Appendix J

Preliminary Design Philosophy Statement

Let's GET Wellington MOVING

10 November 2021

Thorndon Quay Hutt Road

Preliminary Design Philosophy Statement

WAKA KOTAHI NZ TRANSPORT AGENCY
greater WELLINGTON REGIONAL COUNCIL Te Pane Matua Taiao
Absolutely Positively Wellington City Council Me Heke Ki Pōneke

Table of Contents

1 Introduction

1.1 Purpose

The purpose of this Preliminary Design Philosophy Statement (PDPS) is to set out the key design parameters and assumptions to be used in the development of the preliminary design for the single stage business case phase of the Thorndon Quay and Hutt Road Project (Project). This is a live document that will be updated throughout the project design phases.

1.2 Background

1.2.1 Let's Get Wellington Moving Programme

Thorndon Quay Hutt Road (TQHR) is part of the Let's Get Wellington Moving (LGWM) early delivery programme and is being progressed through a Single Stage Business Case (SSBC) process.

The priorities for the early delivery programme are to make travel by bus to and through the central city faster and more reliable, and to create a better environment for people walking and on bikes. Thorndon Quay and Hutt Road is the busiest bus route outside of the city centre and the busiest route in the city for people cycling to and from work.

The changes to Thorndon Quay and Hutt Road are needed to improve safety, give buses greater priority and provide better walking and cycling facilities. With a growing number of people expected to live and work in the Wellington region, more people will want to walk, cycle or take the bus instead of going by car. Te Ara Tupua, the planned shared path between Ngauranga and Petone, will enable more people to walk and cycle between the Hutt Valley and Wellington.

1.3 Project Objectives

1.3.1 Problems

From previous consultation and evidence gathered, the following problem statements were defined.

PROBLEM ONE
Unreliable bus travel times result in a poor customer experience for existing and potential bus users which reduces the attractiveness of and ability to grow travel by bus.
PROBLEM TWO
The current state of cycling facilities results in conflict between users, increases risk and limits cycling attractiveness for increasing volumes of cyclists.
PROBLEM THREE
Poor quality of the street environment creates an unpleasant experience for a growing volume of people reducing its attractiveness to walk and spend time in the area.
PROBLEM FOUR
High and growing traffic volumes combined with high speeds increases the likelihood and severity of crashes on Hutt Road.

1.3.2 Benefits of Investment

By addressing the problems, the following potential benefits of investing in transport improvements for the TQHR corridor were identified:

1.3.3 Investment Objectives

The TQHR project has five Investment Objectives which build on the identified problems and benefits for the corridor:

i Improve level of service for bus users including improved access, journey times and reliability. Provide sufficient capacity for growth in public transport

ii Improve level of service, and reduce the safety risk, for people walking and cycling along and across Thorndon Quay and Hutt Road

iii Reduce the frequency and severity of crashes

iv Improve the amenity of Thorndon Quay to support the current and future place aspirations for the corridor/area

v Maintain similar access for people and freight to the ferry terminal

The freight investment objective recognises the need to maintain the freight and people access to the ferry terminal and Centreport while making longer-term investments in other modes along Hutt Road and Thorndon Quay.

1.4 Project Area

1.4.1 General

The TQHR project area is shown in Figure 1 below. Thorndon Quay and Hutt Road are part of a critical route connecting Wellington City to the northern suburbs and the wider region. It is the busiest bus route outside the city centre, with more than 6,000 people travelling through on an average day. It is also the busiest route in the city for people biking to and from work, with up to 1,300 people biking on an average day.

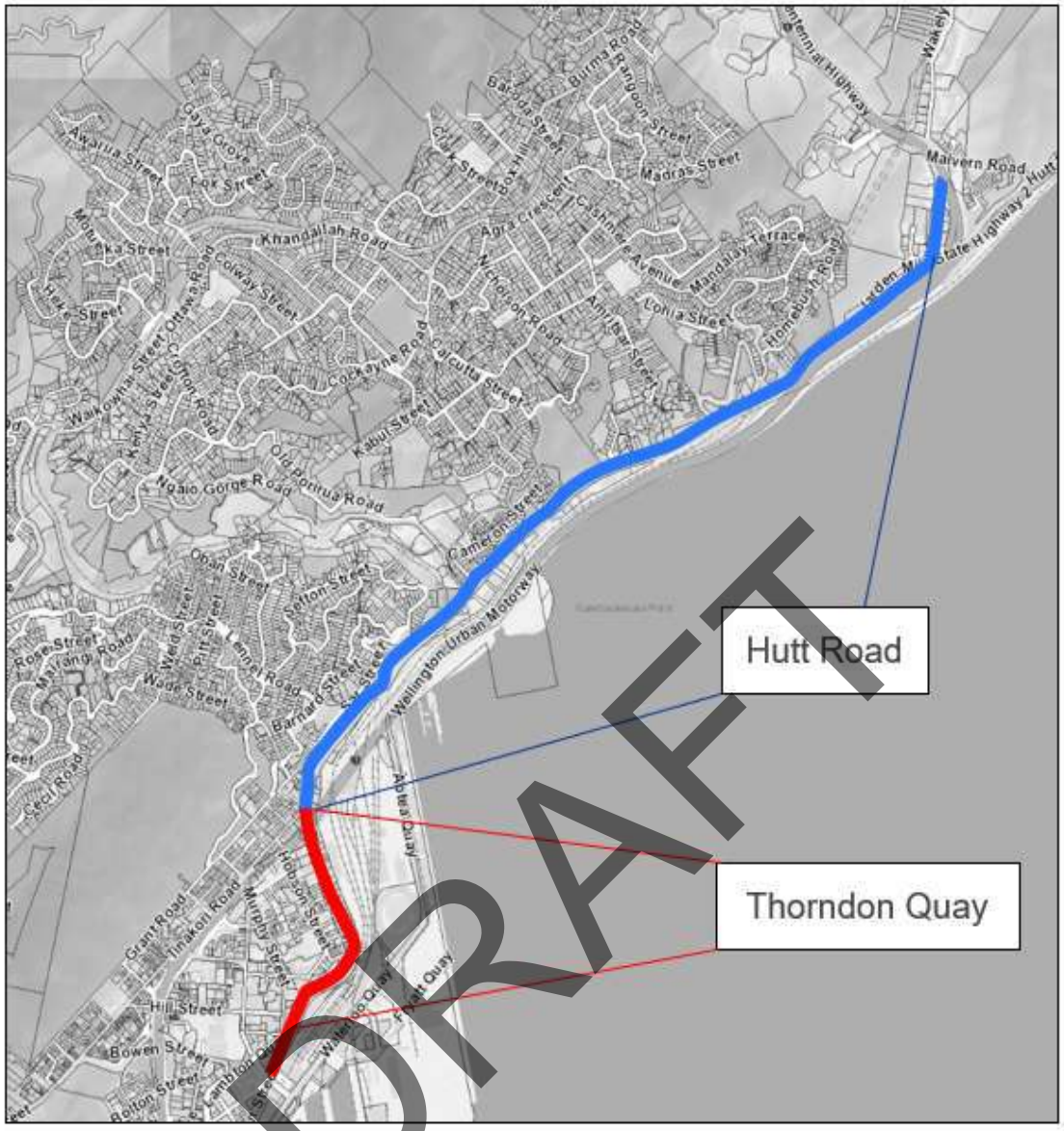


Figure 1 TQHR SSBC Project Area

1.4.2 Hutt Road / Jarden Mile Intersection

The signalised intersection between Centennial Highway, Jarden Mile, Hutt Road and the SH2 on and off ramps heading north from Wellington City has three traffic islands (between Jarden Mile and Hutt Road, the SH2 off-ramp and Hutt Road and Centennial Highway and SH2 on-ramp). There are also three median islands (on Hutt Road, Centennial Highway and SH 2 off-ramp). Facilities, in close proximity to the intersection and the Ngauranga Railway Station include an effluent disposal point (near the station) and commercial activity on Jarden Mile and Centennial Highway.

Figure 2: Existing Hutt Road / Jarden Mile Intersection

Existing speeds approaching the intersection vary between posted 50km/hr and 80km/hr limits.

There is a shared path running on the southbound side of Hutt Road and on the northbound side of Centennial Highway. Footpaths exist on both sides of Jarden Mile and the southbound side of Centennial Highway.

The intersection also includes bus stops on both sides of Hutt Road to the south of the Intersection and a further stop on the traffic island at the start of the SH2 on-ramp.

