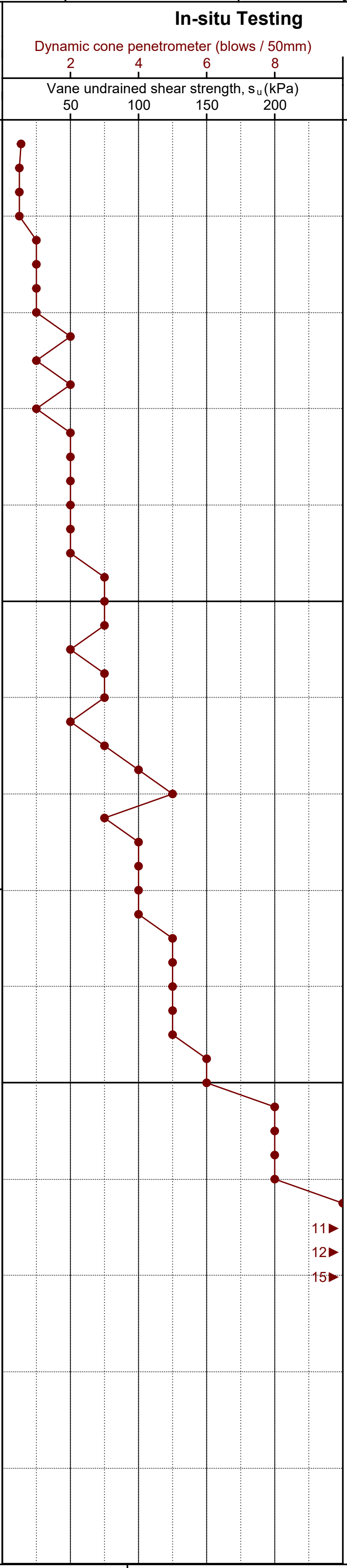
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA02** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709075mN, 2035841mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Very loose; moist; sand, fine.<br>0.10m: SAND. Sand, fine to medium. | | |
| | Holocene Beach Deposits | SAND; light brown. Loose; moist; sand, fine to coarse. | | |
| 0.5 | | | | 4.5 |
| | | 0.65m: Medium dense. | | |
| 1.0 | | | | 4.0 |
| | | 1.10m: Wet. | | |
| | | 1.30m: Saturated. | ▼ | |
| 1.5 | | 1.50m: Dense; poor recovery > 30%. | | 3.5 |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |



Values

Vane ID: N/A

peak / residual (sensitivity)

**Hole Depth:** 1.60m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

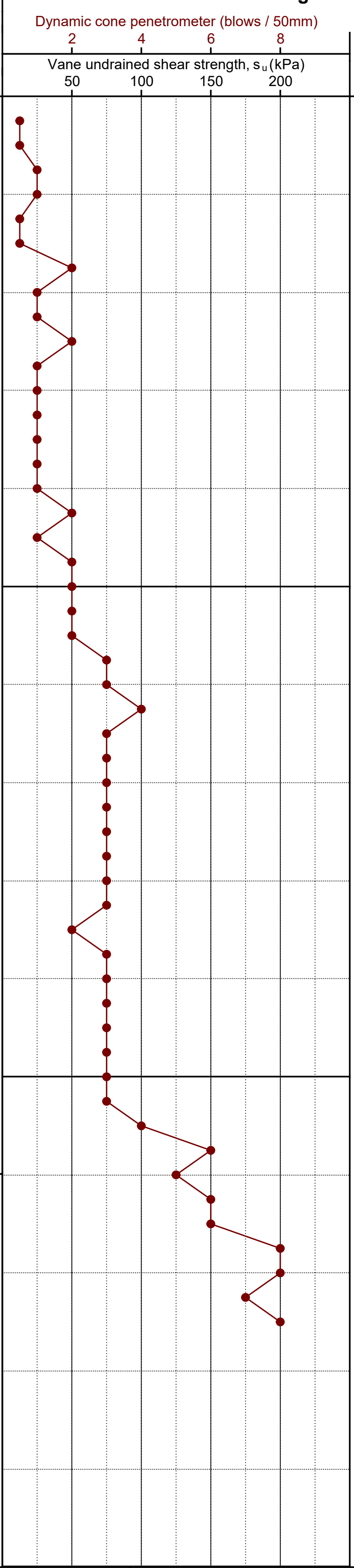
| | |
|---|---|
| **Test ID:** | HA03 |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709084mN, 2035835mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0 – 0.40 | Topsoil | SAND, with minor silt, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium. | | |
| 0.40 – 2.20 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>0.95m: Medium dense.<br>1.10m: Light brown.<br>1.50m: Wet.<br>1.80m: Saturated.<br>2.10m: Dense; poor recovery > 50%. | ▼ 1.80 | |

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5 — RL scale: 4.5, 4.0, 3.5, 3.0, 2.5

**In-situ Testing**



Values

Vane ID: N/A

peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.20m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

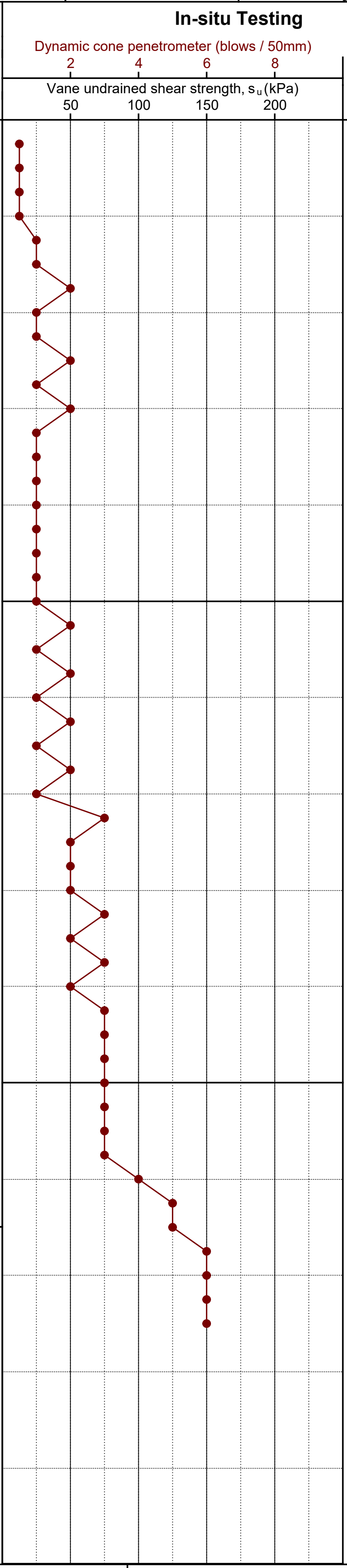
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:41 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | HA04 |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709077mN, 2035830mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water |
|---|---|---|---|---|
| | Topsoil | | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | |
| 0.5<br>1.0<br>1.5<br>2.0 | Holocene Beach Deposits | | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.45m: Medium dense.<br>1.60m: Wet.<br>1.90m: Saturated.<br>2.10m: Poor recovery>50%.<br>2.20m: Dense. | ▼ |
| 2.5 | | | | |



Values
Vane ID: N/A
peak / residual
(sensitivity)

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

| | |
|---|---|
| **Hole Depth:** 2.30m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

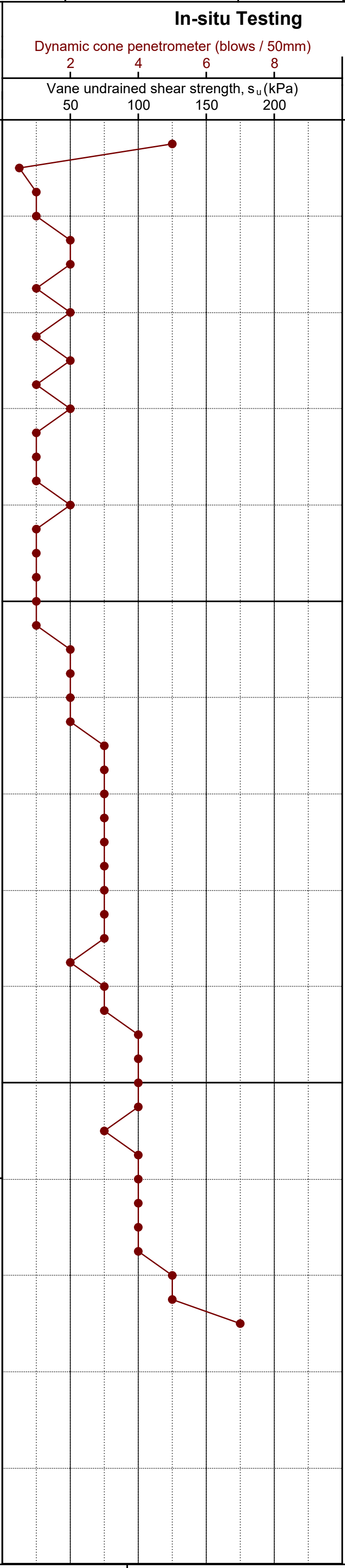
**Test ID:** HA05
**Project ID:** 24729
**Sheet:** 1 of 1

**Client:** NZHG
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne
**Test Site:** Refer to site plan

**Coordinates:** 5709093mN, 2035825mE
**System:** NZTM
**Elevation:** 5m (Presumably)
**Located By:** Site plan/map

**Test Date:** 14/09/2023
**Logged By:** SS
**Prepared By:** SS
**Checked By:** RH

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.0–0.3 | Uncontrolled Fill / Topsoil | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium; trace rock fragments. | |
| 0.3–2.2 | Holocene Beach Deposits | SAND; brownish orange. Medium dense; moist; sand, fine to medium.<br>1.00m: Light brown.<br>1.50m: Wet.<br>1.80m: Saturated.<br>1.90m: Dense.<br>2.00m: Poor recovery > 50%. | ▼ 1.8 |



Values
Vane ID: N/A
peak / residual (sensitivity)

| Depth (m) | RL (m) |
|---|---|
| 0.5 | 4.5 |
| 1.0 | 4.0 |
| 1.5 | 3.5 |
| 2.0 | 3.0 |
| 2.5 | 2.5 |

**Hole Depth:** 2.20m
**Termination:** HOLE COLLAPSE
**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow
UTP = Unable to Penetrate

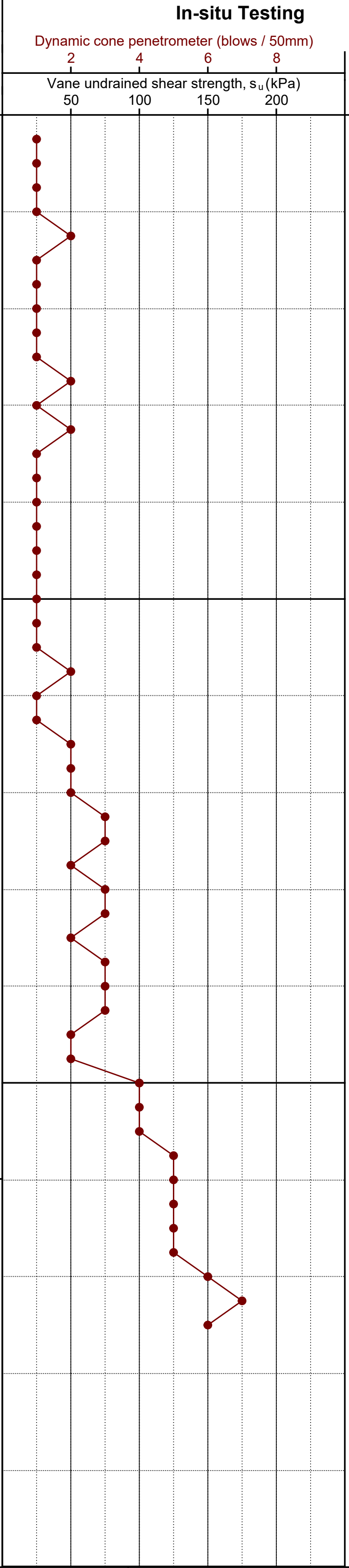
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA06** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035819mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0 – 0.60 | Uncontrolled Fill / Topsoil | SAND, with minor silt, with trace rootlets and gravel; dark brown. Loose; moist; sand, fine to medium; gravel, fine to medium, subangular.<br>0.40m: Brownish black. | | |
| 0.5 | | | | 4.5 |
| 0.60 – 2.20 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.30m: Medium dense.<br>1.60m: Wet.<br>1.80m: Saturated.<br>2.00m: Dense.<br>2.10m: Poor recovery > 30%. | ▼ (approx. 1.9m) | |
| 1.0 | | | | 4.0 |
| 1.5 | | | | 3.5 |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



**Values**

Vane ID: N/A
peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.20m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

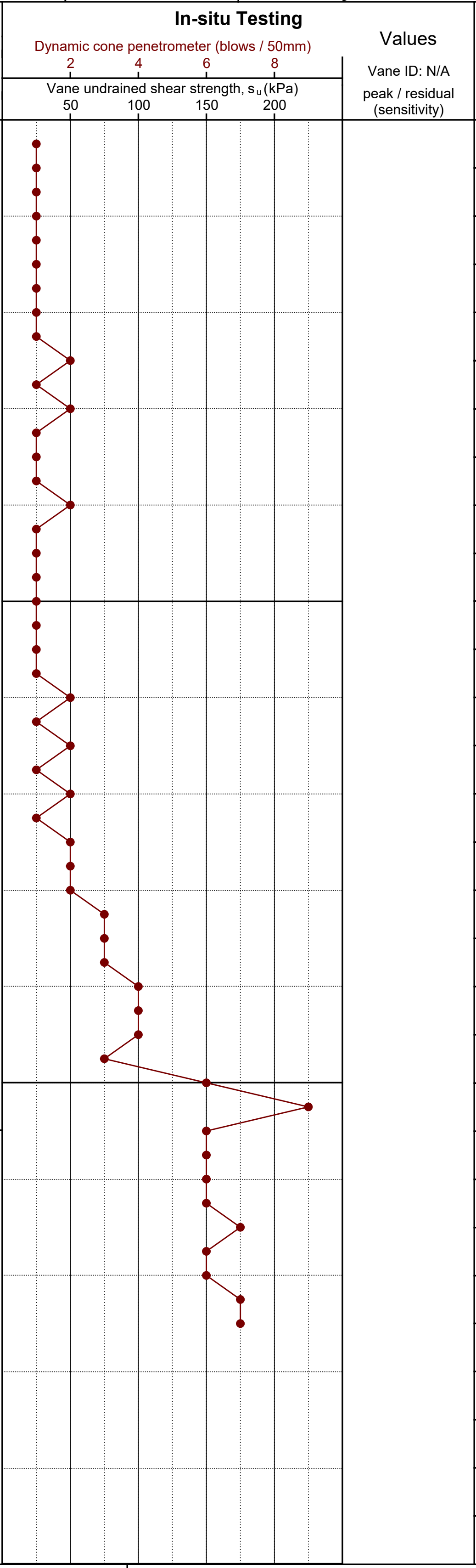
| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

# Hand Auger Borehole Log

| | | | |
|---|---|---|---|
| **Test ID:** | HA07 | | |
| **Project ID:** | 24729 | | |
| **Sheet:** | 1 of 1 | | |
| **Client:** | NZHG | **Coordinates:** | 5709106mN, 2035822mE |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map |
| **Test Date:** | 14/09/2023 | | |
| **Logged By:** | SS | | |
| **Prepared By:** | SS | | |
| **Checked By:** | RH | | |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| | Topsoil | Silty SAND, with trace rootlets; dark brown. Loose; moist; sand, fine to medium. | | |
| 0.5 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium. | | 4.5 |
| 1.0 | | 1.10m: Light brown.<br>1.20m: Medium dense.<br>1.30m: Wet. | | 4.0 |
| 1.5 | | 1.60m: Saturated. | ▼ | 3.5 |
| 2.0 | | 1.80m: Dense; poor recovery > 50%. | | 3.0 |
| 2.5 | | | | 2.5 |



**Hole Depth:** 2.10m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | | | |
|---|---|---|---|
| ● | Vane peak | ▼ | Standing water level |
| ○ | Vane residual | ◁ | Groundwater inflow |
| ◆ | Vane UTP | ▷ | Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:46 pm

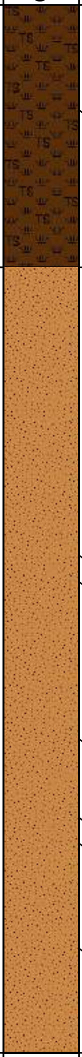
# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA08** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

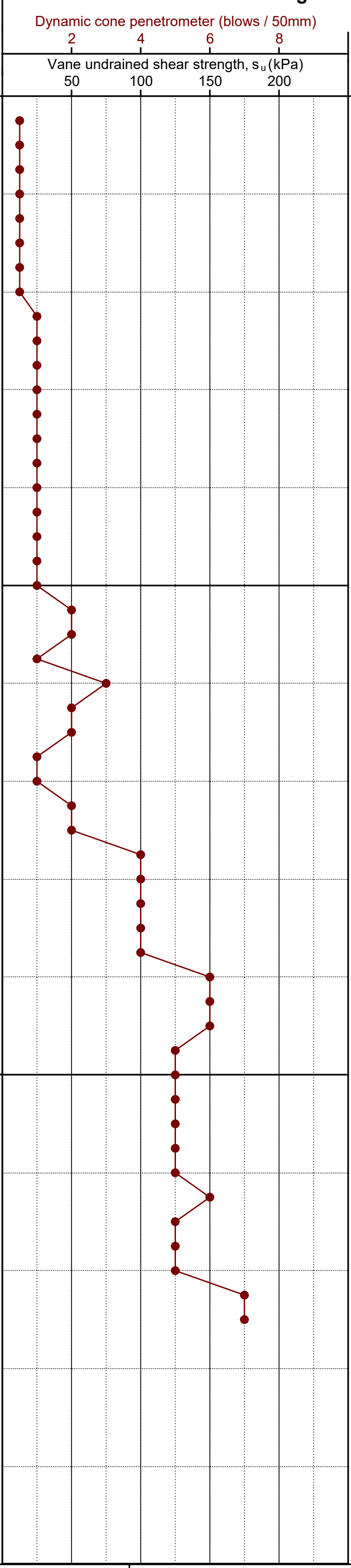
| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709111mN, 2035824mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.5 | Topsoil | SILT, with minor sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine.<br>0.20m: SAND, with minor silt. Sand, fine to medium. | | |
| 0.5–2.0 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.05m: Medium dense.<br>1.10m: Light brown.<br>1.40m: Wet.<br>1.55m: Dense.<br>1.60m: Saturated.<br>1.80m: Poor recovery > 30%. | ▼ (1.60m) | |

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5 — RL scale: 4.5, 4.0, 3.5, 3.0, 2.5



**In-situ Testing**



Values
Vane ID: N/A
peak / residual (sensitivity)

| | |
|---|---|
| **Hole Depth:** 2.00m | **Termination:** HOLE COLLAPSE |

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

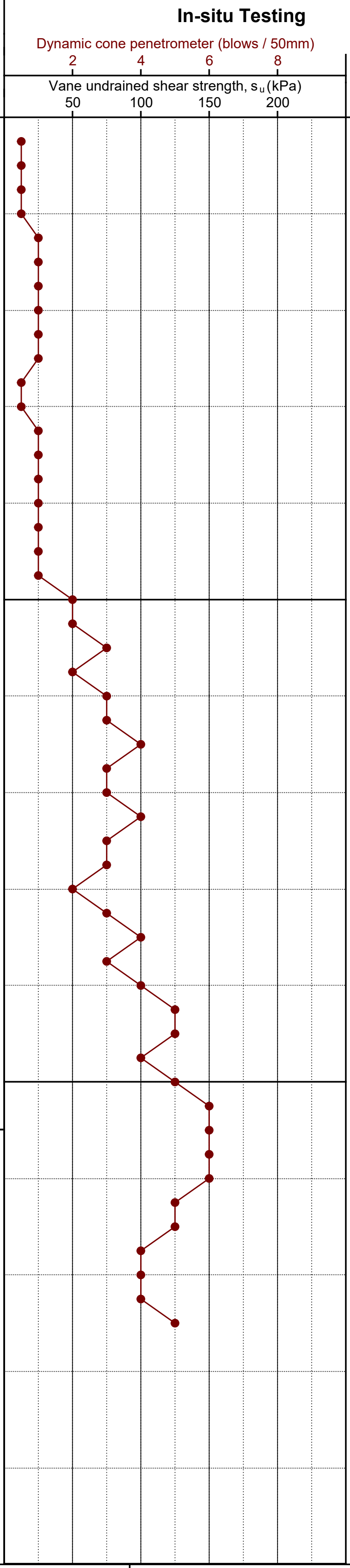
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:47 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA09** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709117mN, 2035814mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.40 | Uncontrolled Fill / Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine; trace glass fragments. | | |
| 0.40–2.10 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.00m: Medium dense.<br>1.10m: SAND; light brown. Sand, fine to coarse.<br>1.50m: Wet.<br>1.70m: Dense; saturated. | ▼ | |



Values

Vane ID: N/A

peak / residual (sensitivity)

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5

RL (m): 4.5, 4.0, 3.5, 3.0, 2.5

**Hole Depth:** 2.10m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

UTP = Unable to Penetrate

Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:49 pm

# Hand Auger Borehole Log

LDE LAND DEVELOPMENT & ENGINEERING

**Test ID:** HA10
**Project ID:** 24729
**Sheet:** 1 of 1

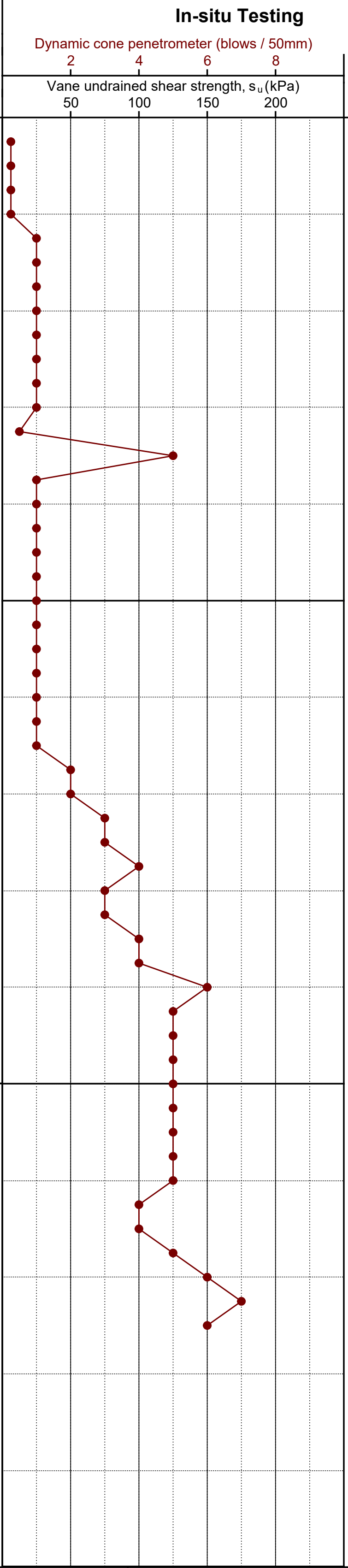
**Client:** NZHG
**Project:** Geotechnical Investigation for Proposed Subdivision
**Location:** 99A Stanley Road, Gisborne
**Test Site:** Refer to site plan

**Coordinates:** 5709108mN, 2035814mE
**System:** NZTM
**Elevation:** 5m (Presumably)
**Located By:** Site plan/map

**Test Date:** 14/09/2023
**Logged By:** SS
**Prepared By:** SS
**Checked By:** RH

| Depth (m) | Geology | Material Description | Water | RL (m) |
|---|---|---|---|---|
| 0.0–0.3 | Topsoil | SILT, with some sand, with trace rootlets; dark brown. Stiff; moist; non-plastic; sand, fine. | | |
| 0.3–2.0 | Holocene Beach Deposits | SAND; light brown. Loose; moist; sand, fine to medium.<br>1.20m: With minor silt.<br>1.35m: Medium dense.<br>1.40m: SAND. Sand, fine to coarse.<br>1.50m: Wet.<br>1.70m: Dense; saturated. | ▼ (1.70m) | |
| 0.5 | | | | 4.5 |
| 1.0 | | | | 4.0 |
| 1.5 | | | | 3.5 |
| 2.0 | | | | 3.0 |
| 2.5 | | | | 2.5 |

**In-situ Testing**



**Values**

Vane ID: N/A
peak / residual
(sensitivity)

**Hole Depth:** 2.00m
**Termination:** HOLE COLLAPSE
**Remarks:** Hole collapse in saturated sands..

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow
UTP = Unable to Penetrate

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

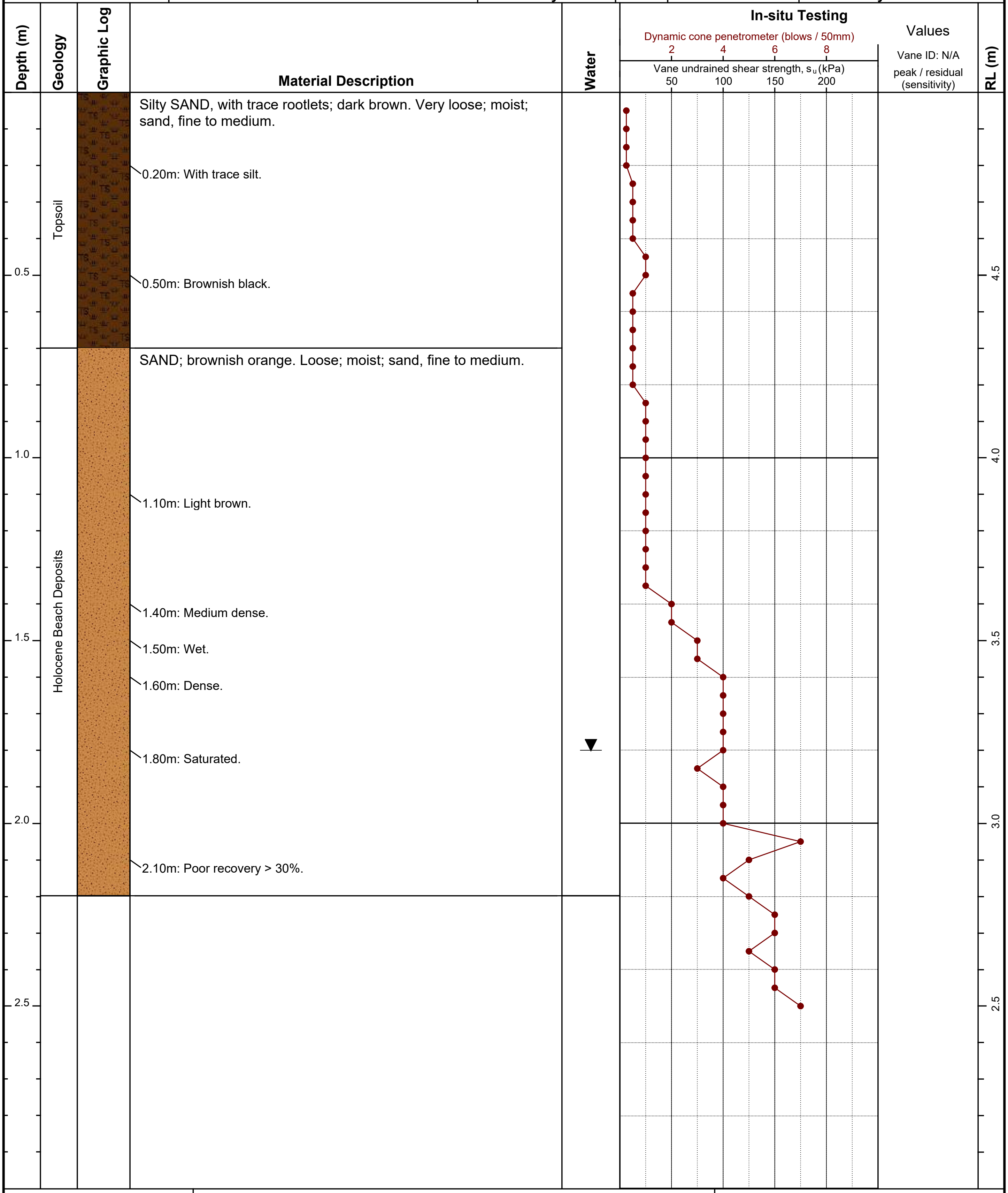
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:50 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA11** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709098mN, 2035805mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Material Description | Water |
|---|---|---|---|
| 0.00–0.70 | Topsoil | Silty SAND, with trace rootlets; dark brown. Very loose; moist; sand, fine to medium.<br>0.20m: With trace silt.<br>0.50m: Brownish black. | |
| 0.70–2.20 | Holocene Beach Deposits | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.40m: Medium dense.<br>1.50m: Wet.<br>1.60m: Dense.<br>1.80m: Saturated.<br>2.10m: Poor recovery > 30%. | ▼ 1.80 |



**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak
○ Vane residual
◆ Vane UTP
▼ Standing water level
◁ Groundwater inflow
▷ Groundwater outflow
UTP = Unable to Penetrate

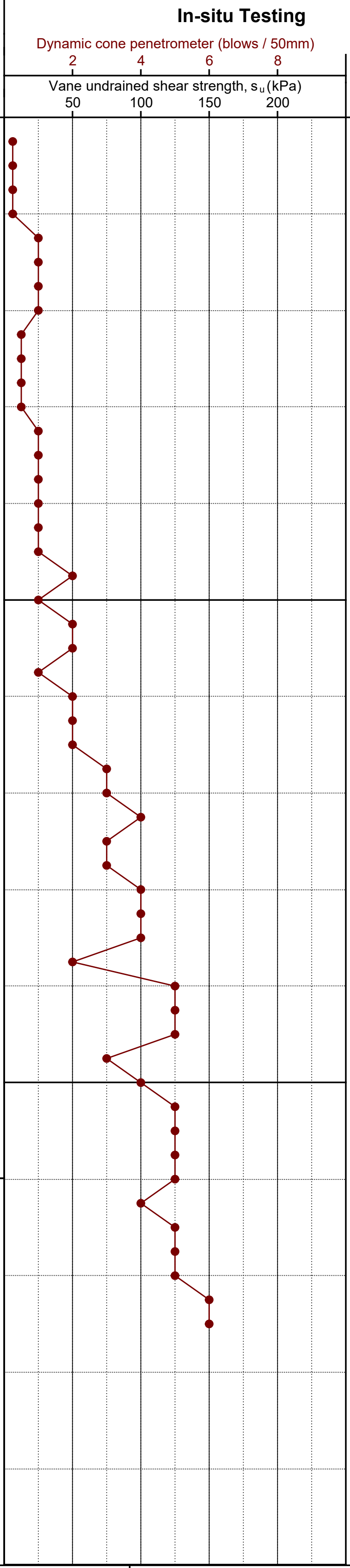
Generated with CORE-GS by Geroc - HAxTP Log v9 - 10/10/2023 12:08:51 pm

# Hand Auger Borehole Log

| | |
|---|---|
| **Test ID:** | **HA12** |
| **Project ID:** | 24729 |
| **Sheet:** | 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| **Client:** | NZHG | **Coordinates:** | 5709088mN, 2035801mE | **Test Date:** | 14/09/2023 |
| **Project:** | Geotechnical Investigation for Proposed Subdivision | **System:** | NZTM | **Logged By:** | SS |
| **Location:** | 99A Stanley Road, Gisborne | **Elevation:** | 5m (Presumably) | **Prepared By:** | SS |
| **Test Site:** | Refer to site plan | **Located By:** | Site plan/map | **Checked By:** | RH |

| Depth (m) | Geology | Graphic Log | Material Description | Water | Values<br>Vane ID: N/A<br>peak / residual (sensitivity) | RL (m) |
|---|---|---|---|---|---|---|
| 0.5 | Topsoil | | Silty SAND, with trace rootlets; brownish black. Very loose; moist; sand, fine to medium.<br>0.50m: Brownish grey. | | | 4.5 |
| 1.0<br>1.5<br>2.0 | Holocene Beach Deposits | | SAND; brownish orange. Loose; moist; sand, fine to medium.<br>1.10m: Light brown.<br>1.20m: Medium dense.<br>1.50m: Wet.<br>1.80m: Saturated.<br>2.00m: Dense; poor recovery > 50%. | ▼ | | 4.0<br>3.5<br>3.0 |
| 2.5 | | | | | | 2.5 |



**Hole Depth:** 2.20m **Termination:** HOLE COLLAPSE

**Remarks:** Hole collapse in saturated sands..

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

| | |
|---|---|
| ● Vane peak | ▼ Standing water level |
| ○ Vane residual | ◁ Groundwater inflow |
| ◆ Vane UTP | ▷ Groundwater outflow |

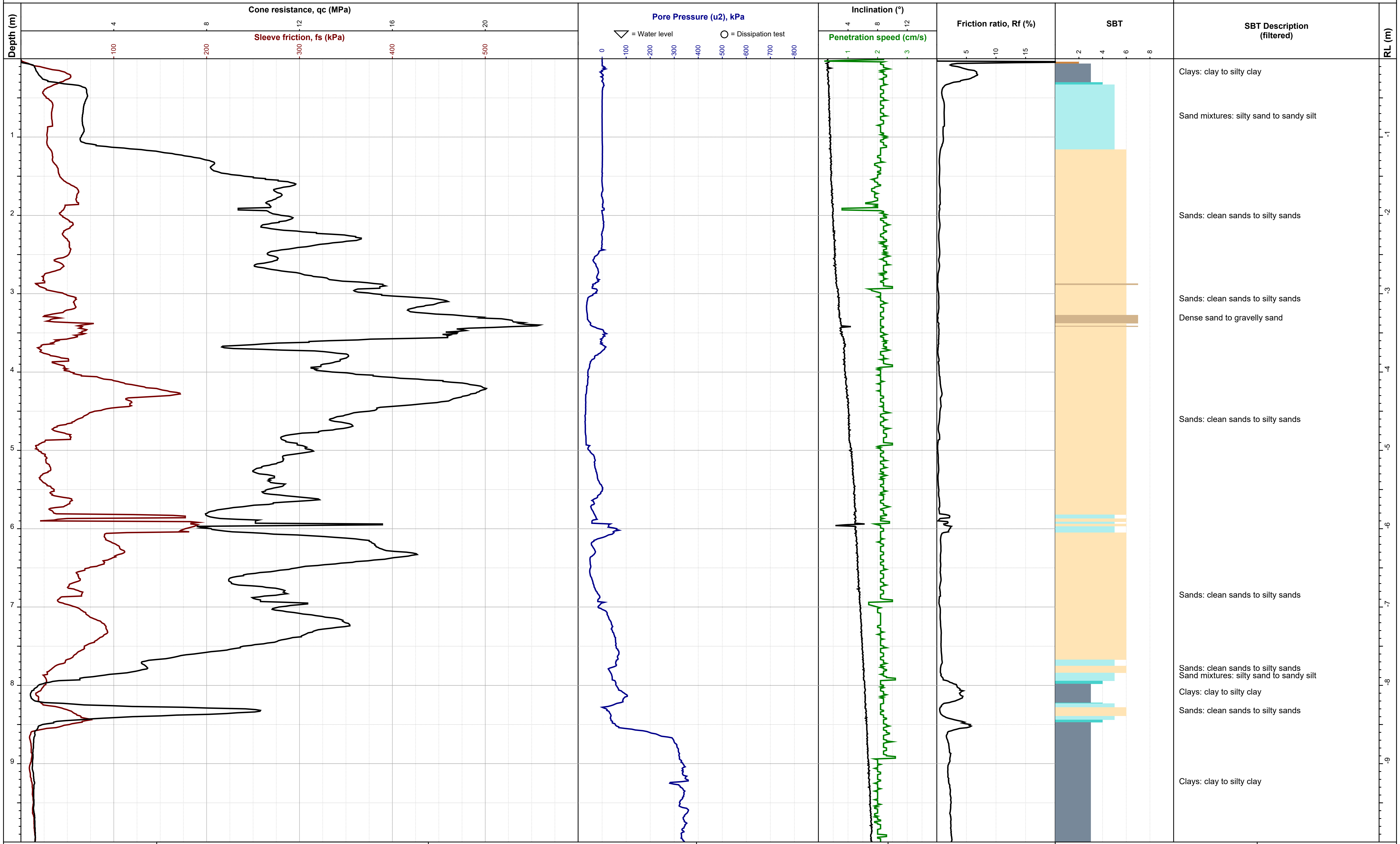
UTP = Unable to Penetrate

# APPENDIX C

# CONE PENETROMETER TEST LOGS

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT01**



LDE
LAND DEVELOPMENT & ENGINEERING

| | |
|---|---|
| **Client:** | TW Property Holdings Limited |
| **Project:** | Geotechnical Investigation for Proposed Subdivision |
| **Location:** | 99A Stanley Road, Gisborne |

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

| | |
|---|---|
| **Northing:** | 5709111mN |
| **Easting:** | 2035820mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | CK |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 001042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

**Test ID:**

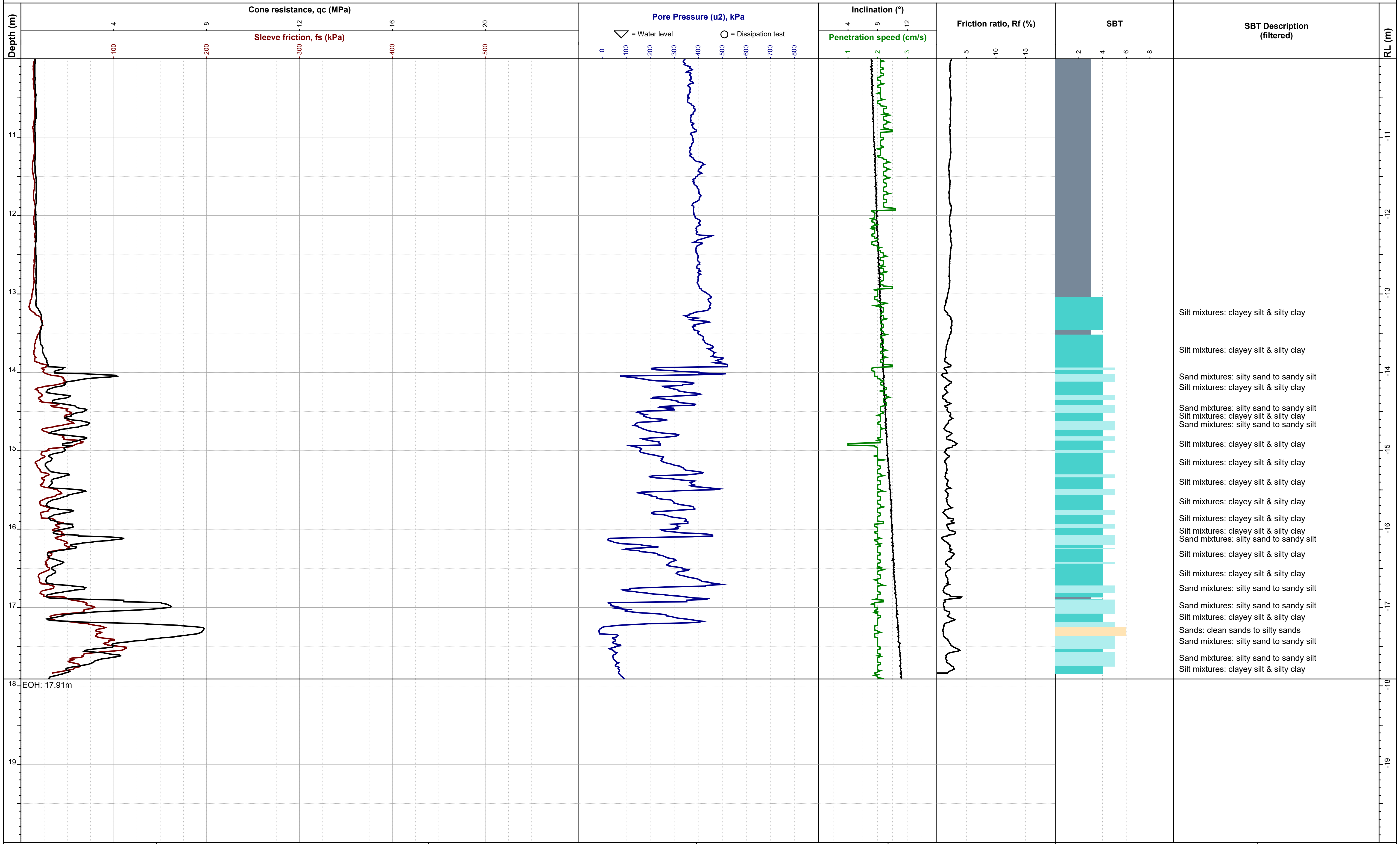
**CPT01**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 17.91m |
| **Sheet:** | 1 of 2 |
| **Date:** | 03/10/2023 |

Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:08 am

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT01**



Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 5/10/2023 10:01:09 am

LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.15m and dipped dry.