The intersection has high traffic volumes for all modes of transportation. Approximate average daily vehicle traffic volumes (ADT) are (circa 2016):

- Hutt Road (both directions): 16,400 (5% HCV)
- Jarden Mile (both directions): 1,400 (4% HCV)

- Centennial Highway (both directions): 25,500 (6% HCV)
- SH2 ramps (both directions): 12,100 (7% HCV)

1.4.3 Hutt Road

Hutt Road is some 3.5km in length starting from the north at the Jarden Mile Intersection and finishing where Hutt Road turns into Thorndon Quay at the Tinakori Road Junction. Hutt Road transitions from the urban environment of Thorndon Quay to a transportation corridor with larger retail units and local accesses. It is bounded immediately to the west by a steep scrub covered escarpment. To the east is State Highway 1, the North Island main railway lines and Wellington Harbour.

The key characteristics of Hutt Road include:

- Hutt Road is an over-dimension route and hazardous goods route.
- Hutt Road is a dual lane bi-directional road. Current lane widths are in the order of 3.4m. The central median is delineated by either chevron white lining or low-profile mountable kerbing. Lighting varies from single sided on the western side to sections on both sides after the rail bridge. There are numerous retaining walls, of various typologies, along the road.
- There are a number of stormwater structures along Hutt Road. Flows are predominantly from the North West draining 'across' the road/railway towards Wellington Harbour.
- A railway overbridge with central piers is located between Ngauranga Gorge and the Onslow Intersection.
- The intersection with Onslow Road is signalised. Onslow Road rises steeply from Hutt Road and runs parallel (northwards) with Hutt Road. This results in vehicles wanting to head north from Onslow Road needing to turn a full 180 degrees effectively cutting across the two lanes of Hutt Road.
- From the Intersection of Onslow Road into the city (Khaiwharawhara Intersection area) there are a number of large commercial units with direct access onto Hutt Road.
- The final Intersection on Hutt Road before it changes to Thorndon Quay is with Tinakori Road. This is another intersection where 180-degree manoeuvres are made onto a steeply rising side road. There are no pedestrian facilities for the first 100m of Tinakori Road.
- It is noted that the bulk of HCV's on Hutt Road are heading to and from the Port. Levels of movement beyond (entering Thorndon Quay) are significantly reduced.

1.4.4 Thorndon Quay

Thorndon Quay is an urban corridor approximately 1.3km in length between the intersections with Tinakori Road and Mulgrave Street. Thorndon Quay is primarily a single lane in each direction with a typical lane width of 3.5m. Angle parking is provided through the main commercial centre of Thorndon Quay. Cyclists are accommodated by space between the angled parking and the traffic lanes. The commercial units in Thorndon Quay are smaller in nature than the units on Hutt Road. There are three pedestrian zebra crossings on the Thorndon Quay.

There are two 'T' Intersections (Davis Street and Moore Street) on the western side of Thorndon Quay, which provide access to the Wellington Girls College and hence have significant traffic at school times. Davis Street provides access to the local Thorndon area. Moore Street is a Cul-de-sac with pedestrian access to Pipitea Street and Wellington Girls College.

Mulgrave Street is a one-way road at the intersection of Kate Sheppard Place, Lambton Quay (reserved for buses only) and Thorndon Quay. The Intersection has a number of crossing manoeuvres only some of which are currently signalised.

2 Preliminary Design Development Philosophy

2.1 Approach

This project is about people, enhancing communities and providing effective and efficient transport. This means prioritising modes of transport and allocation of space that supports moving people and accommodating freight.

Throughout the design development the LGWM project objectives have been principle guides to the design. Complementing the five objectives from the LGWM programme, it is proposed to apply fundamental urban design principles. Urban Design principles cover all aspects in the delivery of places. It provides guidance in achieving and assessing the quality of developed and restored urban areas.

Hutt Road and Thorndon Quay are both constrained corridors with limited available width to accommodate the various transport modes and other improvements. There are areas where compromises have been necessary to develop the design. For the different transport modes, the design has prioritised provision for walking and cycling, then public transport followed by general traffic. A strong safety focus has been used in the development of the preliminary design and has been a key criteria used in compromise discussions where necessary.

2.2 Mana Whenua Values

The following are the draft Mana Whenua values for the LGWM programme. These values are to be used to guide the development of the design.

Tahi – Whakapapa - A sense of Place

- Building works restore a healthy relationship with nature
- Finished projects tell the story of the place
- Native plantings
- Urban agriculture

Rua - Wai-ora - Respect the Role of Water

- Acknowledge the importance of water
- Resurrect the natural water courses
- Manage water run off to ensure only purest water flows to the harbour

Toru - Pūngao-ora – Energy

- Minimise energy use during construction
- Completed projects to aim to be energy neutral

Whā - Hau-ora – Optimising Health & Wellbeing

- Prior to construction minimise uncertainty by clear goals and timeline
- During construction minimise disturbance to neighbours
- Completed projects to use plantings and water flows to provide healthy environments

Rima - Whakamahitanga - Use of Materials

- Recycle the maximum of materials disposed of during construction

- Build with materials and methods that use the lowest energy possible
- Avoid toxic materials that may leach into air or ground water

Ono - Manaakitanga – Support a Just and Equitable Society

- Embody our values in these projects
- Work with locals to the extent possible
- Provide safe and inviting public spaces

Whitu - Whakāhuatanga - Celebrate Beauty in Design

- Design in a way that lifts the human spirit
- Incorporate public art and interpretation to tell the story of what has gone before

Whakamatautautanga

- Monitoring

3 Interim Option Scope

3.1 General

The technically preferred option is Option 4A. It includes Northbound and Southbound bus lanes on both Thorndon Quay and Hutt Road. The priority lane on Hutt Road (between Ngauranga and Kaiwharawhara) will be available for certain vehicles to use (e.g. buses, and freight), and will use the lane nearest the kerb, leaving one lane for general traffic. This will improve bus and freight reliability throughout the whole corridor in both directions by improving journey times to and from the city during the morning and afternoon peak traffic.

This option also introduces a separated cycle path on Thorndon Quay to improve cycle safety and level of service. It is complemented by the existing and proposed bidirectional cycle path on Hutt Road. This project is part of the Te Ara Tupua (Wellington CBD to Hutt Valley walking and cycling link) project and will connect to the Ngā Ūranga to Pito-one section of Te Ara Tupua.

The technically preferred option includes the following elements:

- Special Vehicle Lanes in both directions on Hutt Road
- Bus Lanes in both directions on Thorndon Quay
- A bidirectional cycleway on Thorndon Quay / Hutt Rd
- A roundabout on Aotea Quay
- Speed limit changes
- Intersection upgrades
- Pedestrian crossing improvements
- Bus stop rebalancing
- Amenity improvements to Thorndon Quay
- A median on Hutt Road to manage safety risks with turning movements /

The sections that follow summarise the design criteria for key design elements of the project, including where relevant, minimum and desirable widths for traffic lanes, bus lanes, cycleways and other infrastructure.

3.2 Hutt Road / Jarden Mile Intersection

A specimen design of the Hutt Road interchange was carried out by Beca in 2016. Figure 3 indicates the extents of that design. As part of the Stage 2 preliminary design the previous design has been reviewed for integration issues with the proposed preliminary design for the Hutt Road section.

The preferred design was prepared in accordance with the Austroads suite of design guides.

It is noted that there are some stormwater ponding issues that will need to be addressed in the detailed design on the northbound Hutt Road approach to the Intersection.

The proposed configuration (Figure 4) has been altered from the specimen design after consultation with the partner organisations. The main changes are the relocation of bus stops, the reassignment of lanes for the approaches northbound, including the removal of the central cycle lane converting to a bus lane. Consideration has also been given to weaving lengths for traffic approaching northbound. A 200m distance is provided where the SPV lane has been dropped to allow vehicles to correctly position themselves at the junction. Pedestrian and cyclist crossing provision has been made by designated crossings and increasing the sizes of the islands.

It is noted that an illegal movement carried out by some vehicles heading southbound on SH1 but turning left to jump queues needs to be addressed during the detailed design.