**Termination Reason:**
Excessive inclination

**Northing:** 5709111mN
**Easting:** 2035820mE
**System:** NZTM
**Elevation:** Ground
**Located By:** Phone GPS
**Location:** As per GIP

**Operator:** CK
**Rig:** Pagani TG63-150
**Cone ID:** 001042
**Type:** Comp. piezo cone
**Cone Area:** 10 cm²
**Sleeve Area:** 150 cm²
**Area Ratio:** 0.8

**Soil Behaviour Type - Robertson 1986**

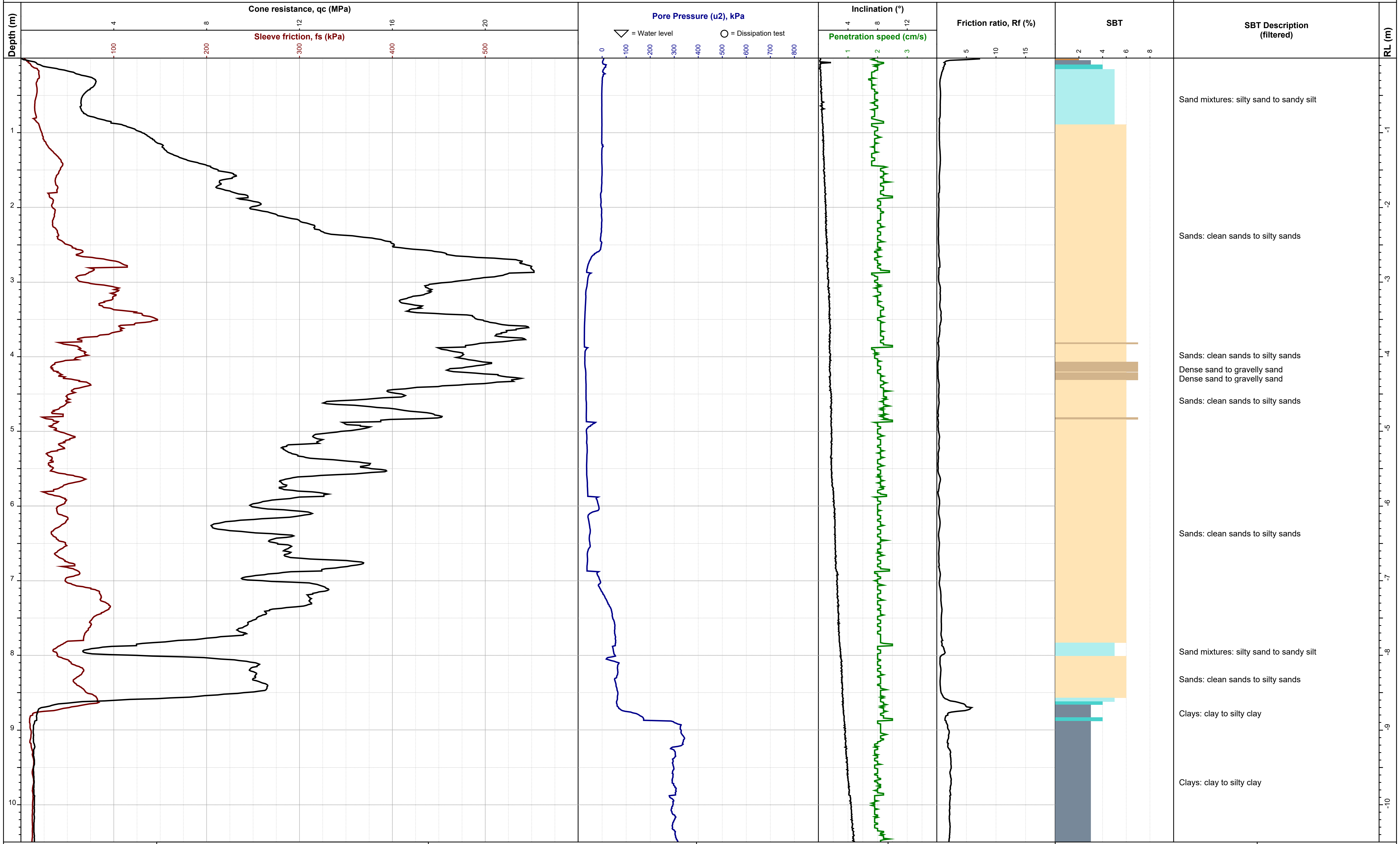
| | | | |
|---|---|---|---|
| 0 | Undefined | 5 | Sand mixtures: silty sand to sandy silt |
| 1 | Sensitive fine-grained | 6 | Sands: clean sands to silty sands |
| 2 | Clay - organic soil | 7 | Dense sand to gravelly sand |
| 3 | Clays: clay to silty clay | 8 | Stiff sand to clayey sand |
| 4 | Silt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

**Test ID:**
**CPT01**

**Project ID:** 24729
**Depth:** 17.91m
**Sheet:** 2 of 2
**Date:** 03/10/2023

# Cone Penetration Test (CPTu) Log

**Test ID:** **CPT02**



Generated with CORE-GS by Geroc - CPT Combined A3 v1 - 2/10/2023 11:42:11 am

LAND DEVELOPMENT & ENGINEERING

**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 1986**

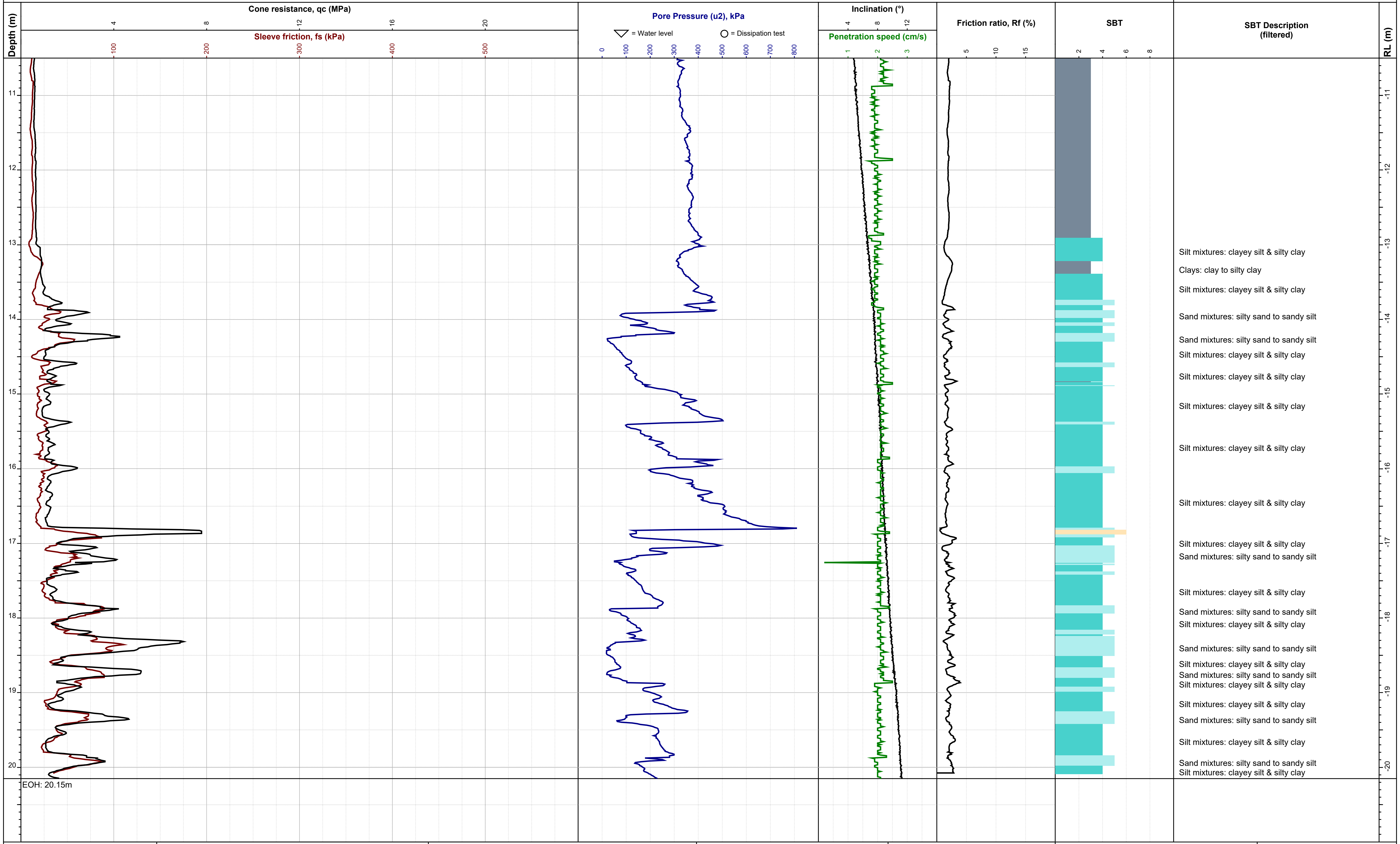
| | | | |
|---|---|---|---|
| 0 | Undefined | 5 | Sand mixtures: silty sand to sandy silt |
| 1 | Sensitive fine-grained | 6 | Sands: clean sands to silty sands |
| 2 | Clay - organic soil | 7 | Dense sand to gravelly sand |
| 3 | Clays: clay to silty clay | 8 | Stiff sand to clayey sand |
| 4 | Silt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

**Test ID:** **CPT02**

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 1 of 2 |
| **Date:** | 14/09/2023 |

# Cone Penetration Test (CPTu) Log

**Test ID:** CPT02



**Client:** TW Property Holdings Limited

**Project:** Geotechnical Investigation for Proposed Subdivision

**Location:** 99A Stanley Road, Gisborne

**Remarks:**
Hole collapsed at 1.10m and dipped dry.

**Termination Reason:**
Target depth

| | |
|---|---|
| **Northing:** | 5709081mN |
| **Easting:** | 2035837mE |
| **System:** | NZTM |
| **Elevation:** | Ground |
| **Located By:** | Phone GPS |
| **Location:** | As per GIP |

| | |
|---|---|
| **Operator:** | JC |
| **Rig:** | Pagani TG63-150 |
| **Cone ID:** | 1042 |
| **Type:** | Comp. piezo cone |
| **Cone Area:** | 10 cm² |
| **Sleeve Area:** | 150 cm² |
| **Area Ratio:** | 0.8 |

**Soil Behaviour Type - Robertson 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 |

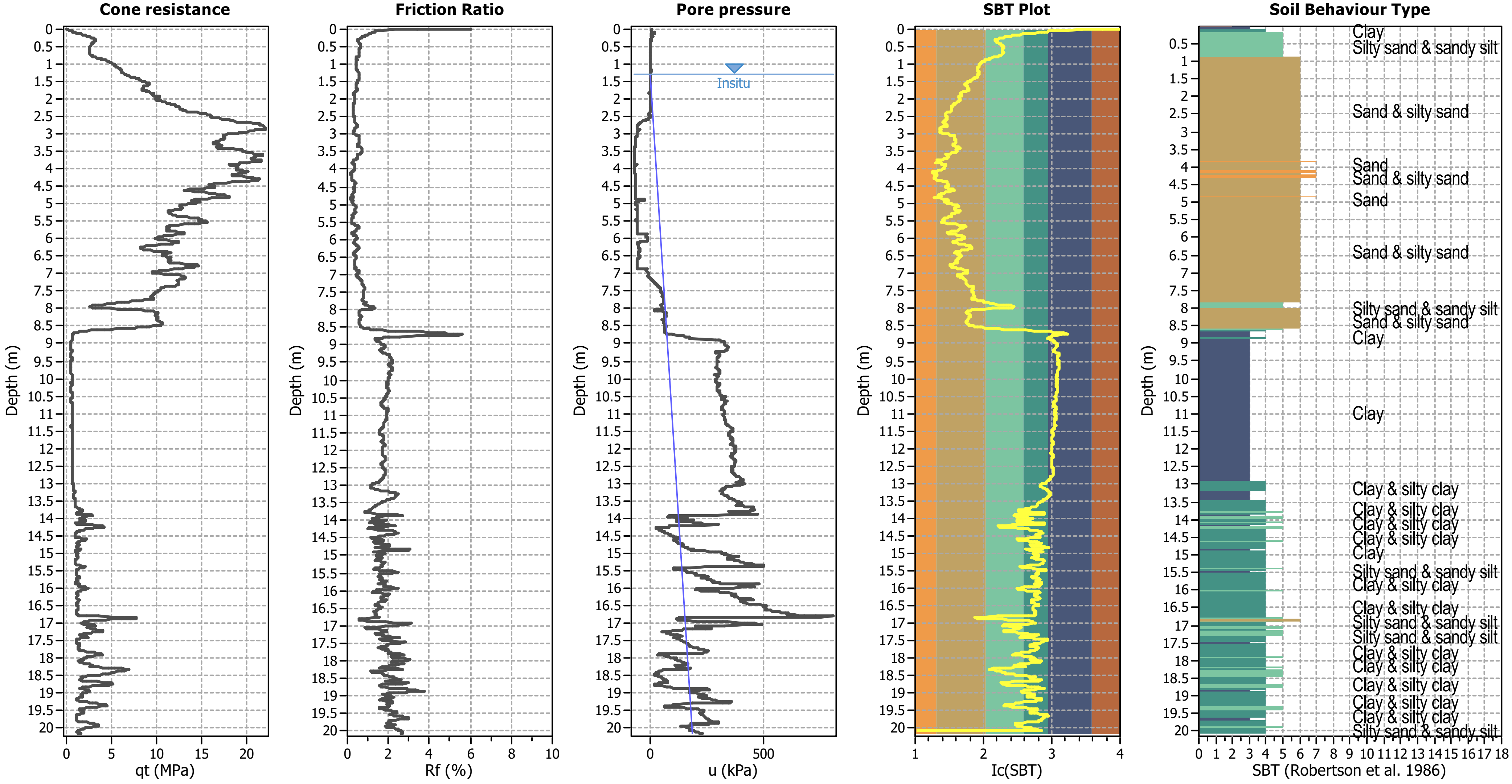
**Test ID:** CPT02

| | |
|---|---|
| **Project ID:** | 24729 |
| **Depth:** | 20.15m |
| **Sheet:** | 2 of 2 |
| **Date:** | 14/09/2023 |

# APPENDIX D

# LIQUEFACTION ANALYSIS RESULTS

# CPT basic interpretation plots



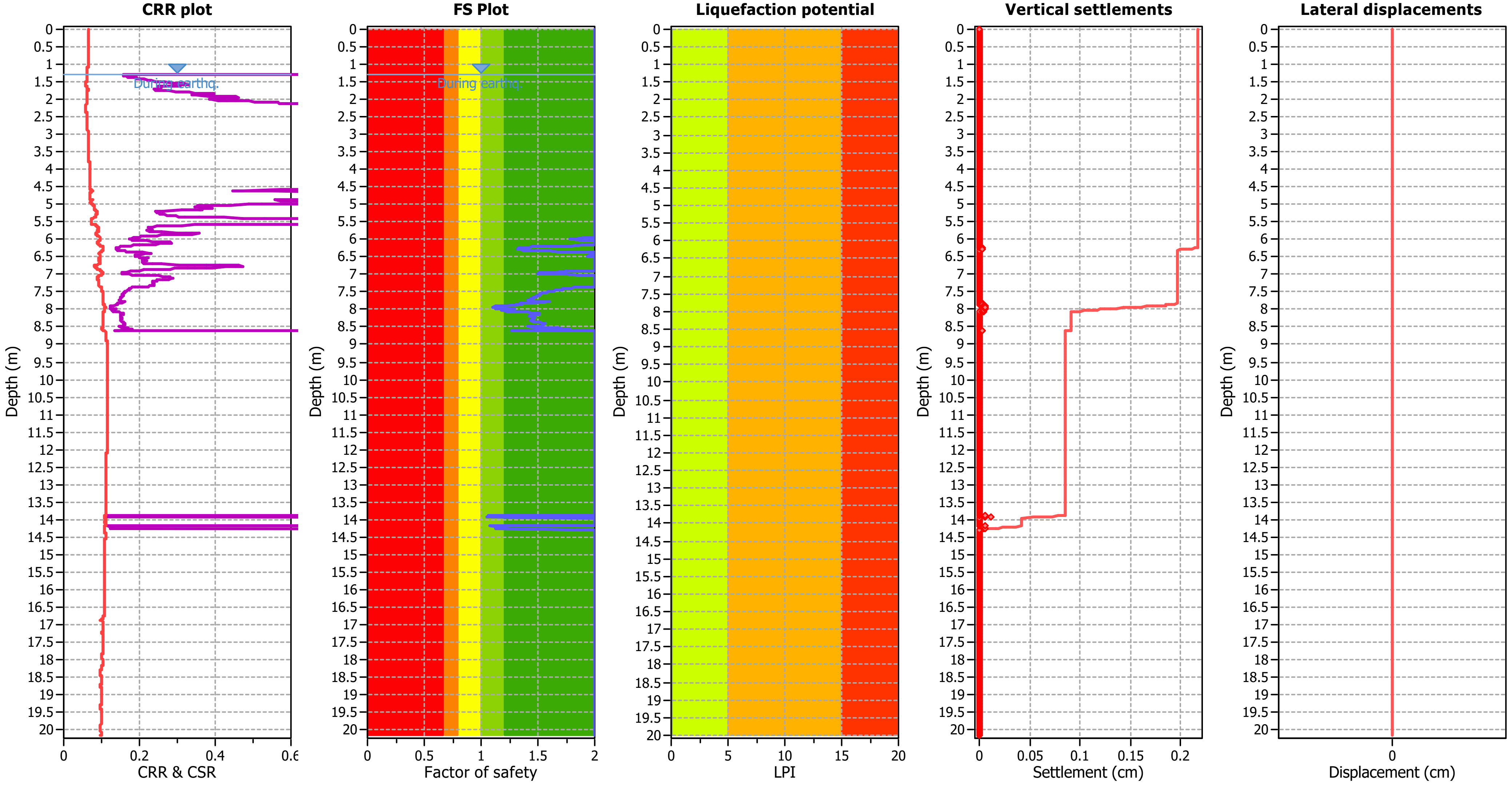
## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬛ 8. Very stiff sand to |
| 🟦 3. Clay to silty clay | 🟫 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.30
Peak ground acceleration: 0.12
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 15.00 m