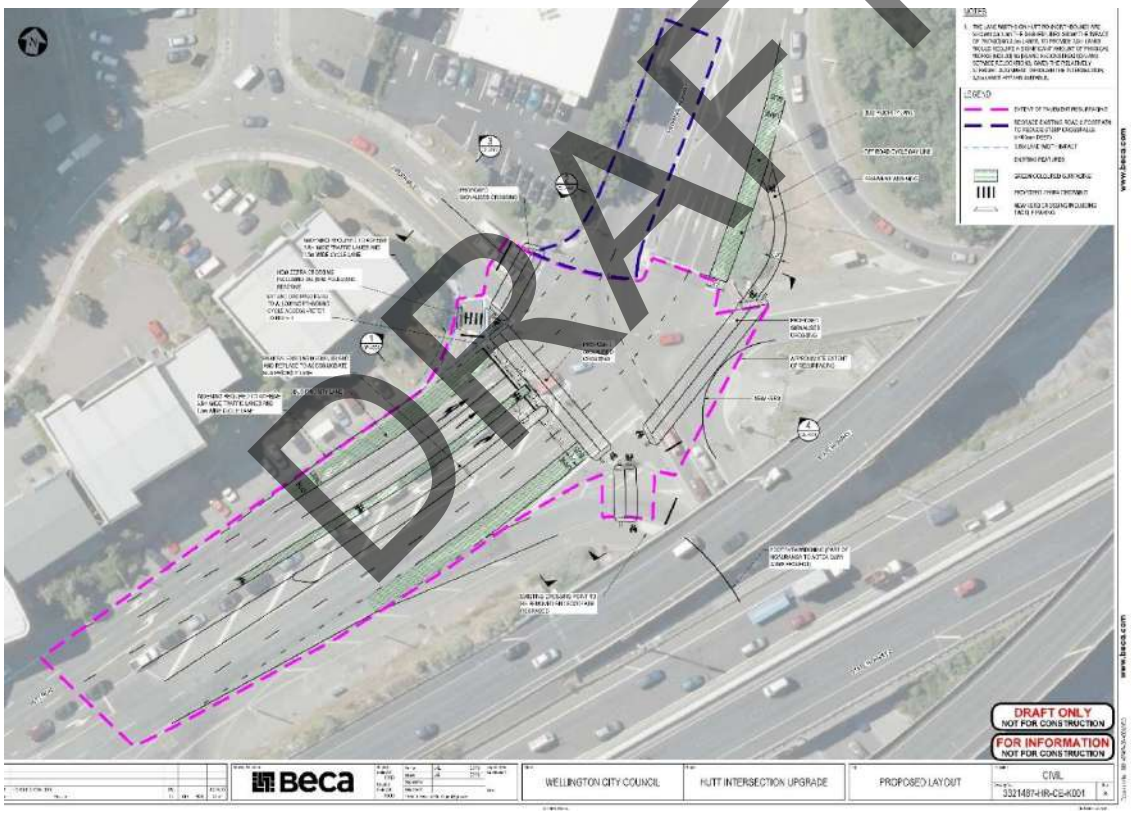


Figure 3: Specimen Design Diagram of the Hutt Road / Jarden Mile Intersection

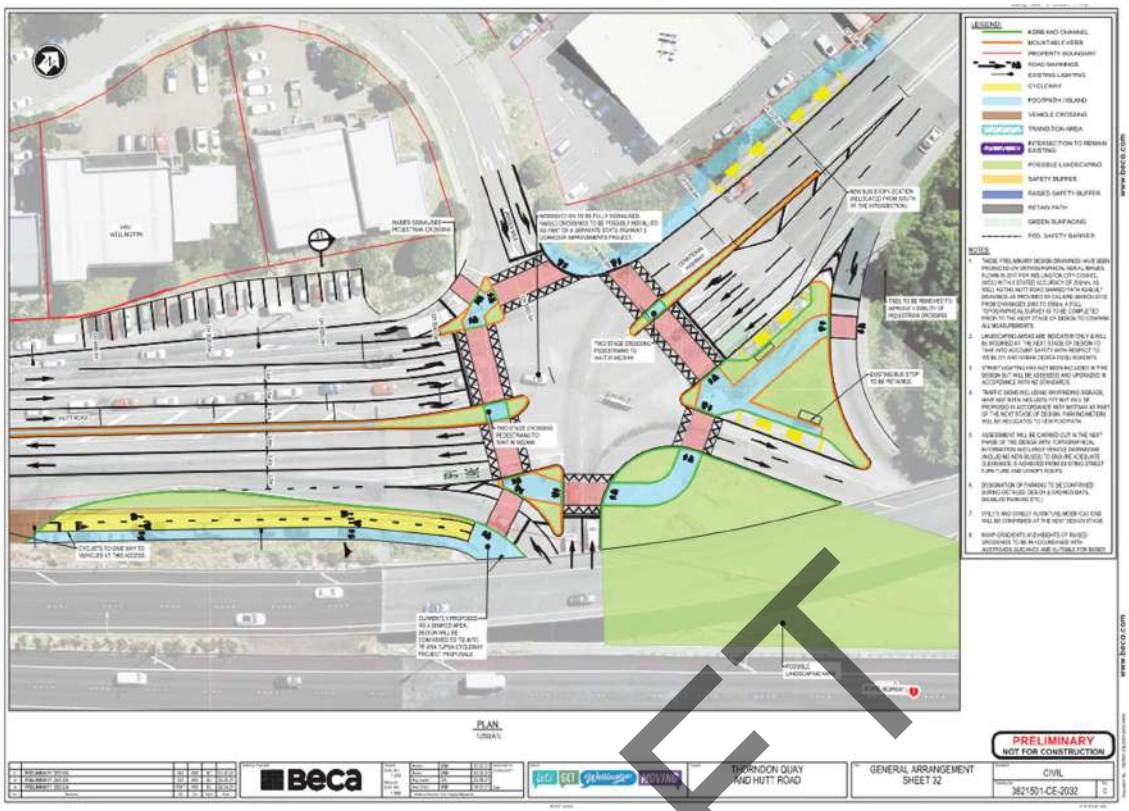


Figure 4: TQHR Project Prelim Design Diagram for the Hutt Road / Jarden Mile Intersection

3.3 Hutt Road

The proposal for Hutt Road is to reallocate road space by repurposing one lane in each direction to provide a peak period special vehicle lane (SPV) for buses and freight.

The key elements of the project along Hutt Road include:

- One general vehicle lane in each direction
- In the northern section, an SPV Lane for buses and freight.
- In the southern section the SPV lane becomes a peak period bus lane. During off peak the bus lane becomes on-street parallel parking.
- A raised central median to restrict right turns except at clearly defined and controlled locations.
- A 0.8m safety buffer to protect vulnerable users from traffic, from the wind blasts from large vehicles and from doors opening direct into the cycle path.
- Widened cycle and pedestrian lanes tying into the newly constructed lengths at the southern end of Hutt Road. These are proposed to be at the same level along Hutt Road to provide flexibility for multipurpose usage. The widths have been considered to allow for safe passing, considering people of varying competency levels. In a few locations the widths have had to be reduced from the desirable due to spatial constraints.

The proposed general cross sections for Hutt Road is shown in Figure 5 below.

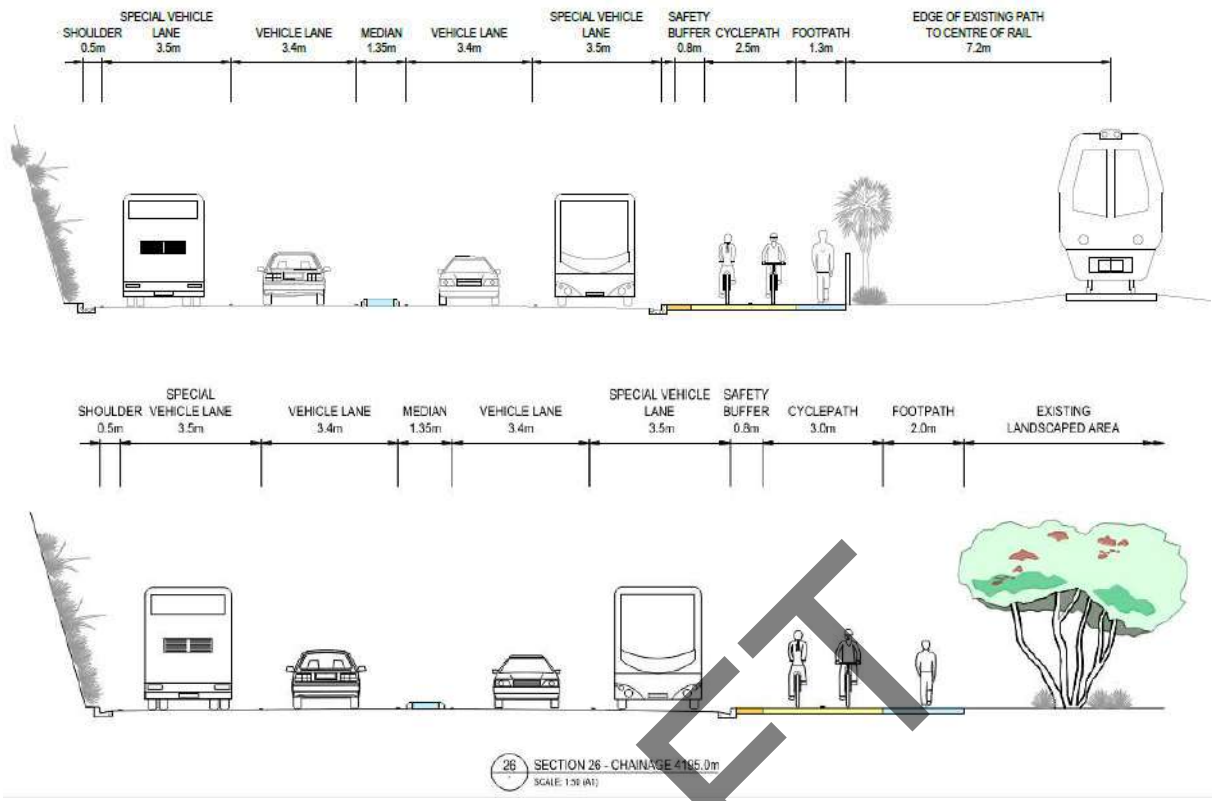


Figure 5: Proposed Hutt Road Cross Sections

The preliminary design does not alter the current configurations for Sar Street, Khaiwharawhara Road, and Rangiora Ave intersections. However, at the Onslow Road intersection the current Seagull configuration is proposed to be fully signalised. The purpose for signalisation is to provide a secure crossing for cyclists who are not currently catered for. Space at this intersection is constrained. However, sufficient space has been identified to widen the main cycle/pedestrian pathway as well. This will require combining the southbound through and right movements into one lane and 'split' phasing the intersection to restrict right turn filter movements. There is no provision for pedestrians going up Onslow Road and hence there is no proposed pedestrian crossing.

At Tinakori Street intersection raised crossings provide a safer crossing environment for both pedestrians and cyclists. Along Hutt Road, the recently constructed cycleway/footpath ties into the new configuration for the Thorndon Quay section. The bulk of the manoeuvres remain unchanged with exception of the addition of the bus lanes.

At the interface around the Tinakori Road Intersection, currently the existing uni-directional cycleway crosses to a bi-directional cycleway on the eastern side of Hutt Road. Cycle/Pedestrian crossing locations and functionality needs to be developed in conjunction with the review of the intersections as these are the logical crossing points. It is felt that currently the more vulnerable users are not well served.

The tables below summarise the existing vs proposed widths for key elements along Hutt Road.

Description	Existing	Proposed
Running lanes	2 lanes in each direction with approx. 3.4m lanes	1 lane in each direction for main traffic – proposed width varies 3.2 – 3.5m 1 SPV (nearside) lane varies 3.4 - 3.5m
Median	Flush - Varies approx. 3m	Raised - 3.0m
Safety Buffer	N/A	0.8m – same level - Buffer/Cycle/Ped
Cycle path	Combined Cycle ped 2.0m	3.0m - same level - Buffer/Cycle/Ped
Pedestrian path	As above	2.0m - same level - Buffer/Cycle/Ped
Parking	N/A	N/A

Table 1: Hutt Road – Existing vs Proposed Widths - North Section (Aotea Quay to Jarden Mile)

Description	Existing	Proposed
Running lanes	2 lanes in each direction approx. 3.4m lanes	1 lane in each direction for main traffic – proposed width varies 3.2 – 3.5m 1 SPV (nearside) Lane varies 3.4 - 3.5m Off peak SPV lane turns in to Parking lane
Median	Flush - Varies approx. 3m	Raised - 3.0m
Safety Buffer	0.8m – same level - Buffer/Cycle/Ped	0.8m – same level - Buffer/Cycle/Ped
Cycle path	3.0m - same level - Buffer/Cycle/Ped	3.5m same level - Buffer/Cycle/Ped
Pedestrian path	2.0m - same level - Buffer/Cycle/Ped	3.0m - same level - Buffer/Cycle/Ped
Parking	N/A	Off peak hours SPV lane becomes parking

Table 2: Hutt Road – Existing vs Proposed Widths - South Section (Tinakori Rd to Aotea Quay)

3.4 Thorndon Quay

The proposal for Thorndon Quay is to reallocate road space to provide:

- One general traffic lane in each direction
- One peak period bus lane in each direction which will be parallel parking off peak
- A dedicated, off road cycle path on the eastern side
- Raised buffers and amenity areas

The proposed general cross section for Thorndon Quay is shown in Figure 6 below.

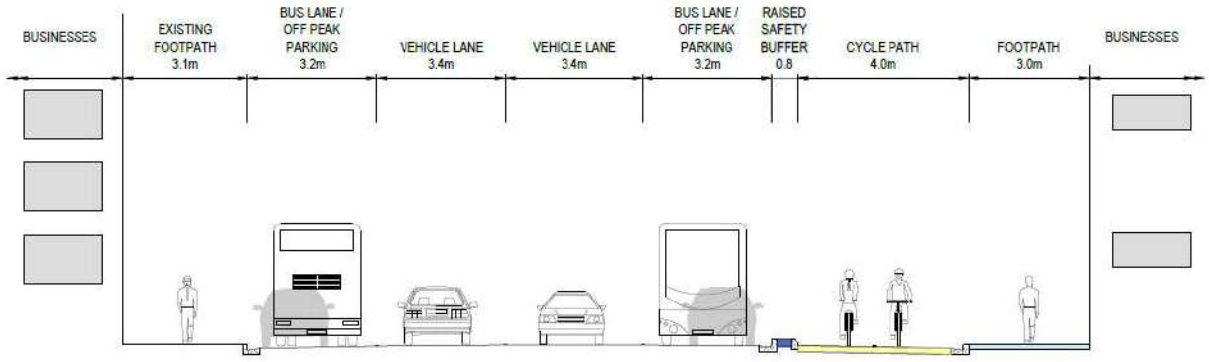


Figure 6: Proposed Thorndon Quay Cross Section

The proposed relocation of the cycle path to between the footpath and the parking / bus lane will significantly improve safety removing the potential conflict between cyclists and vehicles. Pedestrian and cycle crossings of Thorndon Quay will also be improved (raised signalised crossings), as well as the addition of landscaping and other amenity improvements.

Enhancements to the Mulgrave Street intersection, including full signalisation, have been developed which are intended to improve bus movements in and out of the adjacent bus station.

The table below summarises the existing vs proposed widths for key elements along Thorndon Quay.

Description	Existing	Proposed
Running lanes	1 lane in each direction approx. 3.5m lanes	1 lane in each direction for main traffic – proposed width 3.4m 1 Bus (nearside) Lane 3.2m Off peak Bus lane turns in to Parking
Safety Buffer	N/A	0.8m – raised level - Buffer/Cycle/Ped
Cycle path	In carriageway	4.0m - dropped level - Buffer/Cycle/Ped
Pedestrian path	Primarily in the order of 2m on both sides of road	West side unchanged - Eastern side 1.8 – 3.3m - raised level - Buffer/Cycle/Ped
Parking	Northbound mix parallel and diagonal parking Southbound mix some parallel but mostly diagonal parking	Off peak Bus lane turns in to Parking

Table 3: Thorndon Quay – Existing vs Proposed Widths

3.5 Aotea Quay Roundabout

A roundabout on Aotea Quay is proposed to provide a turnaround location for vehicles/freight as a result of restricting turning movements on Hutt Road. A design was carried out by (Spiire, circa 2014). This is shown in Figure 7 below. The design was reviewed by the project team for issues

that may impact upon the integration into the preliminary design for TQHR. The following key issues were raised:

- There is no space to provide the footpath on the seaward side of the road / roundabout as the fenceline is hard up to the existing road with rail sidings on the other side
- The 'Seagull' configuration raises safety concerns due to the nature of the vehicles that will be pulling into the fast through lane. HCV's will be exiting the roundabout at low speed and then merging into the fast lane of the through traffic on Aotea Quay. From a safety point of view this manoeuvre is considered problematic due to the differences in road speeds and limited visibility on the blind side of HCV's as they pull out.

Figure 7: Aotea Quay Roundabout (Spiire Design for Wellington City Council)

Following the review and the safety audit comments it has been agreed that a full roundabout controlling all movements is the preferred option (Refer Figure 8). It is also the intention that the posted speed limit along Aotea Quay will be reduced from the current 70km/hr to 50km/hr and hence will be consistent with the posted speed on Hutt Road.