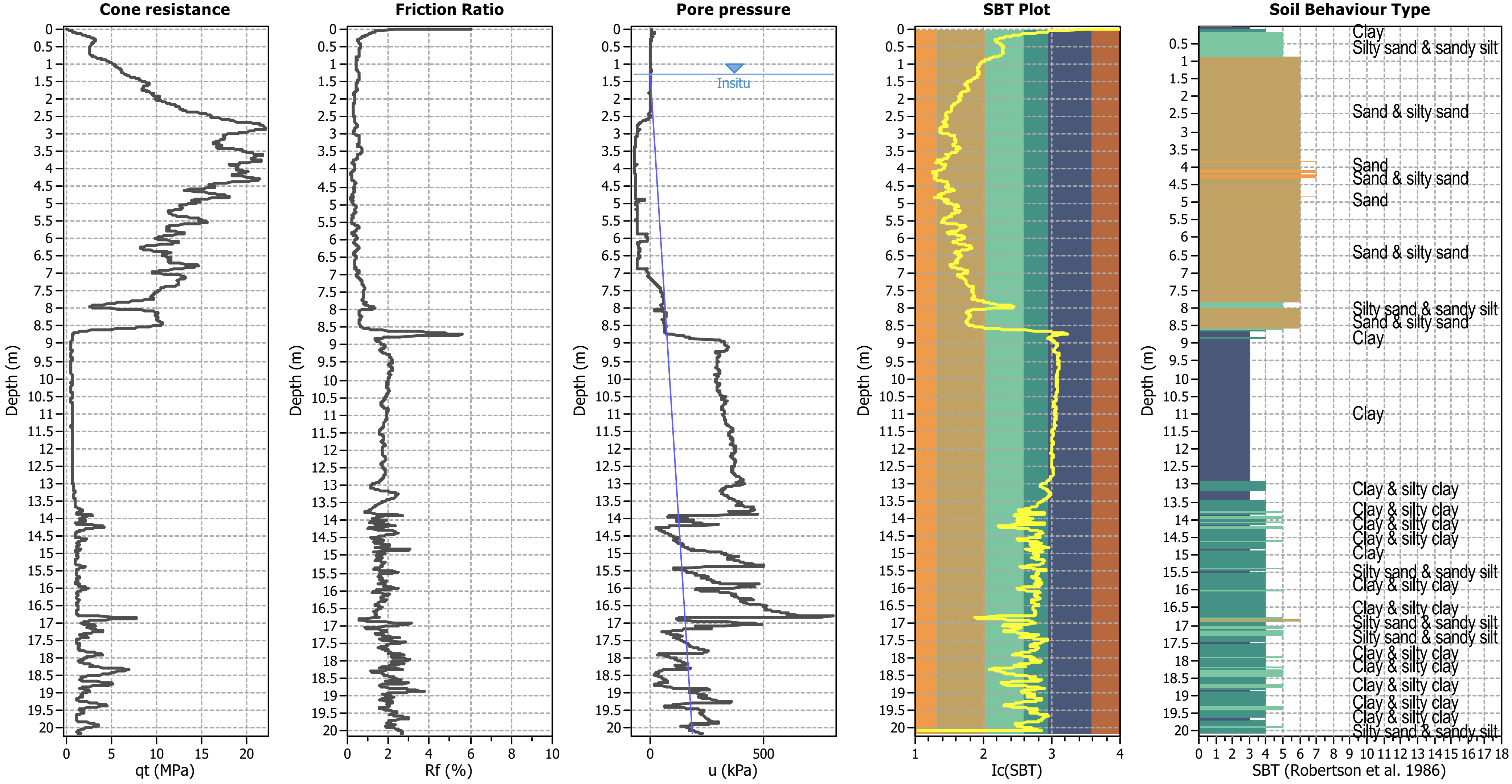
**F.S. color scheme**

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

# CPT basic interpretation plots



## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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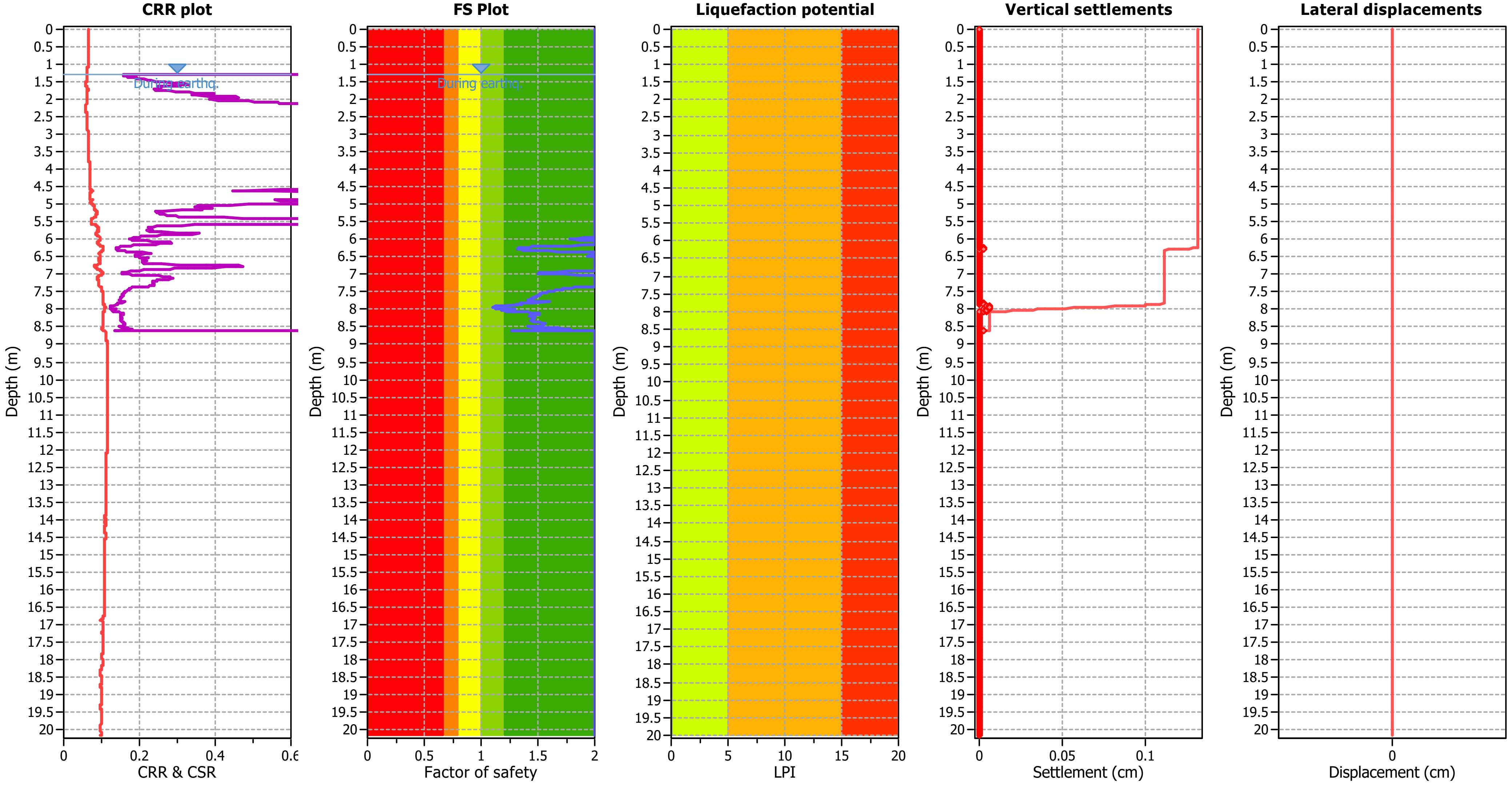
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
| 🟫 2. Organic material | 🟩 5. Silty sand to sandy silt | ⬜ 8. Very stiff sand to |
| 🟦 3. Clay to silty clay | 🟫 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.30 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.12 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

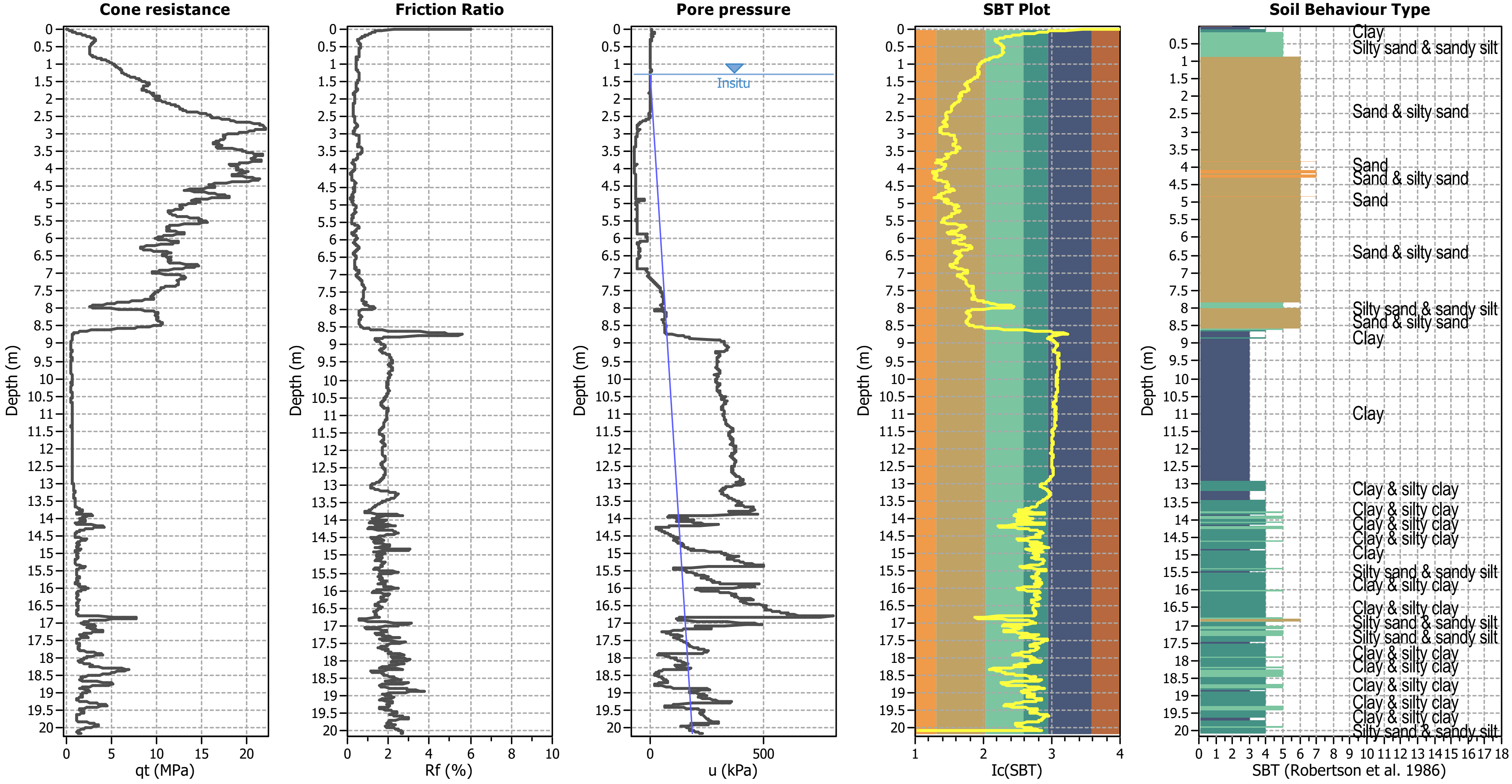
## F.S. color scheme

- 🟥 Almost certain it will liquefy
- 🟧 Very likely to liquefy
- 🟨 Liquefaction and no liq. are equally likely
- 🟩 Unlike to liquefy
- 🟩 Almost certain it will not liquefy

## LPI color scheme

- 🟥 Very high risk
- 🟧 High risk
- 🟨 Low risk

## CPT basic interpretation plots



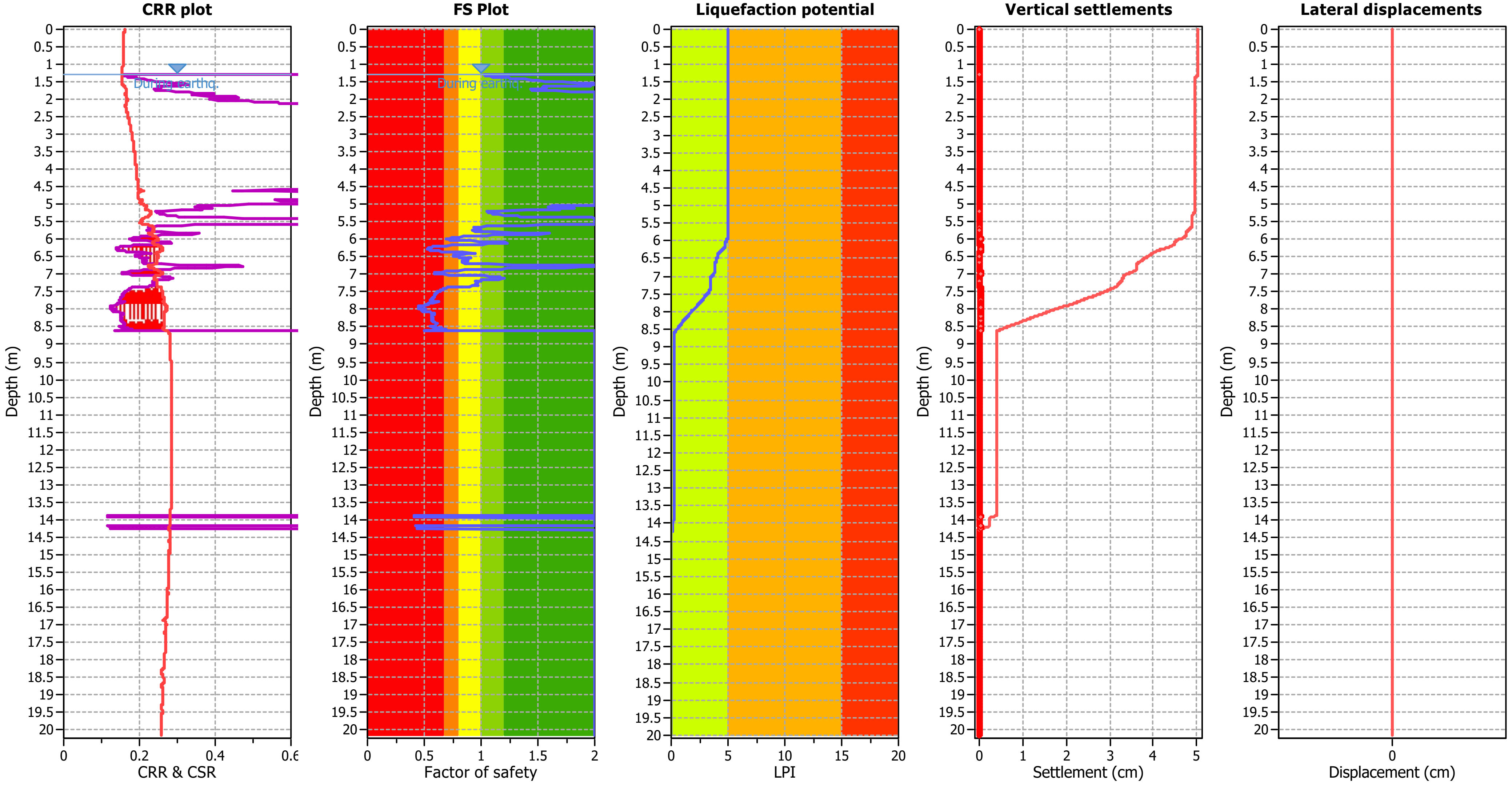
**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

| | | | | | |
|---|---|---|---|---|---|
| 🟥 | 1. Sensitive fine grained | 🟩 | 4. Clayey silt to silty | 🟧 | 7. Gravely sand to sand |
| 🟫 | 2. Organic material | 🟩 | 5. Silty sand to sandy silt | ⬜ | 8. Very stiff sand to |
| 🟦 | 3. Clay to silty clay | 🟫 | 6. Clean sand to silty sand | ⬜ | 9. Very stiff fine grained |

# Liquefaction analysis overall plots



**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
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| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**F.S. color scheme**

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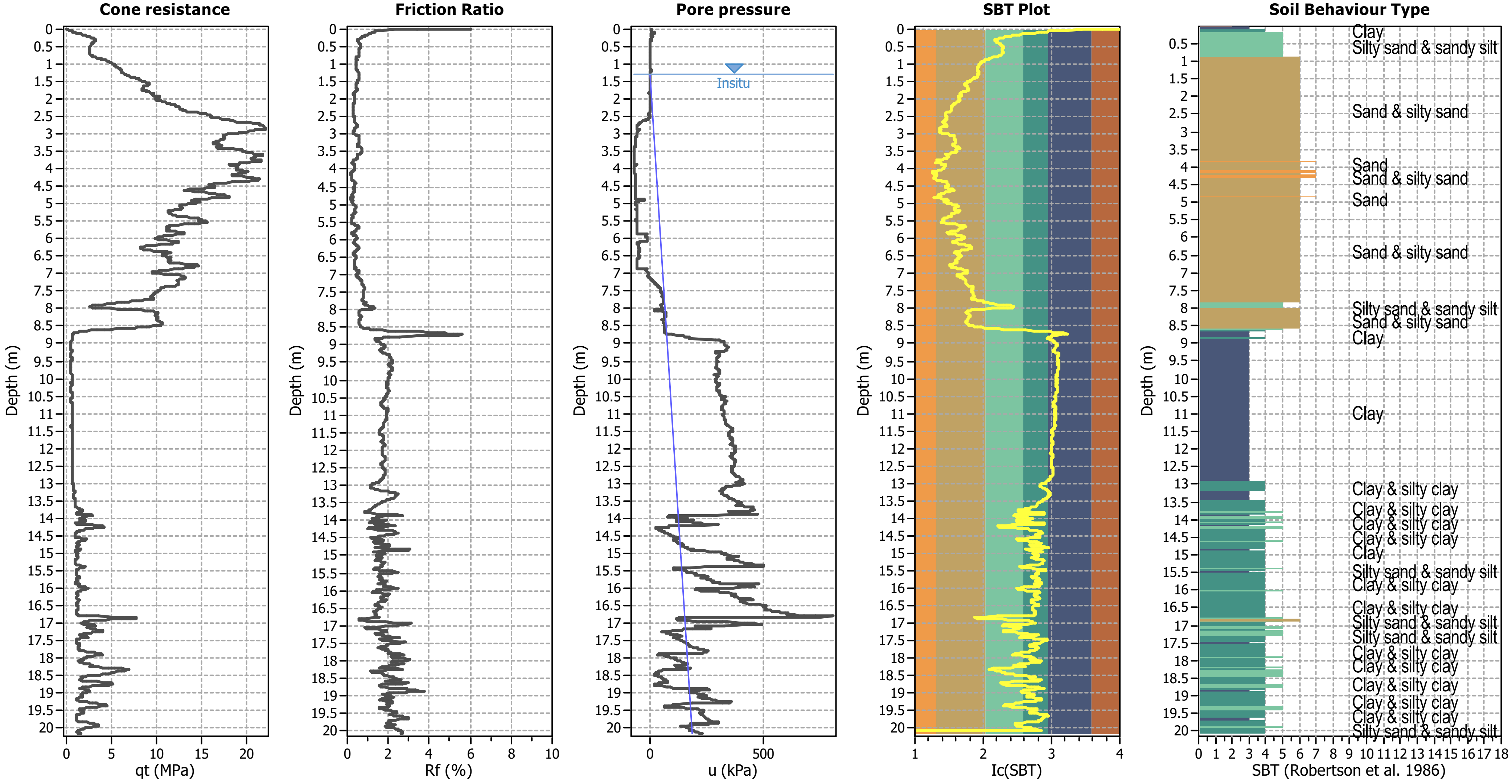
**LPI color scheme**