The proposed intersection needs to be signalised for traffic control purposes for the nearby sports stadium which has an emergency evacuation plan requiring closure of the road in an emergency. The signals are unlikely to be required 24/7 but may be required for other reasons during peak traffic times to facilitate vehicles exiting from the freight yards.

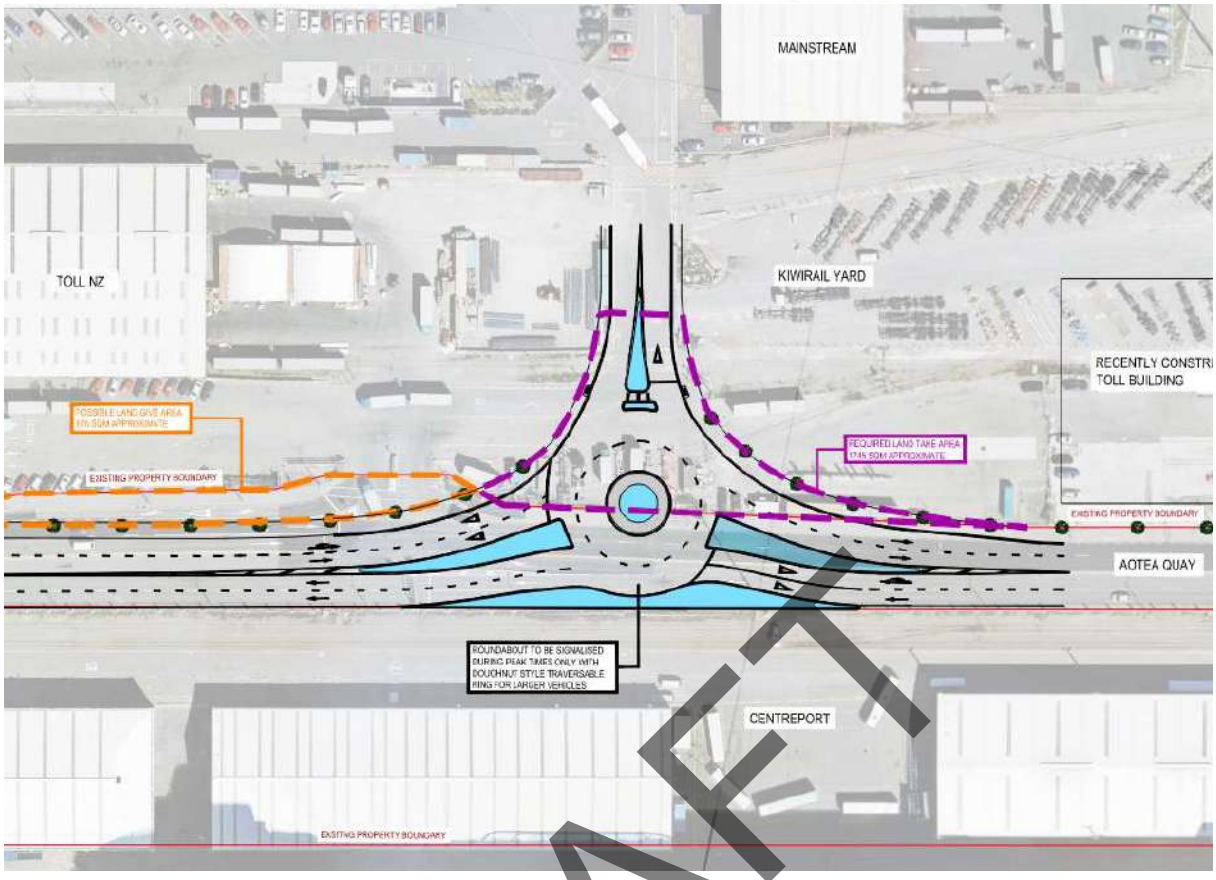


Figure 8: Proposed Aotea Quay Roundabout

At the time of writing this report further options were being developed to provide an option that mitigates the encroachment into KiwiRail land.

4 Design Criteria

4.1 Design Standards

The following design guides have been used as part of this design stage of the project:

- Austroads – Guide to Road Design including the following sections:
  - Part 2 Design considerations
  - Part 3 Geometric design
  - Part 4 Intersections and Crossings
  - Part 5 Drainage
  - Part 6 Roadside design Includes Part 6A Paths for walking and Cycling
- Cycling Aspects of Austroads Guides 2017
- Supplementary guidance from TM2501 – May 2012 - (Super-elevation calculations) and TM2502 – January 2014 – (on Surface water Run-off).
- The State Highway Geometric Design Manual (SHGDM)
- NZTA - Pedestrian planning and design guide – Nov 2009
- Wellington Water, Regional Standards for Water Services, May 2019 (Wellington Water, 2019)

- WCC Code of Practice for Land Development December 2012
- NZTA - P46 Stormwater Specification April 2016 (NZTA, 2016)
- NZTA – Traffic Control Devices Manual (Dec 2008)
- NZTA - Manual of Traffic Signs and Markings (MOTSAM)
- NZTA - Pedestrian Planning guide
- NZTA – Walking-cycling and public transport – Cycling standards and guidance
- NZTA – Technical Note 2 (TN002) - Separated cycleways at side roads and driveways

4.2 Design Traffic / Traffic Modelling

The following table summarises traffic data for Hutt Road and Thorndon Quay, taken from the Waka Kotahi One Network Classification database.

Road	Heavy Goods Vehicles %	Traffic ADT
Hutt Road	5 – 9 %	20,000 - 23,250
Thorndon Quay	5%	7,000 – 11,500

Table 4: Existing Traffic Volumes

Traffic modeling was initiated using Sidra modeling for each individual intersection. The output from these assessments was then submitted to Greater Wellington Regional Council for analysis using the regional models. The project team are awaiting the results of that modeling.

4.3 Road Classification

The road classification for both Hutt Road and Thorndon Quay is Arterial roads. The proposed classification will remain unchanged.

4.4 Design Speed

The current posted speed on Thorndon Road is 50km/hr. The operating speed is in the order of 60km/hr. It is proposed to drop this posted speed to 40km/hr.

The current posted speed on Hutt Road is 60km/hr rising to 80km/hr north of Onslow Road. The operating speed is between 70 and 90km/hr. It is proposed to drop these posted speeds to 50 and 60km/hr respectively.

The reduction in speeds is proposed on a safety basis.

Speeds less than 69km/hr are classified as low speed in *Austroads, Guide to Road Design Part 3*. This classification is then used to assist in the definition of suitable lane widths.

5 Geometric Design

5.1 Topographical Data

The preliminary design has been developed from the single stage business case phase using LIDAR data as the ground model and aerial photography from 2018. This information is considered suitable for the preliminary design stage. However, it is anticipated that a detailed topographical survey will need to be undertaken to enable refinement of the geometric design to inform the pre-implementation phase. Some specific areas such as the Mulgrave Intersection, Tinakori Road

intersection and the section between Moore Street and Davis Street were approved for additional survey work to inform the preliminary design primarily due to the mature trees obscuring the LIDAR vision. The results of these surveys resulted in some realignment of the designed kerb lines at the Tinakori Road Junction.

5.2 Typical Cross Sections and Lane Widths

Indicative cross sections were developed for Stage 1. During Stage 2 these sections have been challenged and finalised in discussions with the partner organisations and inform the geometric design.

The project team have worked with the partner organisations to develop and agree parameters to inform the geometric design including lane widths, Special Purpose Vehicle (SPV) lane operations, bus stop locations and functionality as well as the amenity treatment. Meeting minutes from a joint design standards session with the partner organisations is included in Appendix A.

Table 5 summarises standard design widths for elements of the road corridor.

Table 5: Standard Design Widths for Individual Elements of the Road Corridor

Road Element	Standard Width	Design Source	Selected Widths
Footpath	Arterial Road 2.4m + Commercial Outside CBD 1.8m	NZTA Ped Planning Guide chapter 14 (Table 14.3)	2.0 - 2.4m Thorndon Quay 1.6m - 3.1m Hutt Rd
Cyclepath – Uni Directional	Min 2.4 / Tolerable 2.6 / preferred 3.0m	NZTA Cycling Network Guidance	Not used
Cyclepath – Bi Directional	Min 3.0 / Tolerable 3.5 / preferred 4.0m	NZTA Cycling Network Guidance	3.0-4.0m
Bus Lane	Min 3.7m / Preferred > 4.5m	AustRoads Part 3 section 4.9.2 (Table 4.22)	3.2m Thorndon Quay 3.5m Hutt Rd
Traffic Lane	Low Use/Low truck Vol 3.0 – 3.4m General Width All Roads 3.5m	AustRoads Part 3 (Table 4.3)	3.4m
High Occupancy Vehicle (HOV) Lane	3.5 – 4.5m	AustRoads Part 3 (Table 4.3)	SPV lane Hutt Rd 3.5m
Parking	2.1 – 3.2m (2.3m in normal conditions)	AustRoads Part 3 (Fig 4.46)	2.4m (within bus lane)

The existing shoulder and median spaces on Hutt Road have been redistributed to provide a raised median and improved cycle/ pedestrian widths. With the off-road cycle facility, the shoulders will not be required for cyclists, and broken-down vehicles will not completely block the road as there are two lanes in each direction.