- 🟥 Very high risk
- 🟧 High risk
- 🟩 Low risk

# CPT basic interpretation plots



**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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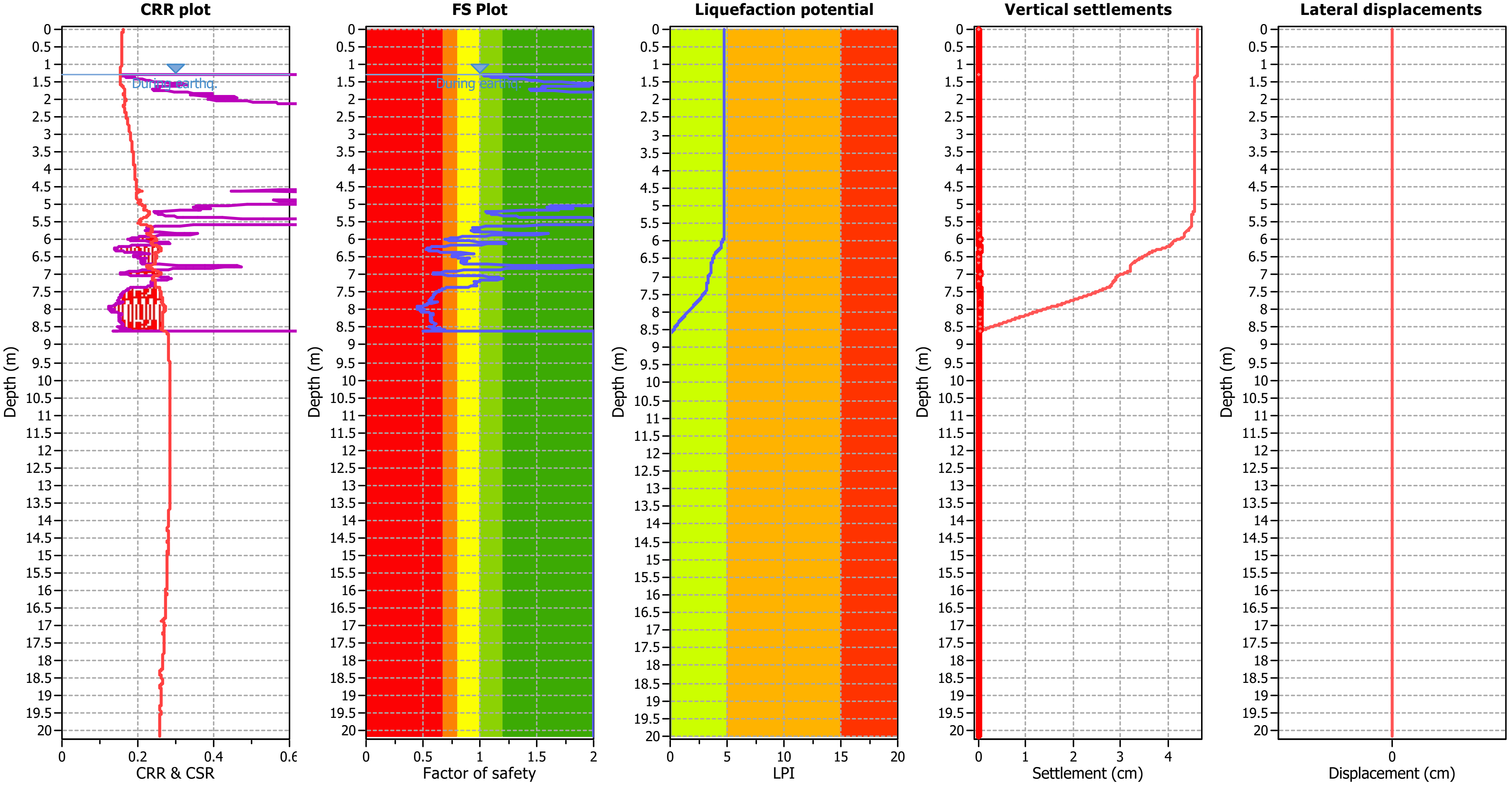
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.80 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.28 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

- 🟥 1. Sensitive fine grained
- 🟫 2. Organic material
- 🟦 3. Clay to silty clay
- 🟩 4. Clayey silt to silty
- 🟩 5. Silty sand to sandy silt
- 🟫 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 6.80
Peak ground acceleration: 0.28
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

## F.S. color scheme

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## LPI color scheme

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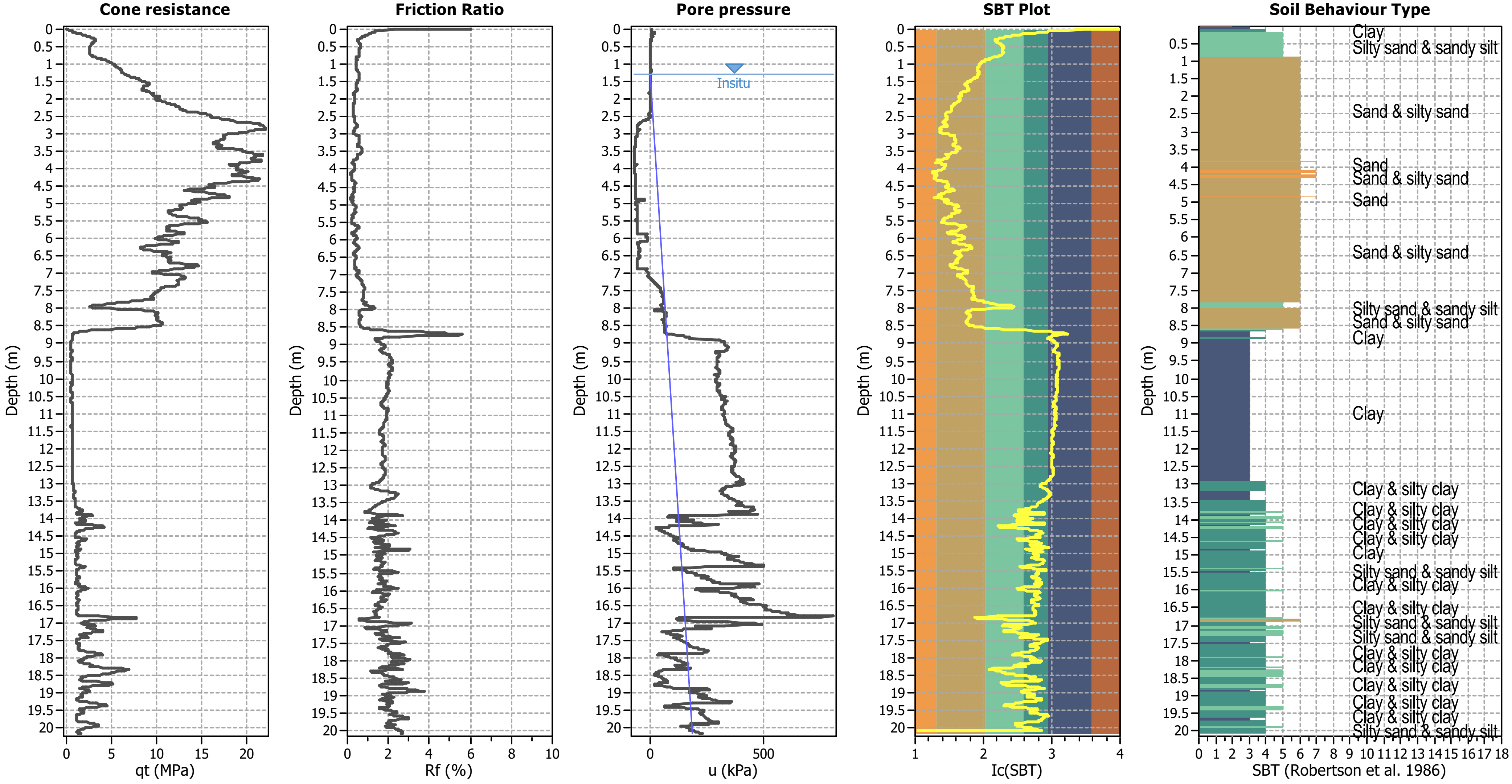
# CPT basic interpretation plots



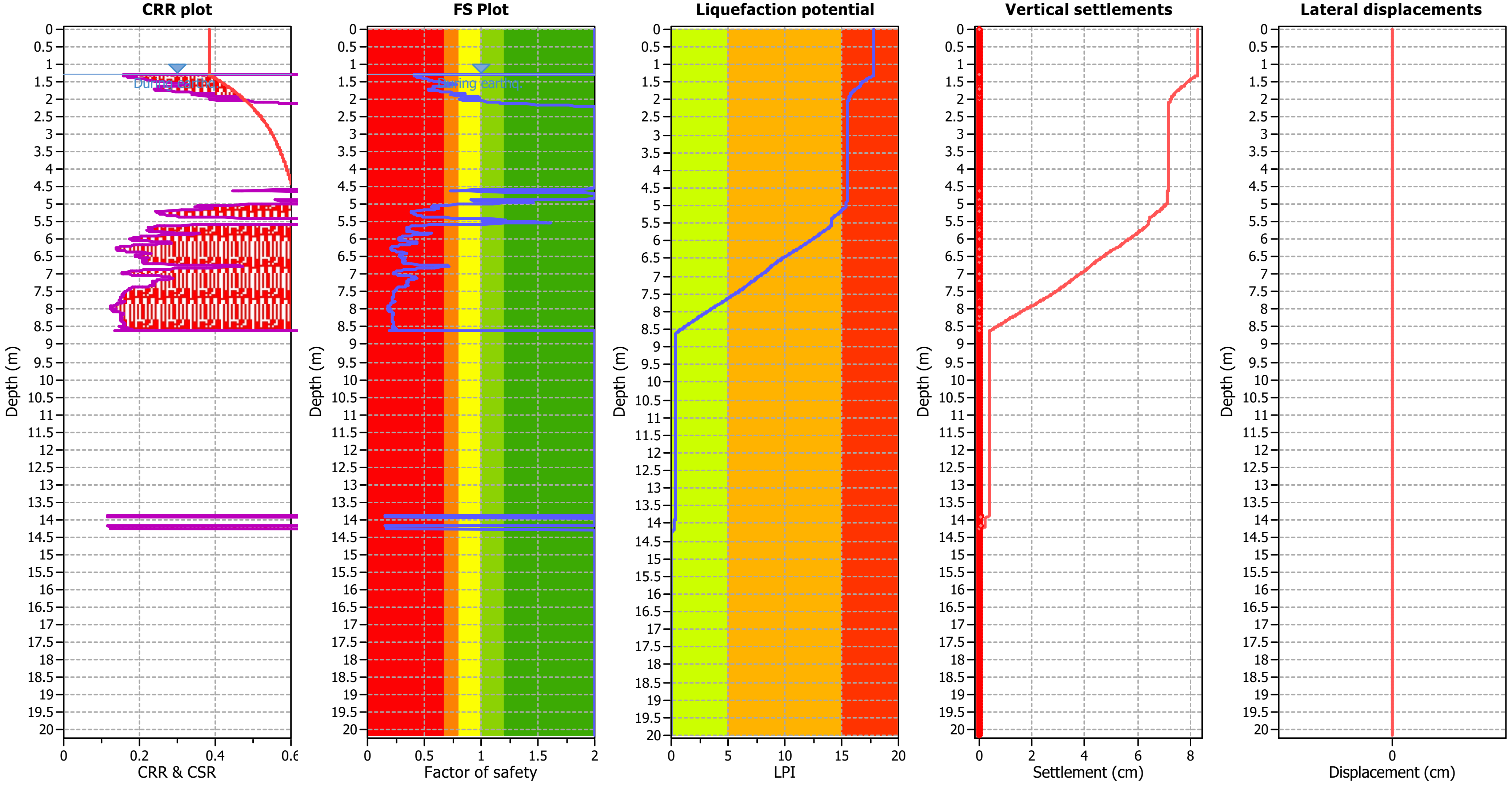
**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.65 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

**SBT legend**

| | | | | | |
|---|---|---|---|---|---|
| 🟥 | 1. Sensitive fine grained | 🟩 | 4. Clayey silt to silty | 🟧 | 7. Gravely sand to sand |
| 🟫 | 2. Organic material | 🟩 | 5. Silty sand to sandy silt | ⬛ | 8. Very stiff sand to |
| 🟦 | 3. Clay to silty clay | 🟫 | 6. Clean sand to silty sand | ⬜ | 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 7.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
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**LPI color scheme**

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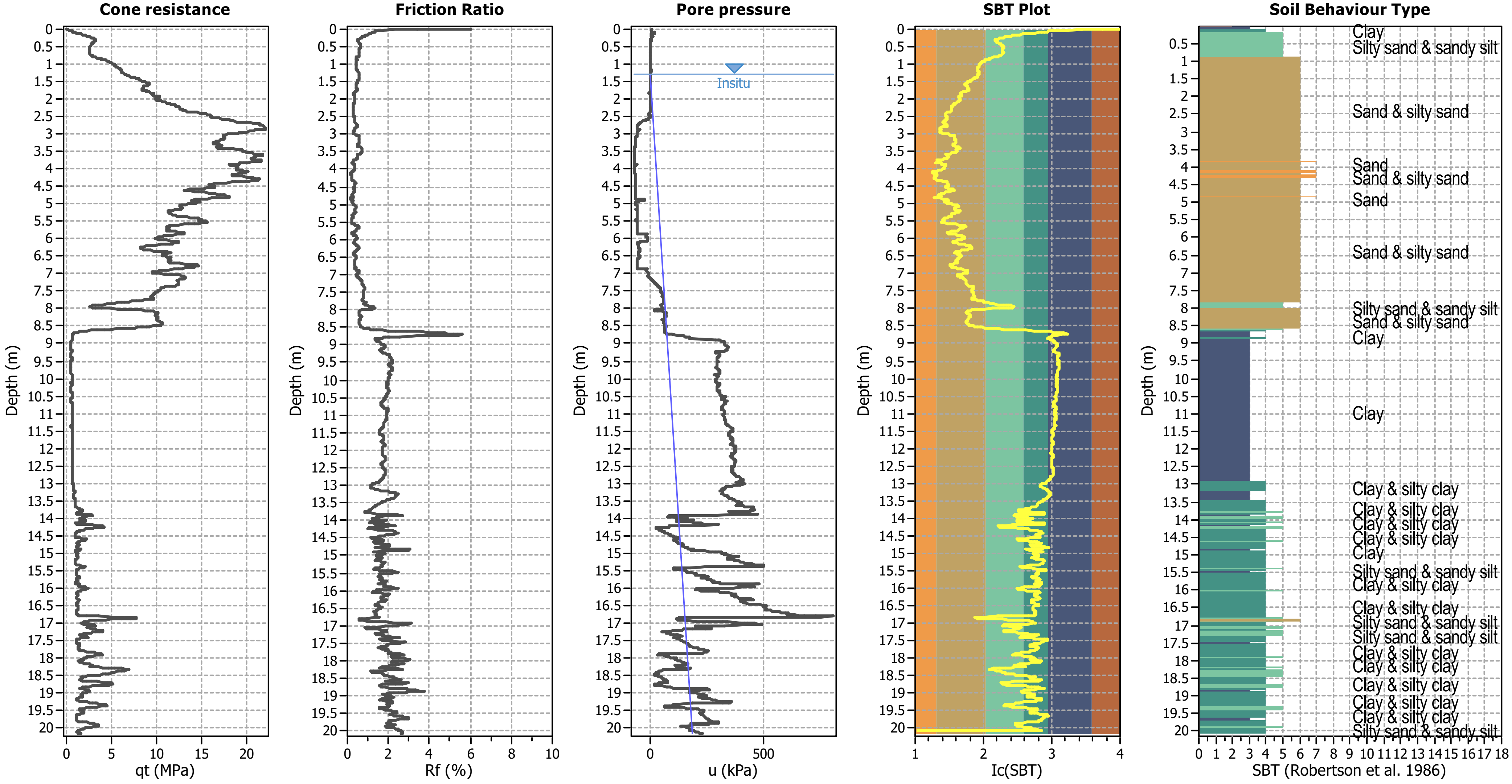
# CPT basic interpretation plots



**Input parameters and analysis data**

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|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
| Fines correction method: | B&I (2014) | Average results interval: | 3 | Transition detect. applied: | No |
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| Earthquake magnitude $M_w$: | 7.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
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| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

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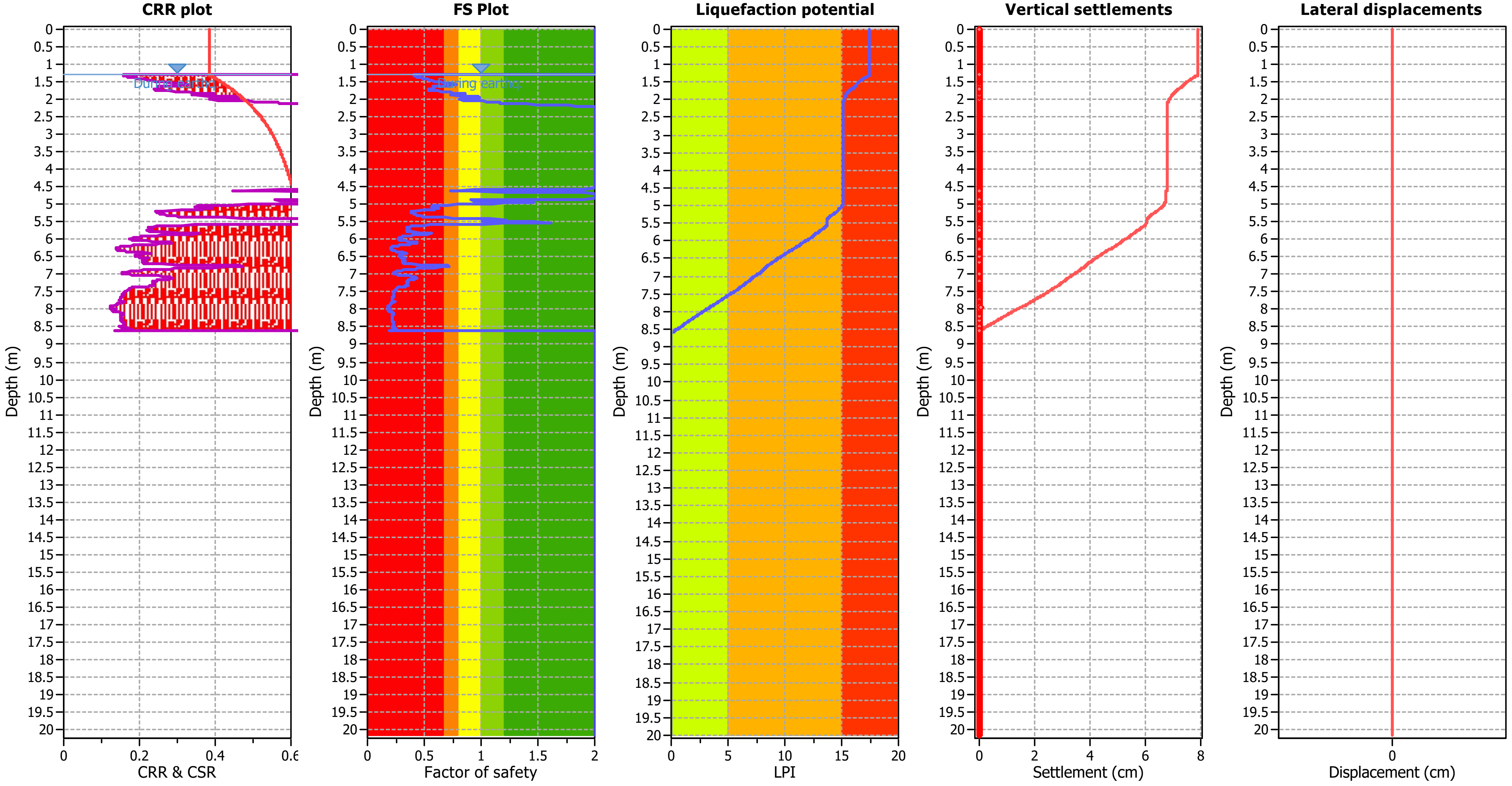
- 🟩 5. Silty sand to sandy silt
- 🟫 6. Clean sand to silty sand
- 🟧 7. Gravely sand to sand
- ⬛ 8. Very stiff sand to
- ⬜ 9. Very stiff fine grained