5.3 Intersections

Other than the Aotea Quay Roundabout, no new intersections are proposed. Existing intersections have been assessed and developed against the new road configurations/proposed cross sections, performance assessments and safety. Traffic modelling of the intersections is currently being carried out.

5.4 Traffic Signals

5.4.1 Design Standards

The Traffic Signal design is to be based on the following standards:

- Austroads Guide to Road Design – Part 4a: Unsignalised and Signalised Intersections
- Austroads Guide to Traffic Management – Part 9: Traffic Operations
- RTS 14 Guidelines for Installing Pedestrian Facilities for People with Visual Impairment
- Signals New Zealand User Group (SNUG) National Traffic Signal Specification
- NZ Transport Agency Standard Signal Layout Draughting Guide Drawing 1/ 1061/ 140/ 8104/ Sheet 1/ Rev 0

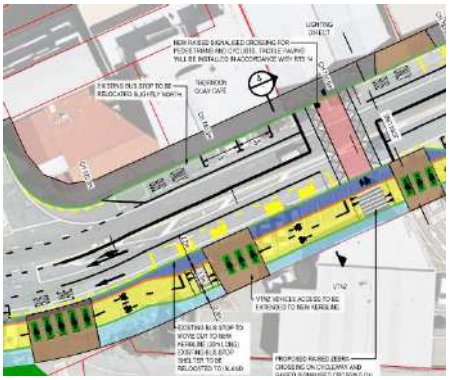
5.4.2 Overview

There are currently four signal-controlled intersections in the project area, being Jarden Mile, Kaiwharawhara Road, Onslow Road and Mulgrave Street. As the design developed, the functionality of the signalised intersections was assessed against the proposed cross section and functionality changes. Changes to signalised intersections include:

- The Mulgrave Street/Lambton Quay/Thorndon Quay intersection is proposed to be fully signalised. This is to reduce the safety risk for the currently unsignalised left turn movement from Mulgrave to Thorndon Quay which has reduced visibility due to the acute angle of the intersection as well as mature trees.
- The Tinakori Road and Onslow Road intersections are proposed to be fully signalised to improve pedestrian/cycle crossing facilities.
- Pedestrian crossings along Thorndon Quay will be signalised and the pedestrian crossing on Hutt Road near Rangiora Ave will also be signalised.

5.5 Pedestrian Crossings

It is proposed that all pedestrian crossings along Thorndon Quay will be raised and signalised. The locations of these crossings have been adjusted to tie in with the relocated bus stop locations. The crossings being located first before the bus stop in each direction which results in passengers crossing behind the buses and hence reducing potential delays to the onward journeys of the buses once those passengers have alighted. It also improves safety as it makes the crossing pedestrians more visible to other road users (not hidden by the departing buses).



The existing pedestrian crossing on Hutt Road near Rangiora Ave will also be signalised.

5.6 Accessways and Driveways

The potential conflict between people on bikes and scooters and pedestrians and vehicles entering/leaving properties is a key issue that has been considered during the preliminary design phase. Most access locations are in the Onslow Road to Tinakori Road section of Hutt Road and along Thorndon Quay on the eastern side.

A number of serious or significant issues as well as minor issues were identified in a safety audit of the Hutt Road cycleway. The more serious issues focussed on access/egress to businesses along the south-eastern side of the corridor. These predominantly identified issues with vulnerable users on the shared use facility and for cyclists. In relation to accesses generally, the safety audit notes *"A high level of cyclist / vehicle and pedestrian / vehicle conflicts were observed at major access points. In most situations, it was the exiting drivers not looking for cyclists, and pulling directly in front of the vulnerable user"*. The higher speed of cyclists was also observed to contribute to these conflicts. One of the key recommendations in the safety audit is to investigate improving cyclist safety at accesses through the installation of passive and active warning measures to raise awareness and mitigate the risk. Identifying and improving visibility lines and controlling speeds have also been key considerations.

It is proposed that all vehicles exiting units turn left only. U turns will only be at designated locations, where designated right turn lanes are provided within the central median. Vehicle tracking indicates that only a car with trailer can make use of the U turns. An 8m rigid truck fails due to its turning radii.

As part of the project investigation, traffic turning right across multiple lanes was raised as a significant road safety risk. This is due to turning drivers focussing on oncoming traffic which may be operating at differential speeds which may miss a filtering motorcyclist and cyclists/peds on the shared path as they turn. A Safe System Framework Assessment was undertaken on the existing arrangement and a number of options. Through this process the raised median island was identified as a significant improvement to this safety risk. Vulnerable users tend to be more susceptible to serious or fatal injury and the LILO was noted to result in a 58% and 48% reduction in risk score for cyclists and motorcyclists respectively. It is considered that the U-turning risk, which although may be present, is much less likely to result in serious injury. Further, any turning risk to vehicle occupants may be mitigated by a proposed speed limit reduction and by providing focal points for turning rather than at multiple crossing points.

It is proposed to retain the flush median from Sar Street to Aotea Quay as part of the preliminary design. A raised median is proposed from Aotea Quay through to Jarden Mile with strategically placed breaks to allow for business access and to control the locations of U-turns. Potentially, the U-turning risk could be mitigated further by the use of electronic warning signs triggered by the presence of vehicles in the U-turn bays.

5.7 Vehicle Tracking

Tracking path analysis has been undertaken on heavy vehicle turning movements at intersections using AutoTURN. A minimum of 600mm clearance has been allowed in addition to the tracking path to cater for driver error or misjudgement. The design vehicle is the 18m long quad rear axle semi-trailer and the 20m B-train tanker combinations. Note: No U-turns are possible for these large vehicles, however there is enough space for an 11m rigid truck and less to U-turn from Northbound to Southbound at the Jarden Mile intersection but not at any other intersections along Thorndon Quay and Hutt Road.

5.8 Structures

No additional structures are proposed. Existing structures include two rail bridges, the SH1 over bridge, retaining walls and signage structures. It is not intended to impact these structures.

The Aotea Quay overbridge is noted as constraining space for lane width. Based on this constraint it is proposed to have only a single lane under the overbridge section. The reduction in lane numbers happens straight after a bus stop and signalised pedestrian crossing.

5.9 Signage and Road Markings

All signage will be to NZTA Traffic Control Devices Manual and MOTSAM standards (where appropriate) during the detailed design stage.

5.10 Design Departures

The main areas identified for potential departures are lane widths, due to the constrained width of the corridor. The proposed departures and a comparison with the design guides is included in Table 5.

6 Other Design Features

6.1 Public Transport Facilities

6.1.1 Bus Stop Locations

Figures 9 and 10 show the current bus stop locations as well as the indicative new bus stop locations as part of rebalancing proposed in Stage 1. The relocation of bus stops have been explored further with GWRC and the operators and adopted in the preliminary design. One area where the final location may need to be further considered is the stops near Moore Street intersection (Capital Gateway). From an urban design perspective, the driver is to have the stop near to the Marae area. Whereas from a purely spatial perspective (distances between stops) it is located the other side of Moore Street. The final locations will be developed during the detailed design phase.