# Liquefaction analysis overall plots



## Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 7.50
Peak ground acceleration: 0.65
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sands only
Limit depth applied: Yes
Limit depth: 10.00 m

**F.S. color scheme**

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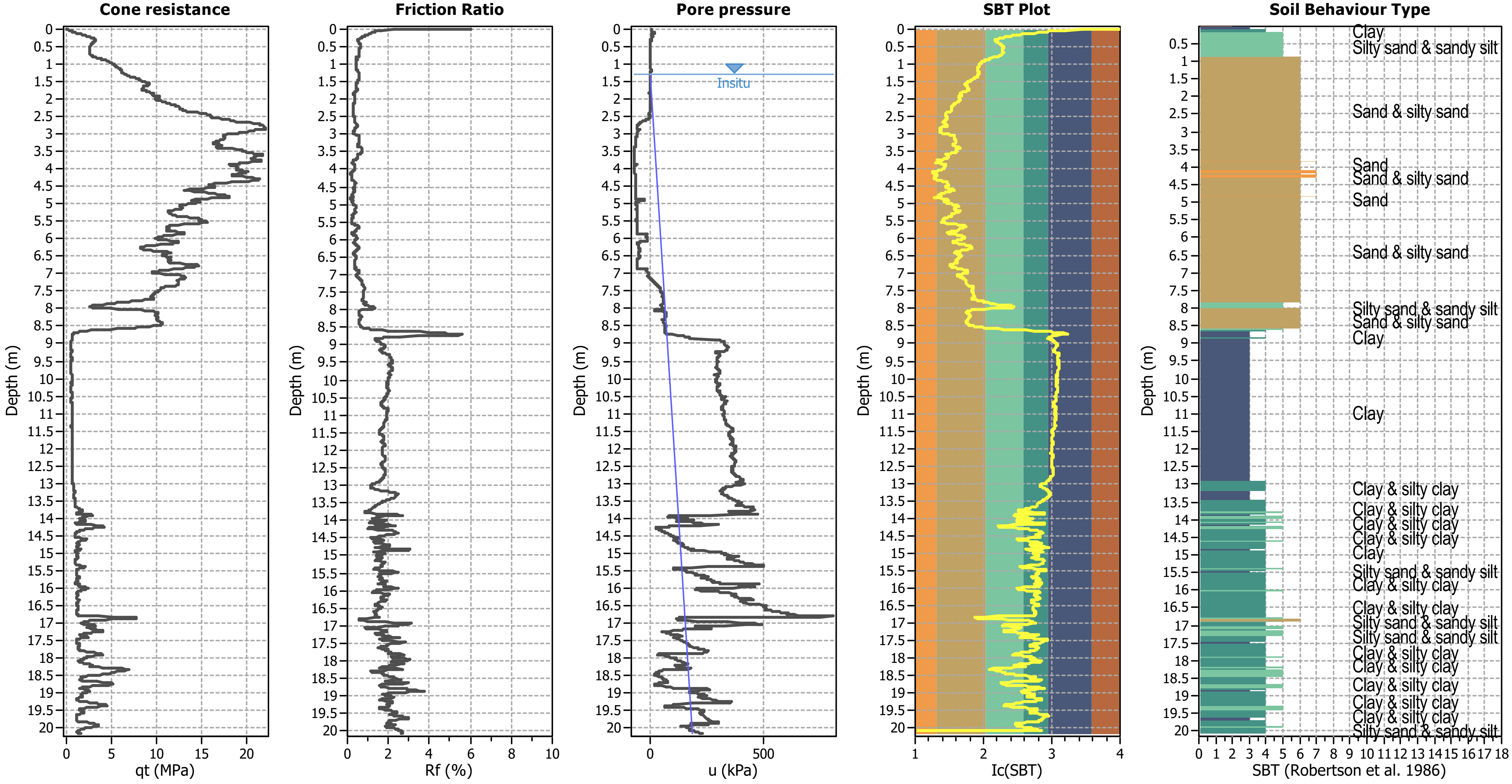
## CPT basic interpretation plots



### Input parameters and analysis data

Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on Ic value
Earthquake magnitude $M_w$: 7.50
Peak ground acceleration: 0.65
Depth to water table (insitu): 1.30 m

Depth to GWT (erthq.): 1.30 m
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT
Use fill: No
Fill height: N/A

Fill weight: N/A
Transition detect. applied: No
$K_\sigma$ applied: Yes
Clay like behavior applied: Sand & Clay
Limit depth applied: Yes
Limit depth: 15.00 m

### SBT legend

| | | |
|---|---|---|
| 🟥 1. Sensitive fine grained | 🟩 4. Clayey silt to silty | 🟧 7. Gravely sand to sand |
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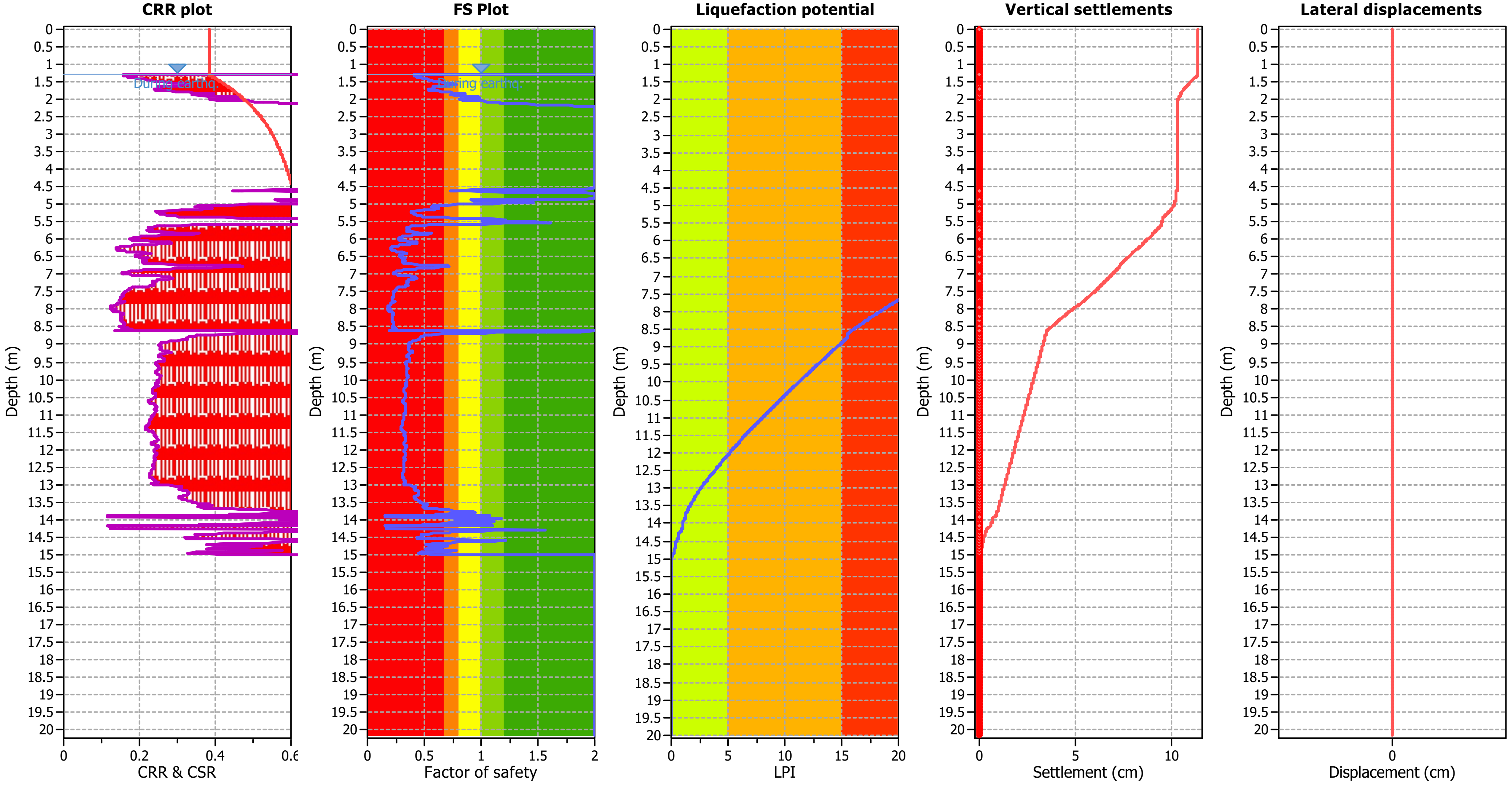
| 🟦 3. Clay to silty clay | 🟫 6. Clean sand to silty sand | ⬜ 9. Very stiff fine grained |

# Liquefaction analysis overall plots



## Input parameters and analysis data

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| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 m | Fill weight: | N/A |
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| Peak ground acceleration: | 0.65 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 15.00 m |

## F.S. color scheme

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## LPI color scheme

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- 🟧 High risk
- 🟩 Low risk

# Appendix 7

## District Plan Compliance Analysis

## Part C1-4 Region Wide Provisions

## C1 – Air Quality: N/A to current application

## C2 – Built Environment, Infrastructure, Energy:

## C2.1.7 Rules for Provision of Infrastructure for Development (Works and Services)

| C2.1.7.1 General Standards | | |
|---|---|---|
| Condition | | Analysis |
| **A** | **GENERAL SERVICING REQUIREMENTS**<br>a) Reticulated services shall be provided to the net area of new allotments.<br>b) Vehicle crossings shall be provided to the boundary of the road reserve for new allotments.<br>c) Services shall be reticulated underground in any new road reserve, shared accessway or new allotment within the Reticulated Services Boundary and in residential and commercial zones district wide. provided that stormwater infrastructure may be provided above ground where retention or attenuation measures are required or low impact design approaches are to be used. Individual customer connections may be provided above ground where there is an existing overhead supply.<br>d) Where there is a shared access way the necessary works and services shall be provided to the terminus of the right-of-way.<br>e) The location of reticulated services and vehicle crossings shall be identified prior to consent approval. | **Complies**<br>a) It is proposed to provide reticulated services to the net area of each allotment as part of the proposed subdivision<br>b) It is proposed to form two crossings including the JOAL and a double crossings for Units 1 and 2 which all are provided to the boundary of the road reserve.<br>c) All services are to be reticulated underground and located within the JOAL where the services are to be private.<br>d) The proposed lots 3-8 are serviced by a shared accessway/JOAL and all connections are to be provided to the boundary of each lot.<br>e) The submitted subdivision scheme plan and servicing plans indicate the location of reticulated services and the vehicle crossings. |
| **B** | **STRUCTURE PLANS**<br>a) Where relevant, subdivision, development and provision of infrastructure shall be consistent with the Taruheru Block Infrastructure Plan (Schedule G24) the Roading Concept Plan for the Rural Industrial A Zone (Appendix H11) and the Structure Plan for the Citrus Grove development control area (Schedule G10) | **N/A**<br>Site is not located within a structure plan area. |

| | | |
|---|---|---|
| C | **STREET PLANTING**<br>a) For new roads in residential, commercial and industrial zones either:<br>i. A minimum of $5m^2$ of land shall be set aside within the road reserve for each potential allotment accessed from that road (based on minimum permitted site areas) for the purpose of landscaping. Such areas may be combined but shall still be located evenly throughout the road. The land shall be free from utility services; or<br>ii. A dedicated berm for landscaping shall be provided. The minimum planting is one tree per allotment. The land shall be free from underground utility services. | **N/A** |
| D | **STORMWATER SYSTEMS**<br>a) Sites shall be provided within their site area with a means of collecting, managing and discharging stormwater from the roof of all buildings, accessways and from all impervious surfaces.<br>b) Any connections or discharge points to the existing public stormwater system, where available, shall be at an outlet or outlets approved by the Council.<br>c) Primary stormwater systems shall have sufficient capacity to convey a 10% AEP rainfall event without relying on secondary flow paths.<br>d) Secondary stormwater systems shall be sufficient capacity to convey a 1% AEP rainfall event while protecting buildings and household gully traps from inundation.<br>e) Secondary flow paths shall be free of obstructions and located on public land, land protected by an easement or land identified as a public drain.<br>f) Stormwater conveyance shall be by way of gravity outfall with ground levels and/or contours identified prior to consent approval; and<br>g) With regard to Rules c) and d) where stormwater runoff is greater than the capacity of the system which is to receive it, runoff shall be managed to the relevant pre-development rates or the capacity of the system shall be upgraded. | **Complies**<br>It is proposed to attenuate storm water in a combination of above ground tanks collecting roof water from each dwelling and by the use of two below ground storage areas located within the JOAL's.<br>A total of 10m3 of rainwater tank storage is required. Units 1-6 need 1m3 storage tank each discharging water at 0.29L/s. Units 7-8 need a 2m3 tank each discharging water at 0.58L/s to control stormwater runoff for 10% AEP events,<br>Stormwater will be discharged to the existing DN450 RC stormwater main. A connection to the stormwater main is required to drain the below-ground attenuation storage.<br>Further detail of the proposed stormwater design is provided in the Servicing Report prepared by INfIR. |
| E | **WATER SUPPLY**<br>a) Water supply within Reticulated Services Boundary<br>i. Sites for any activity that will require a water supply shall be provided with a connection or connection point to the Council reticulated water system. | **Complies**<br>It is proposed to install DN20 connections will be taken from the DN63 within the carriageway and 550mm in front of the face of the northern kerb. The DN63 main will be connected to the DN150 water main within Stanley Road, |

|  |  |  |
|---|---|---|
| **F** | **WASTEWATER SYSTEMS**<br>a) Within the Reticulated Services Boundary, sites for any activity that will create wastewater shall be provided with a connection or connection point to the Council reticulated wastewater system. | **Complies**<br>It is proposed to install a DN150 gravity main discharging to the existing DN225 sewer main in Stanley Road. A new manhole will be required at the connection point. |
| **G** | **ENERGY AND TELECOMMUNICATIONS**<br>a) Sites for any activity that requires electricity and telecommunication services, shall be provided with those services | **Complies**<br>Power and telecommunication utilities are to be provided within the proposed JOAL's. |
| **H** | **ROADS** |  |
| **H1** | **Infrastructural Requirements**<br>a) All proposed new roads shall connect to, and be compatible with, the district roading hierarchy, as depicted in the roading hierarchy maps.<br>b) To meet the access needs of potential users, all new or upgraded roads required for subdivision or development shall comply with the following rules for minimum widths. | **N/A**<br>No new roads are proposed.<br>**N/A** |

| | | |
|---|---|---|
| **H2** | **Sightlines**<br>a) All new vehicle crossing /accessways shall be designed, located and developed to ensure that the sight lines (illustrated in Figure C2.13) are established and maintained with no obstructions, whether temporary or permanent. Sight lines are to be in accordance with Figure C2.1.3 and Figure C2.4 specified below.<br>b) All new intersections shall be designed, located and developed to ensure that the sight lines (illustrated in Figure C2.1.3) are established and maintained with no obstructions, whether temporary or permanent. Sight lines are to be in accordance with Figure C2.13 and Figure C2.4 specified below. | **Complies**<br>a) The new vehicle crossing will be compliant with the sightlines provided for within Figure C2.13.<br>**N/A** |
| **I** | **ACCESS** | |
| **I1** | **Sightlines at Vehicle Crossings**<br>a) All vehicle crossings shall be constructed and located to ensure that the sight lines specified in Figure C2.4 are maintained with no obstructions, whether temporary or permanent, for the distances specified in Figure C2.13. | **Complies**<br>The proposed crossings will be designed and located so as to comply with the sightlines specified in C2.4 for the distances specified in Figure C2.12. |
| **I2** | **Distances of Vehicle Crossings from Intersections**<br>a) Sites shall maintain distances of crossings from intersections, so as to comply with Figures C2.6 and C2.7. | **Complies**<br>The posted speed limit for Stanley Road is 50 km/h which is a 'Local' Road and thus Figure 2.7 is the relevant performance criteria where a 20m setback distance is required. The vehicle crossings are located in excess of 20m from the intersection Stanley Road and Childers Road. |
| **I3** | **Manoeuvring Areas**<br>a) Subject to (b) with the exception of sites containing no more than one single dwelling unit, all sites shall provide either accessways, aisles and turning areas or parking spaces adequate to enable vehicles to enter and exit to the road in a forward direction. Note: An adequate turning area is one that provides for the car tracking curves depicted in Figure C2.1.4.<br>b) Sites fronting arterial roads: The construction, addition to, or alteration of buildings (including new dwelling units) shall not encroach on or reduce on-site manoeuvring areas beyond the point that they continue to provide the ability for vehicles to enter and exit to the road in a forward direction. | **Complies.**<br>Lots 3-8 can achieve adequate on-site maneuvering within the JOAL's. Lots 1 and 2 will contain no more than 1 dwelling and thus are exempt.<br>**N/A**<br>Stanley Road is a local road. |

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| **I4** | **Surfaces**<br>a) In residential, commercial or industrial zones or reserves adjoining these zones, all vehicle crossings between the road carriageway and the road reserve boundary shall be finished with a sealed surface and drained.<br>b) In rural zones, or reserves adjoining rural zones, all vehicle crossings between the road carriageway and the road reserve boundary shall be: i. Finished with a sealed surface where the adjoining carriageway is sealed. ii. Finished with a hard surface where the adjoining carriageway is unsealed. | **Complies**<br>The proposed vehicle crossings and JOAL's are to be formed in a concrete surface.<br>**N/A** |
| | c) All shared accessways and associated turning areas shall be: i. Finished with a sealed surface and drained in residential, commercial or industrial zones or reserves adjoining these zones.<br>ii. Finished with a hard surface in rural zones, or reserves adjoining rural zones.<br>d) All accessways and associated turning areas for industrial and commercial activities shall be: i. Finished with a sealed surface and drained in residential, commercial or industrial zones or reserves adjoining these zones.<br>ii. Finished with a hard surface in rural zones, or reserves adjoining rural zones. | **Complies**<br>As above, the JOAL's are to be finished in a concrete surface that is drained in accordance with the overall stormwater design for the site.<br>**N/A**<br>The proposed use is residential |
| **I5** | **Access to sites with more than one road frontage**<br>a) For properties that have legal frontage on to two roads:<br>i. Where the property is located in a Rural zone and adjoins an arterial or principal road, access shall be from the road with the lesser traffic function, as identified in the Roading Hierarchy Maps.<br>ii. Where the property is located in a Commercial zone, Industrial zone or a Port Management zone, and adjoins an arterial or principal road, access shall be from the road with the lesser traffic function, as identified in the Roading Hierarchy Maps. | **N/A**<br>The proposed sites have only one road frontage.<br>**N/A**<br>**N/A** |
| **I6** | **Minimum distance between vehicle crossings**<br>a) The minimum distance between vehicle crossings on any one site shall be 15m.<br>b) In commercial zones, industrial zones and the Port Management zones the minimum distances between vehicle crossings on any two adjacent sites shall be 2m, unless a combined crossing not exceeding 9m serves the two adjacent sites, or the vehicle crossing is for two or more residential dwelling units located on the one site.<br>Note: Attention is drawn to NZ Transport Agency requirement for permission to construct any accessway or vehicle crossing in the road reserve of any state highway. | **Non-Compliance**<br>The proposed vehicle crossings for the JOAL and Lots 1 and 2 will be approximately 3m and thus fails to comply with the minimum 15m.<br>**N/A** – the site is not within commercial zones, industrial zones nor the Port Management Zone. |