Figure 9: Current Bus Stop Locations

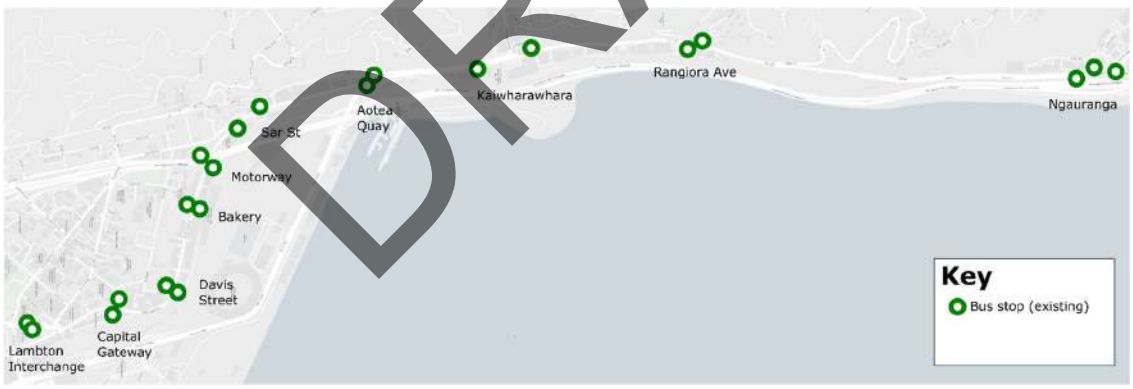
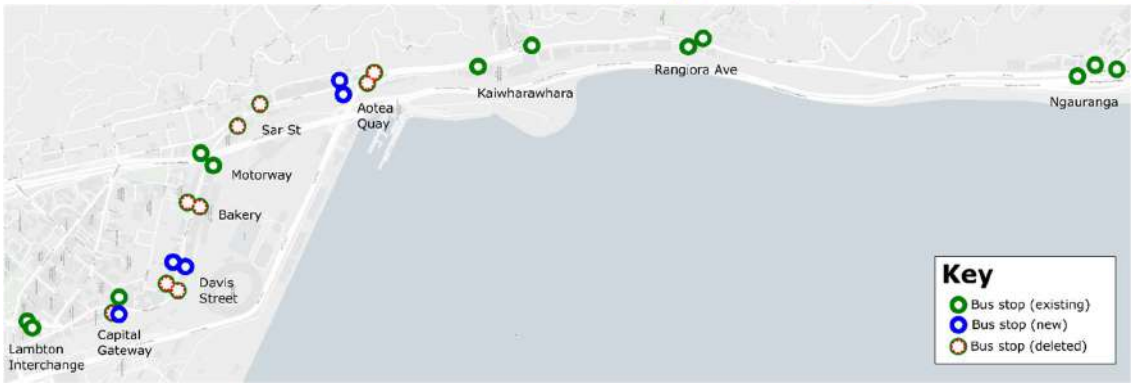


Figure 10: Potential Bus Stop Changes



6.1.2 Special Vehicle / Bus Lanes

The key considerations during preliminary design included:

- lane widths
- the inclusion of off-peak parallel parking within the lane
- whether bus stops will be within or (where space permitted) outside the lane. During the preliminary design process it was confirmed that there is insufficient space to provide bus stops outside the bus lane.

There were various factors discussed in selecting a 3.5m width for the SPV lane on Hutt Road. The road speed, types of vehicles proposed for the lane, the removal of the shoulder and a desire to reduce the temptation for cyclist to use the road in preference to the cycleway were all reviewed.

Conversely on Thorndon Quay where the road speeds will come down to 40km/hr, the bus lane width has been reduced to 3.2m thereby reducing the temptation for cyclists to try and share the lane with buses.

6.2 Parking Facilities

The project will involve loss of and changes to on street parking. These changes are predominantly the removal of the existing angle parking on Thorndon Quay and the replacement with parallel parking. At key locations (where for instance additional visibility is required) it has been necessary to remove some parallel parking.

A summary of the existing versus proposed parking numbers is set out below. As the detailing of the design develops these numbers are subject to change.

- Thorndon Quay – Existing 390 spaces – Proposed 258 spaces
- Hutt Road – Existing 133 – Proposed 125 spaces

6.3 Preliminary Urban and Landscape Design

6.3.1 Overview

The purpose of this PDPS section is to explain the overall approach, standards and requirements and urban design process for the TQHR project. This section sets up the process for the projects masterplan phase which will give effect to the LGWM urban design framework (UDF) through the detailed design phase.

LGWM is developing a programme wide UDF that will be developed in parallel to the TQHR masterplan work being undertaken through the detailed design phase. The urban and landscape masterplan for TQHR will be essential to guiding solutions to meet the project's intent and vision.

The UDF won't be completed in full prior to TQHR design phases starting. Therefore, the project will be required to work collaboratively with the Client and partners to ensure adequate urban design and landscape elements have been considered throughout the design process including the early phases.

TQHR project is located on what was the original foreshore prior to reclamation and seismic events occurring. This original foreshore continues north to Petone and south through the Golden Mile. There are various cultural, heritage, social, economic, and environmental places of interest along the TQHR corridor that will provide valuable opportunities to inform the projects design response.

The projects physical scope of works is located within the TQHR road corridor however, wider contextual data needs to be considered to deliver a sound urban and landscape design response.

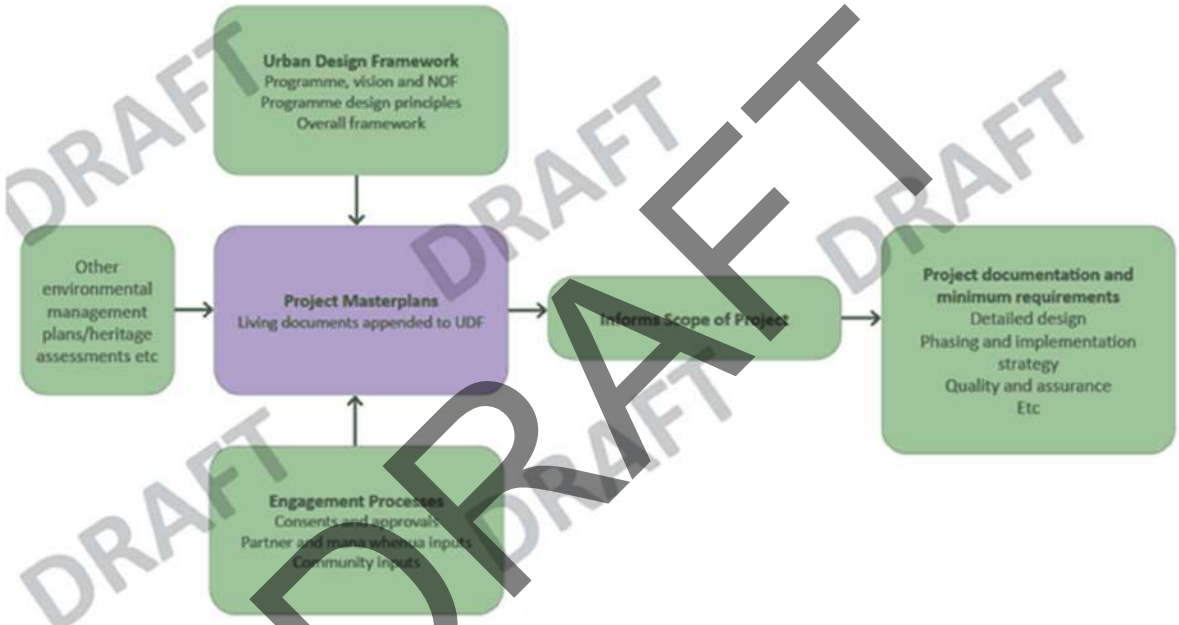


Image above: Draft LGWM Programme UDF process and how it relates to the LGWM projects like TQHR.

The TQHR project looks to:

- Consider and connect with the wider Wellington city vision and partnerships, its context, cultural heritage and landscape;
- Define streets and roads and reflect the Network Operating Framework (NOF);
- Shape streets to work with civic spaces and functions, neighbourhoods and street users;
- Define precincts that help characterise place and identity;
- Encourage safe and accessible mixed mode transport;
- Support and acknowledge urban development potential as well as infrastructure (services) needs;
- Measure and evaluate through:
  - Shift in physical and operational changes / improvements;
  - Changes in its use and function and its resulting impacts;

- Determining if investments delivered desired outcomes (safety, quality of life, sustainability, economic, environmental, improved mobility etc).

Both quantitative and qualitative metrics are important. There are different methodologies in how to measure the above; these include before and after photos, survey and consultation with local patronage and communities and traffic count recorders.

Urban design, landscape and aesthetic considerations will be developed through solutions that deliver value for money through the detailed design phases. CPTED, Safety in Design, Maintenance in Design, Whole of Life Costs (not just capital costs) also need to be considered within the urban design and landscape design process.

A preliminary urban design nodal point study report has been completed as part of the SSBC and Preliminary Design Philosophy Statement (PDPS) process (refer Appendix B) but further investigation and testing is required to consider the whole corridor.2

6.3.2 Urban Design Framework and TQHR Masterplanning work

Wellington City's six goals for the city and the community's urban design and transport principles have influenced the preliminary urban design aspects of the TQHR project and provides guidance to achieving and assessing the quality of developed and restored urban areas. This project is about people, enhancing communities and providing effective and efficient transport. This means prioritising modes of transport and allocation of space that supports moving people and accommodating freight.