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| **I7** | **Single-site vehicle access**<br>a) The width of accessways and vehicle crossings for individual sites shall comply with the rules in Figure C2.8. | **Complies**<br>The new accesses serving lots 1-2 will be 3m wide, whilst the JOAL serving lots 3-8 will have a minimum width of 4m. |
| | b) The number of accessways and vehicle crossings onto a road frontage on any one site shall not exceed that shown in Figure C2.9. and<br>c) Accessways shall comply with the standards set out in New Zealand Fire Service fire-fighting water supplies Code of Practice SNZ 4509:2008. | **Non-Compliance**<br>The development is served by more than one crossing and thus exceeds the maximum of one crossing per site.<br>**Complies.**<br>Fire hydrants are located opposite 91 Stanley Road and at 497 Childers Road. |
| **I8** | **Multiple-site access and/or multiple unit access**<br>a) Up to 10 potential dwelling units may share access from a single accessway and vehicular crossing.<br>b) Access to serve more than 10 dwelling units are required to be served by a public road vested in the Gisborne District Council.<br>c) Up to three commercial or industrial sites may share access from a single accessway and vehicular crossing.<br>d) More than three commercial or industrial sites are required to be served by a public road vested in the Gisborne District Council.<br>e) To meet the access needs of potential users, every accessway and vehicle crossing serving more than one site shall be constructed in accordance with the Figure C2.10.<br>f) Accessways shall comply with the standards set out in New Zealand Fire Service Firefighting Water Supplies Code of Practice SNZ PAS 4509:2008. | **Complies**<br>The maximum number of dwellings to be accessed from the JOAL's is 5 whilst the other vehicle crossing serves two dwellings.<br>**N/A**<br>**N/A** – not a commercial or industrial site.<br>**N/A** – not a commercial or industrial site.<br>**Complies.**<br>**Complies.** |
| **J** | **PARKING** | |
| **J1** | **Provision of Parking and Loading Spaces**<br>a) Unless otherwise provided for in this chapter, parking spaces and loading bays shall be provided on site in accordance with Figure C2.11 below.<br>b) When activities on the same site occur at different times during the day, then the number of parking spaces and loading bays to be provided shall be for the | **N/A**<br>The NPS-UD removed made it mandatory for Council to remove minimum parking standards and this done by Council in November 202. Notwithstanding, the proposal includes a total of ten parks are provided.<br>**N/A.** |
| | maximum requirement at any one time during the day or night.<br>c) In Figure C2.11 GFA = gross floor area.<br>d) Parking spaces and loading bay requirements are as follows in Figure C2.11 | **N/A**<br>**N/A** |

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| **J2** | **Waiver of Parking Space or Loading Bay Requirements**<br>a) It shall not be necessary to provide parking spaces, loading bays or financial contributions in lieu of parking spaces or loading bays on sites in the Inner Commercial zone or the Fringe Commercial zone: provided that<br>1. The site has frontage to streets marked as continuous street facade on the urban maps.<br>2. The site has no legal access to any other road or service lane. | **N/A** |
| **J3** | **Assessment of Number of Spaces**<br>a) The required number of parking spaces and loading bays shall be:<br>i. Calculated in respect of each activity undertaken on the site.<br>ii. Re-calculated in the event of a change in activity.<br>iii. Re-calculated in the event of a change in the scale or intensity of land use. | **N/A** |
| **J4** | **Sharing of Parking and Loading Spaces**<br>a) Parking spaces and loading bays may be shared between different activities that occupy the same site. provided that:<br>1. The occupier requiring the parking spaces or loading bay is located adjacent to the occupier who provides the parking spaces or loading bay.<br>2. The total number of required parking spaces or loading bays calculated from Figure C2.11 for the site is still provided.<br>3. The written agreement of the occupier providing the parking or loading bay is obtained and a copy of the agreement is lodged with Gisborne District Council prior to the commencement of the activity | **N/A** |
| **J5** | **Availability of Spaces**<br>a) All required loading and parking spaces shall be kept clear and available for use of occupants or visitors during the normal hours of operation of that use.<br>b) With the exception of the following activities, no parking space or loading bay shall obstruct access to any other parking space or loading bay:<br>i. Parking spaces for single residential or minor dwelling units.<br>ii. Parking spaces for home occupations.<br>iii. Parking spaces for service stations. | **N/A** |
| **J6** | **Provision of Parking Spaces for the Disabled** | **N/A** |
| **J7** | **Design and Construction of Parking Spaces**<br>c) All parking spaces shall be formed and constructed to comply with either the following rules for dimensions in Figure C2.12 (to accommodate the 90 percentile car illustrated in Figure C2.12 or the Australian/New Zealand Standard AS/NZS 2890.1:2004, Part 1 off-street car parking or any subsequent replacement AS/NZS for this standard. | **Complies** |
| **J8** | **Design and Construction of Loading Bays** | **N/A.** |

## **C3 –Coastal Management:** N/A to current application

## **C4 – Cultural and Historic Heritage:** N/A to current application

## Part C5-8 Region Wide Provisions

## **C5 – Environmental Risk:** N/A to current application

## C6 – Freshwater:

| **6.2.3 Rules for Point Source Discharge** | | |
|---|---|---|
| **Flood Hazard Overlay F7 (Urban Stormwater Flood Hazard Area) Rules** | | |
| 6.2.3(2) | **Permitted Activity**<br>The discharge of stormwater from land, roofs, paved areas and roads, or diversion of the same to a public stormwater network, except:<br>a) From industrial or trade premises; or<br>b) Discharges to Regionally Significant Wetlands and Outstanding Waterbodies identified in Schedule G17 (Regionally Significant Wetlands) and G18 (Outstanding Waterbodies) not lawfully established before the date of notification of this plan.<br>Note: This rule applies to point source discharges of stormwater from forestry roads and earthworks associated with plantation forestry. It prevails over Regulations 97(1) in the Resource Management (National Environment Standards for Plantation Forestry) Regulations 2017.<br>Permitted Activity Standards: | |
| | a) Discharge shall be by pipe, open drain, swale, constructed wetland or vegetated filter into a natural watercourse which is the natural receiver of surface drainage water from that area;<br>b) For stormwater discharge not lawfully established before the date of notification of this Plan;<br>i. Where the impervious area is greater than 1000$m^2$ and the stormwater does not originate from a farming, horticultural, rural community facility or local roading activity; | N/A |
| | ii. Where the impervious area is greater than 1000$m^2$ and the stormwater originates from within the area serviced by the public stormwater network of the Gisborne urban area; | **Does not comply** – impervious area on the site is greater than 1000$m^2$ and the stormwater will discharge into both the stormwater network and to ground through a rainsmart soakage system. |
| | Contaminant reduction methods shall be designed and implemented to treat stormwater from the impervious area in accordance with TP 10, or by alternative methods that are demonstrated to achieve an equivalent level of contaminant removal as TP 10 devices. These methods include but are not limited to constructed wetlands, swales, vegetative filters | Contaminant reduction methods have been employed in line with TP10 including a Hynds First Defence system installed upstream of the soakage device. This will treat and attenuate runoff from paved surfaces across the site including driveways and parking areas. All discharge from the dwelling roofs will be first attenuated onsite via individual attenuation |

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|  | or infiltration practices. **See Advisory Note.** | tanks then discharged to the kerb without treatment noting this will be runoff from inert materials. |
|  | c) The discharge shall not contain any wastes from an industrial or trade process; | **N/A** |
|  | d) The discharge shall not cause erosion of the banks or bed of the watercourse at, or downstream of, the discharge point; | **Will comply** |
|  | e) The discharge shall not give rise to or exacerbate any flooding of land upstream or downstream of the discharge point in rainfall events up to the 10 per cent AEP or flooding of dwellings on other properties in rainfall events up to the 1 per cent AEP; | **Will comply** |
|  | f) The discharge shall not contain hazardous substances, agricultural chemicals, or cause exceedance in trigger values for 95% species protection for substances that are toxic to aquatic ecosystems (as measured relative to the ANZECC Guidelines for Fresh and Marine Water Quality, 2000) in receiving water bodies after reasonable mixing; | **Will comply** |
|  | g) The discharge shall meet the following water quality standards downstream of the discharge point after reasonable mixing: |  |
|  | i. No conspicuous change in the colour or visual clarity of the receiving water; | **Will comply** |
|  | ii. No emission of objectionable odour; | **Will comply** |
|  | iii. No production of conspicuous oil or grease films, scums or foams, or floatable materials; | **Will comply** |
|  | iv. No rendering of fresh water unsuitable for consumption by farm animals; | **Will comply** |
|  | v. No significant adverse effects on aquatic life. | **Will comply** |
|  | ***Advisory Note:*** *Demonstration of compliance with this Rule is required to be given to the Council. Compliance with this rule will be deemed to have occurred where the stormwater treatment is undertaken in accordance with Stormwater Management Devices: Design Guidelines Manual 2003. Technical Publication 10 (TP10) of the Auckland Council.* |  |

## C7 – Land Management: N/A to current application

## C8 – Natural Hazards:

| Rule Number | Rule | Zone/Overlay | Status | Activity Standards; Matters of Control or Discretion; Notification | Compliance |
|---|---|---|---|---|---|
| ***Flood Hazard Overlay F7 (Urban Stormwater Flood Hazard Areas)*** |  |  |  |  |  |

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| 8.2.3(33) | Any activity in the road reserve that may result in the diversion or ponding of floodwaters, including any new road, road alteration or shape correction | F7 Urban Stormwater Flood Hazard Area | Restricted discretionary | Council shall restrict its discretion to the matter a) specified below:<br>a) Avoiding, remedying or mitigating any effects of flooding. This includes ensuring that activities shall not restrict or divert the passage of floodwaters. | **N/A** |
| 8.2.3(34) | Any new solid fence, or alterations to existing solid fence, along any property boundary | F7 Urban Stormwater Flood Hazard Area | Restricted discretionary |  | **R/D** |
| 8.2.3(35) | Earthworks that change the permanent level of the land | F7 Urban Stormwater | Restricted discretionary |  | **R/D** |

## C9 – Natural Heritage

N/A – The subject site is not located within any natural heritage overlay areas.

## C10 – Subdivision

The proposal is determined to be a Discretionary subdivision consent pursuant to Rule C10.1.6 (9).

**C10 – Subdivision** - The proposal is determined to be a Discretionary subdivision consent pursuant to Rule C10.1.6 (9).

<table>
<tr><th colspan="2">C10.1.6 Rules for Subdivisions</th></tr>
<tr><th colspan="2">C10.1.6.1 General Standards</th></tr>
<tr><td><b>A. General Rules</b><br><br>a) Subdivisions shall comply with C2 – Built Environment, Infrastructure and Energy and C9.2 Esplanade Reserves/Strips.</td><td><b>Complies</b></td></tr>
<tr><td><b>B. Allotment Sizes and Dimensions</b><br><br>a) Subdivisions shall comply with the rules for allotment sizes and shape factor and road frontage requirements in C10.1:<br><br>

<table>
<tr><th>Zone</th><th>Minimum Net Area</th><th>Shape Factor and Road Frontage Requirements</th></tr>
<tr><td><b>Residential dwellings</b><br>Inner Residential Zone</td><td>350m² per unit or 280m² per unit attached on one side to another unit or 250m² per dwelling unit attached on two or more sides (including vertically).</td><td>Nil</td></tr>
<tr><td>General Residential and Residential Protection Zones (reticulated)</td><td>400m² per unit or 320m² per unit attached on one side to another unit or 250m² per dwelling unit attached on two or more sides (including vertically)</td><td></td></tr>
<tr><td>General Residential and Residential Protection Zones (non-reticulated)</td><td>1000m² per unit</td><td></td></tr>
<tr><td>Residential Lifestyle Zone</td><td>3000m²</td><td>Refer Rule C10.1.6(8)</td></tr>
<tr><td>Taruheru Subdivision Block</td><td>800m² per unit</td><td></td></tr>
<tr><td>All residential zones covered by a site caution layer</td><td>1000m² per unit</td><td></td></tr>
</table>
</td><td><b>Does not comply</b> – Site is within the General Residential Zone and the Lot areas are proposed as follows:<br><br>Lot 1: 121m²<br>Lot 2: 160m²<br>Lot 3: 130m²<br>Lot 4: 130m²<br>Lot 5: 130m²<br>Lot 6: 131m²<br>Lot 7: 239m²<br>Lot 8: 255m²<br><br>All units each have a unit attached at one side to another unit however do not meet the minimum of 320m² required.</td></tr>
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| **provided that**: | |
| 1. In Rural Productive and Rural Residential zones where an existing site used for farming purposes is occupied by more than one dwelling-house erected prior to 31 March 1987, and any of those dwelling houses, excluding at least one to remain on the site, is no longer required for farming the site, a new site may be created notwithstanding that the site does not meet the requirements in Figure C10.1, but subject to compliance with the following:<br>i. Minimum area – 1000m$^2$<br>ii. Maximum area – 2000m$^2$<br>iii. Maximum shape factor and road frontage requirement. Every site shall be of such a shape as to contain a rectangle 13m x 18m without encroachment on to any yard,<br>iv. the new boundaries of the site to be created are to be so located as to ensure that the existing buildings conform with the requirements of the Plan. | **N/A** |
| 2. The rules for minimum allotment sizes and dimensions shall not apply to subdivisions for meteorological activities. | **N/A** |
| **C. Building Platforms** | |
| **a)** Every site that is intended to be used for any building shall contain a building platform that is stable and not affected by any potentially unstable land. | **Complies** |
| **D. Existing Buildings** | |
| a) Any new boundaries created by subdivision shall be located such that any existing buildings comply with the rules of the relevant zone and (where relevant) overlay; or that the appropriate resource consents have been obtained. | **N/A** – all existing buildings will be removed. |
| **E. Boundary Adjustment** | |
| a) Boundary adjustments shall not create any additional sites or reduce any site below the minimum subdivision size for the zone except where a single site is being created exclusively for a network utility service. This provision shall not apply where sites are to be amalgamated. | **N/A** |
| **F. Easements** | |
| a) The granting of a subdivision consent may include a condition requiring the reservation of a memorandum of easement in respect of any of the following:<br>i. the creation of right of way access to any allotment pursuant to section 321 of the Local Government Act 1974;<br>ii. the right to maintain shelter belts;<br>iii. the right in respect of a dominant tenement or easement in gross to lay, construct, erect, convey, discharge or maintain an underground or overhead | **Complies** – Schedule of easements proposed which covers these aspects. |

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| water, electric power, telecommunications, gas, sewage, or stormwater service;<br>iv. the right to construct and maintain a party wall;<br>v. any other easement that the specific situation may require.<br>b) For stormwater pipes, sewer pipes and water supply pipes that are to be vested in the Gisborne district Council, easement widths shall be the larger of:<br>i. a width equal to 1.5 times the depth to the invert level with the service laid in the centre, or<br>**ii.** a minimum of 3m with the service laid in the centre. | |

## C11 – General Controls (signage, lighting and glare, radiofrequency, petrochemicals exploration) - N/A to this application

## C11.2 Noise and Vibration

| **C11.2.15.2 Rules and Standards for Noise for Construction Activities- All Zones** | |
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| **A Long Term Construction** | |
| 1. Emissions of Construction noise shall not exceed 168 Calendar days in any 12 month period. | **Will comply** – it is anticipated that the construction noise will not exceed 168 calendar days. |
| 2. The construction activity shall comply with the noise limits specified in Figure C.11 | **Will Comply** – We anticipate a condition of consent limiting construction hours to 7am – 6pm, Monday – Saturday. Any works are expected to operate within the limits outlined in C.11. |

## DD1 – Residential Zones

| **DD1.61 Rules For Residential Zones** | |
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| **DD1.6.1.1 General Standards** | |
| **G. Nuisance**<br>a) A heavy vehicle, being a motor vehicle which has a gross laden weight exceeding 3,500kg may only arrive at or depart from a street adjacent to, or a site within any residential zone, between the hours of 0600-2200. No other activity associated with such vehicles shall be conducted outside 0600-2200 hours unless the activity satisfies the rules in this Plan. | **N/A** |
| b) No barricade or structure shall be placed on any property, so as to unreasonably prevent or inhibit entry by the police or any authorised officer of the consent authority. | **N/A** |

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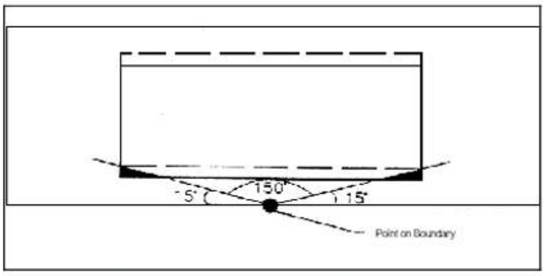
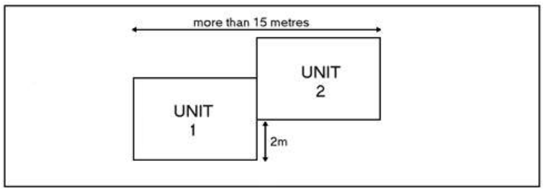
| **H. Recession Planes**<br>a) Buildings, parts of buildings, and structures (excluding chimneys, antennas and support structures, shall be contained within recession planes commencing 2.75m above each site boundary. The angles of the recession plane at each site boundary shall be determined using the recession plane indicator.<br>**provided that** a building or structure may be erected where it exceeds the boundary of the recession plane by not more than one metre if the written consent of the adjoining neighbour is obtained and submitted to the consent authority. | **Pre-Subdivision: Complies** – proposed dwellings will comply with HIRB at all external boundaries.<br>**Post Subdivision: Does not comply** – Due to duplex dwellings being proposed, the proposal will infringe the height in relation to boundary along the internal boundaries as it relates to:<br>• Unit 1 along its southern boundary<br>• Unit 2 along its northern boundary<br>• Unit 3 along its western boundary<br>• Unit 4 along its eastern boundary<br>• Unit 5 along its western boundary<br>• Unit 6 along its eastern boundary<br>• Unit 7 along the eastern boundary<br>• Unit 8 along its western boundary |
| **I. Building Length**<br>b) No building, other than a single dwelling unit, where it adjoins a residential or reserve zone shall be more than 15m long without:<br>i. having a vertical or horizontal offset in plan of at least 2m; or<br>ii. being confined within the arms of a 150o angle formed by two lines intersecting at a common point on all site boundaries such that each line forms an angle of 15o with the boundary (see Figure DD1.2 or<br>iii. being offset from each other unit by not less than 25% of the width of the unit nearest the road, with a minimum offset of 2m (see Figure DD1.3); or<br>iv. the written consent of the adjoining property owners, shall be obtained and submitted to the consent authority at the time a building consent is sought, or prior to the commencement of the activity.<br> <br>Figure DD1.2 – Measurements of Building Length<br> <br>Figure DD1.3 – Measurements of Building Length | **Complies** – no dwelling will be greater than 15m in length. |
| **J. Residential Protection Zone**<br>a) No activity – including any building or construction of any building – shall reduce the vegetative cover visible from a public space by more than 20%, where that vegetation is identified as significant on the list of Residential Protection zone sites.<br>b) No dwelling-unit or other structure shall be erected in the front yard of any existing dwelling-unit detailed for protection on any site within the zone, | **N/A** |

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| where such a dwelling is identified on the list of Residential Protection zone sites.<br>c) No additional dwelling-unit may be erected in the side yard of any existing dwelling-unit.<br>d) Except for routine maintenance, there shall be no addition to or alteration of the front or side façade of any dwelling-unit or other building detailed for protection in this zone, where such a dwelling is identified as significant on the list of Residential Protection zone sites.<br>e) No dwelling-unit or other building detailed for protection may be demolished, relocated on-site or removed from a site in this zone, where such a dwelling is identified as significant on the list of Residential Protection zone sites. | |
| **K. Storage**<br>a) For sites zoned Inner Residential between Grey Street, Awapuni Road, Customhouse Street and the Waikanae Stream, no goods or materials other than those for sale shall be stored on any uncovered portion of the site so that they are visible from a street, public place or residential or reserve zoned land. | **N/A** |
| **L. Building Materials**<br>a) For sites zoned Inner Residential between Grey Street, Awapuni Road, Customhouse Street and the Waikanae Stream the exterior of buildings shall not, after construction, be clad in unpainted corrugated iron or remain as unpainted concrete blocks. | **N/A** |
| **M. Sponge Bay Block**<br>a) No residential development or subdivision of the land legally described as Lot 2 DP 370338 (CT GS285086) and Kaiti 315 Block (CT GS2D/1362) shall be permitted at an intensity greater than one dwelling per hectare of land area, until the land is reticulated with water supply and wastewater services. The provision of these services to the subject land shall be at the full cost of the developer. | **N/A** |

**Rule Table DD1.6.1**

**Permitted Activities**

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| 1.6.1(2) | Construction, addition to or alteration of residential buildings excluding minor dwelling units – Permitted provided the following activity standards are met: | |
| | *Minimum Site Area*<br>a. Inner Residential zone: 350$m^2$ per dwelling-unit or 280$m^2$ per dwelling-unit attached on one side to another dwelling-unit or 250$m^2$ per unit attached on two sides to other dwelling units (including vertically);<br>b. General Residential & Residential Protection zones (reticulated sites only): 400$m^2$ per dwelling-unit or 320$m^2$ per unit attached on one side to another dwelling-unit or 250$m^2$ per unit attached on two sides to other dwelling units (including vertically) | **N/A**<br>**Does not comply** – proposed site areas are as follows:<br>Lot 1: 120.8$m^2$<br>Lot 2: 159.6$m^2$<br>Lot 3: 129.8$m^2$<br>Lot 4: 129.2$m^2$<br>Lot 5: 131.6$m^2$<br>Lot 6: 130$m^2$<br>Lot 7: 239.1$m^2$<br>Lot 8: 254.7$m^2$ |

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| | c. General Residential & Residential Protection zones (non-reticulated sites only): 1000m$^2$ per dwelling-unit | **N/A** |
| | d. Residential Lifestyle zone: 3,000m$^2$ per dwelling unit | **N/A** |
| | e. Taruheru Subdivision Block – All residential zones: 800m$^2$ per dwelling-unit provided that a dwelling-unit may be erected on a site less than 800m$^2$ in extent if the site was created by means of subdivision after 1 October 1994. | **N/A** |
| | f. All residential zones covered by a Site Caution Layer: 1000m$^2$ per dwelling-unit<br>Note: Potential building sites in the Site Caution Layer may be required to have a geotechnical report to determine slope stability, pursuant to the Building Act 2004 | **N/A** |
| | *Site Coverage*<br>a. Maximum net area of any site which may be covered by buildings: 35% | **Pre-Subdivision: TBC**<br>**Post Subdivision: Does not comply** – proposed site coverage are as follows:<br>Lot 1: 29.3%<br>Lot 2: 30.9%<br>Lot 3: 30.8%<br>Lot 4: 32.0%<br>Lot 5: 31.7%<br>Lot 6: 30.8%<br>Lot 7: 39.6%<br>Lot 8: 40.0% |
| | b. Where a site within a residential zone abuts an access strip or right of way to an adjoining rear site, when calculating the site coverage of that site, that portion of the area of that access strip or right-of-way derived by applying the following formula may be added to the area of that site for the purpose of assessing the site coverage: | **N/A** |
| | c. Formula: Length of the boundary of contact multiplied by half the average width of the access strip or right-of-way as it exists along that boundary of contact. | |
| | *Yard Distances*<br>a. Front sites: Front yard: 4.5m Other yards: 2m | **Pre-Subdivision: Non-Compliance** – Although all proposed dwellings will meet the 4.5m front yard setback and 2m setback from side external boundaries, the proposed garden sheds on Lots 7 and 8 will fail to meet the minimum 2m setback.<br>**Post Subdivision – Complies** |
| | b. Rear sites: All yards: 3m | **Pre-Subdivision: N/A**<br>**Post Subdivision: Non-Compliance** – Will infringe along internal duplex yards – also infringe along JOAL boundary (including garden shed for Lot 1), |
| | c. Front yard on Awapuni Road between Grey Street and Customhouse Street 4.5m provided that a building may be erected closer to or on any "Other yard" boundary or any yard boundary on a rear site if the written consent of the adjoining property | **N/A** |

| | | |
|---|---|---|
| | owner is obtained and submitted to the consent authority at the time a building consent is sought, or prior to the commencement of the activity.<br>d. Residential Lifestyle zone: All yards 4.5m<br>e. Eaves, porches, bay or box windows, steps and chimneys may be located 0.6m within any yard area.<br>f. Yard distances shall not be applied between a minor dwelling and the principal dwelling erected on the site.<br>g. All yards adjacent to the Waikanae Stream 20m from MHWM | **N/A**<br>**N/A** |
| | *Parking*<br>a. Residential Protection zone: Parking spaces shall not be located in the front yard, other than on a vehicular accessway. | **N/A** |
| | *Service Area*<br>a. Each dwelling-unit, on sites comprising more than one dwelling-unit, shall be provided with $15m^2$ of exclusive outdoor service area, which shall be screened from adjoining sites and outdoor living spaces and exclude any area set aside for outdoor living space. | **Pre-Subdivisions: Complies** – All units will comply with the minimum $15m^2$ service court areas.<br>**Post Subdivision: N/A** |

# Appendix 8

## Pre-application discussions with Council

**Design Process Overview – 99A Stanley Road, Gisborne - 8 Lot residential development proposal**

**First 5% Design:**

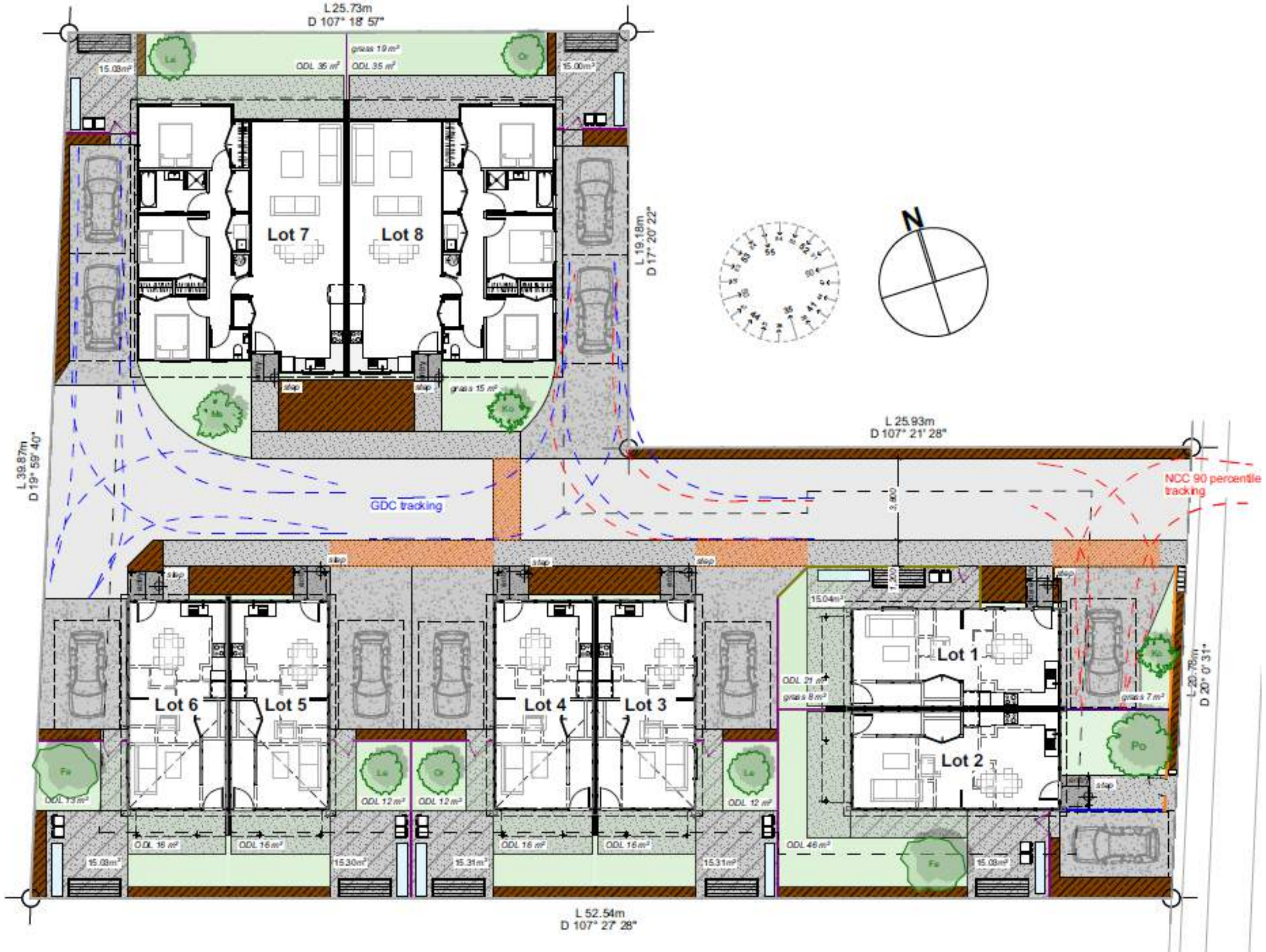
The architect was briefed with 8x units on this site, and the below was presented to Kainga Ora for support. A typology mix of 2 and 3-BR units was supported at this location.

KO Provided the following feedback:

- Lot 1-2 could be improved to achieve good activation and surveillance to the street by having the park off Stanley Rd.
- They suggested shifting units 7&8 south; however, this couldn't be achieved due to vehicle manoeuvring.

Stradegy suggested the following:

- Relocate the service area for lots 3-6 behind the dwellings so the ODLs have better solar gain.

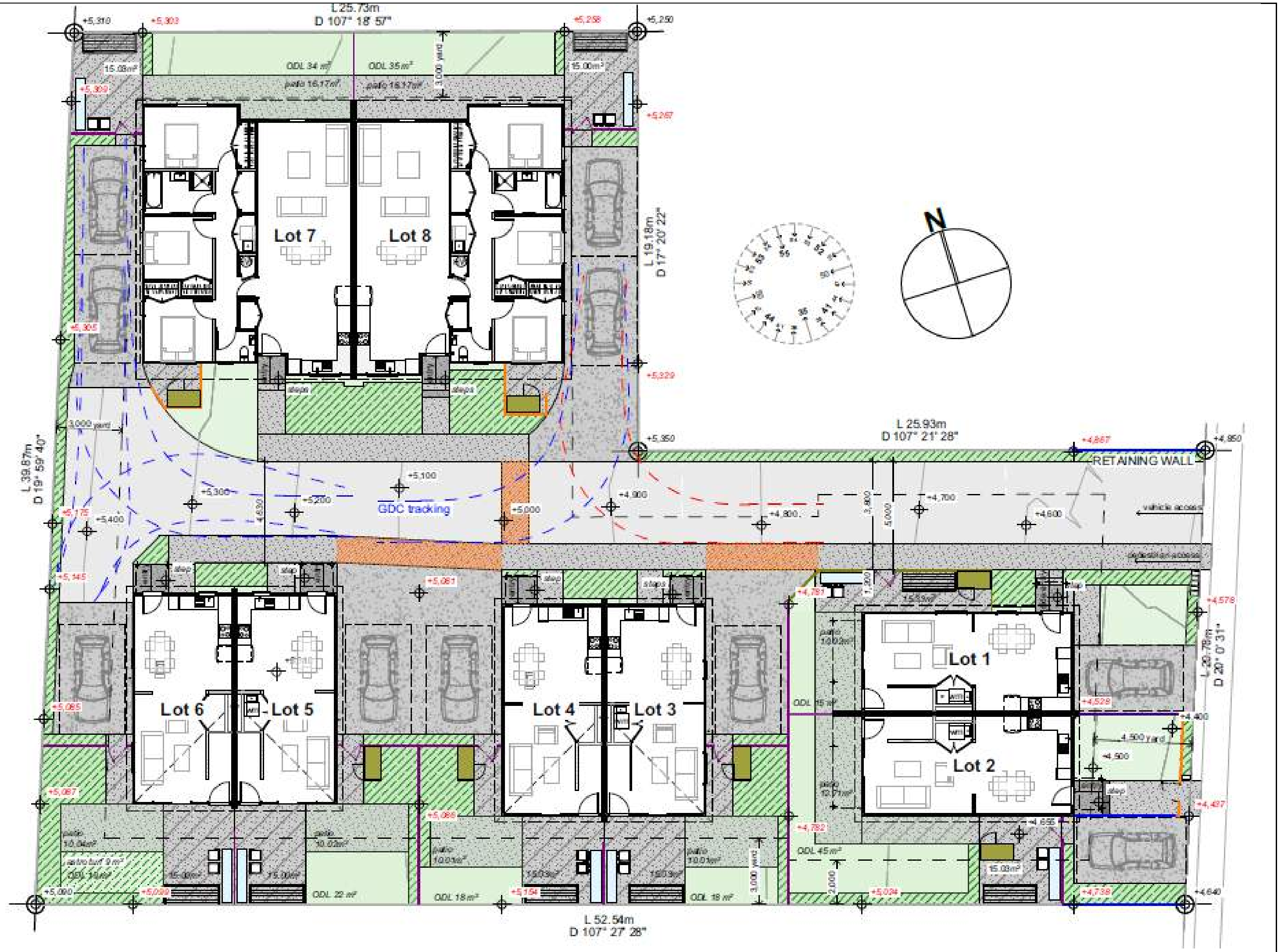


**First 15% Design:**

KO supported the previous design and instructed to progress to 15% design.

KO feedback:

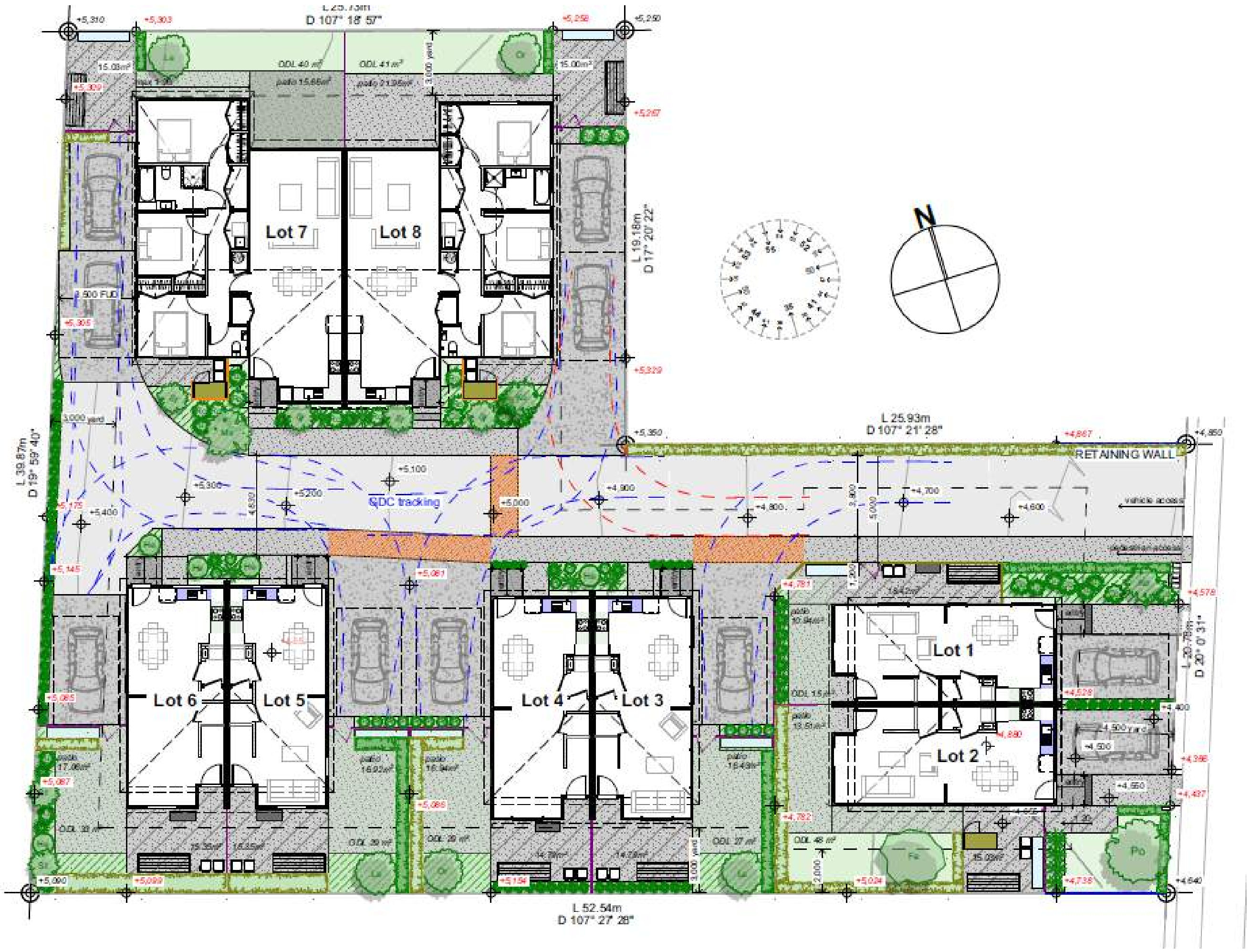
- Supported lot 1 driveway position and suggested lot 2 driveway shifts north.
- Supported the ODL & service area swap for lots 3.
- Provide garden boxes rather than sheds and less lawn (lower maintenance required).
- Requested a more detailed landscaping plan.
- Requested more ODL space for lots 7&8, preferably on the northern boundary.



**Third 15% Design:**

This design looked to incorporate the previous KO comments and was sent back for their support after a design review was completed with TW and KO UD team.

- We could address all previous feedback points.
- Lot 2 driveway shifted north to align with lot 1, with planting strip between.
- Grden boxes shown and attenuation tanks shifted out of ODL and service area to be screened behind planting for lots 3-6. Patios also shown instead of grass.
- Detailed landscaping shown.
- Increased the northern ODL for lots 7&8 by stepping the duplex south so vehicle manoeuvring still works and good JOAL frontage.



**30% Design/RC Set**

We obtained our business case approval on the 15% design and developed this in RC design set. Note, that the landscaping drawing is a separate detail, so the site plan doesn't look crowded.

The 30% design is largely compliant with GDC DP rules apart from density and site coverage.

- The main change from the 15% design to 30%, is the relocation of bins and sheds to the rear so it doesn't hinder the bedrooms' view.