Image above: Our City Tomorrow's six aspirational goals for the city

Natural Identity

The streets within the TQHR project offer social and economic benefits for Wellington. The rawness of the coastal hills along the Wellington harbour is an important context to consider - the TQHR project has an opportunity to celebrate this natural identity. The project should reflect Thorndon Quay & Hutt Road's unique local character and cultural landscape as the original harbour shoreline:

The TQHR section relates and connects to both the Te Ara Tupua project and the central city through nature & character. TQHR has been identified as a 'green boulevard' in WCC Green Network Plan. Green infrastructure including trees, active mode facilities (cycle storage, e-bike charging), green 'pocket' parks and water sensitive urban design are all opportunities to be explored in this design phase.

Pedestrians and a mix of diverse modes of transport aid in developing a sense of place for communities and neighbourhoods. Success is achieved when delivering transport solutions that can also provide public space and 'pause' moments for people to share experiences, interact and socialise. Sound urban design principles are essential and will help guide to the right solutions to meet the project's intent and vision.

Included in Appendix B, the design team have established preliminary urban design principles that begin with focusing on a city-wide extent and describes three precincts within the TQHR area. A nodal point analysis was completed and is included in Appendix B. The project has focused on three nodes – Mulgrave Corner, Thorndon Quay Shops and Jarden Mile. These nodes are developed based on the existing concentration of activities and intensity. The focus is on people, place and transport as interconnected components. A completed site analysis around these nodes describes the preliminary constraints and opportunities for development that this design has been based upon.

In discussions with the local Iwi and when considering the wider picture from an urban design perspective. Connectivity to areas behind Thorndon Quay (to the west) has been considered. There is currently no connectivity between the SH1 overbridge and Davis Street. Creating pedestrian access through has been identified as a potential benefit for the community.

During consultation with the local Iwi one item that seems to have traction with the design team was the concept of pause and reflection spaces. These can be of various elements and outcomes but included ideas such as special plaques or tiling depicting the area's history, heritage and the local environment.

Other urban and landscape design items specific to TQHR for the masterplanning phase:

- Apply a place-based approach to street design and utilise Waka Kotahi's Final Draft of the Aotearoa Urban Street Planning & Design Guidelines;
- Areas along Thorndon Quay near the project site have been identified as growth areas within the WCC Spatial Plan, however, land immediately adjacent to the project has the same height limits as the operative District Plan to account for natural hazards. Consideration of the regeneration and development potential in and around the project area will need to be factored into the urban design and landscape design response;
- The project team will need to collaborate with other workstreams such as MRT and Strategic Highways, Golden Mile, City Streets, CCPI, WCC Streets for People and the Transition Project and coordinate with the Rail Precinct and Port project interfaces. Heritage, archaeology, mana whenua values and cultural considerations need to be taken into account as there are various histories associated with the project site (see also section 2.2 of this DPS for Mana Whenua Values);
- Design for good public transport customer experience in place-specific and accessible street- based stops and interchanges. Celebrate the views to the wider landscape through carefully planned spatial arrangement of lingering and movement spaces in relation to their context;
- Make culture visible. Integrate public arts in public spaces. Celebrate Wellington's weather and work creatively with lighting:
- Consider activation planning and facilitation (especially for the duration of city construction and for existing or future events i.e. Thorndon Fair)
- The context analysis prepared as part of the projects masterplanning and urban design response will help inform placemaking, sense of place and interpretation opportunities within the project;

- Enable universal access, safe and comfortable movement for all people by considering the interplay of public transport, active modes and pedestrian space

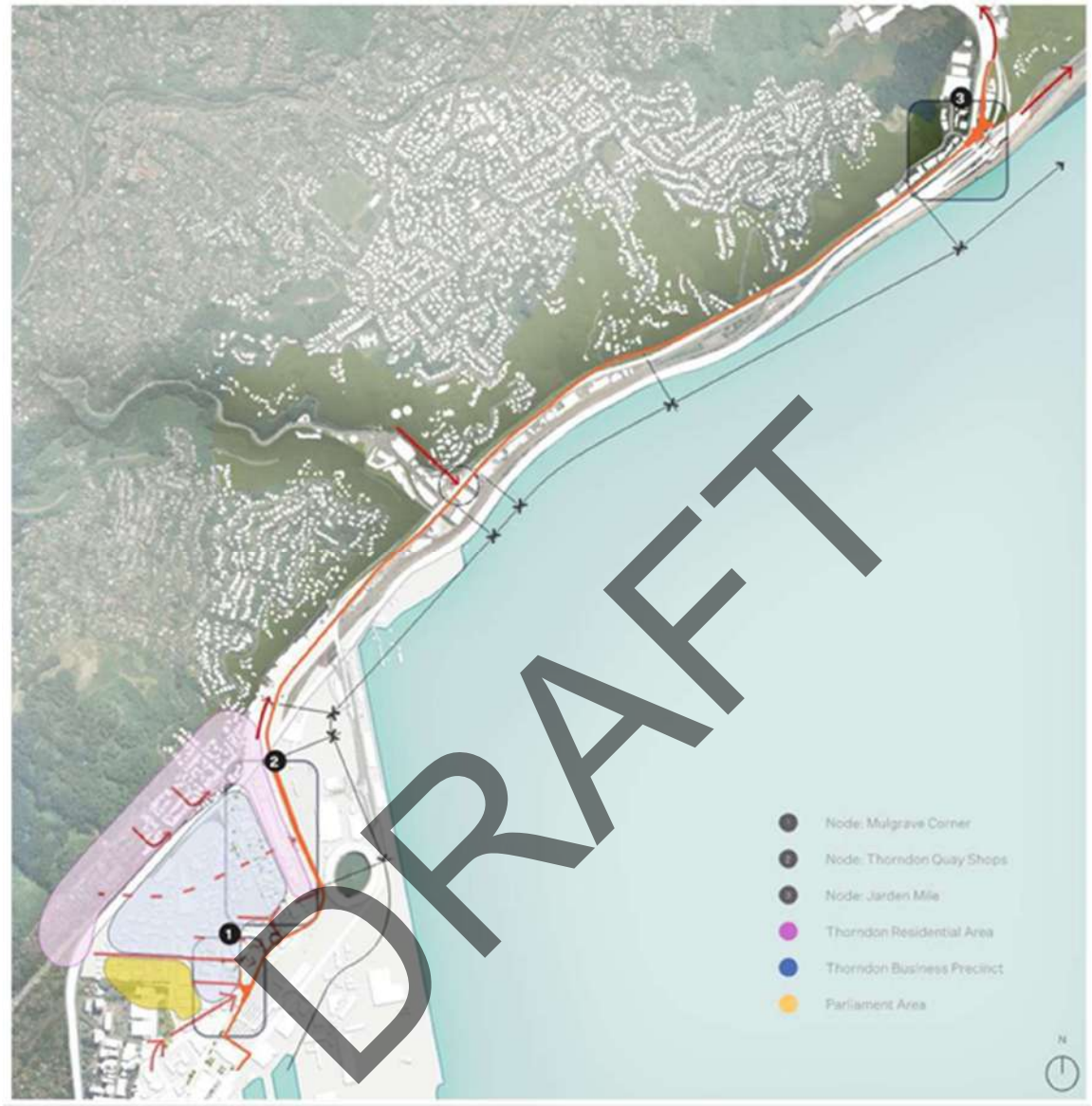


Figure **11: Nodal Point Analysis Location Plan**

6.3.3 Standards and References

The design has been developed in accordance with the NZTA requirements and include:

- NZTA Urban Design Professional Services Guide – PSG/12
- NZTA Bridging the gap: Urban Design Guidelines (2013)
- NZTA Urban Design Objectives and Methods (2013)
- NZTA Environmental and Social Responsibility Policy (2011)
- NZTA Landscape Guidelines – Final Draft September 2014
- NZTA Safe System
- NZTA Environmental Planning Manual

- NZTA P39 Standard Specification for Highway Landscape Treatments (2013)
- Waka Kotahi's Final Draft of the Aotearoa Urban Street Planning & Design Guidelines (2021)
- ESR Standard: Z19 State highway environmental and social responsibility standard

The following documents are key strategies and policies that influence the future shape of the city and will provide a foundation for the projects urban design response. Some of these have already been summarised in the draft LGWM UDF:

- Let's Get Wellington Moving Vison, Objectives, Priorities and Liveability criteria
- Transport Orientated development
- 'Planning for Growth' including the Central City Spatial Vision; Spatial Plan,
- The Operative District Plan (proposed being developed – out for engagement October 2021)' and the Proposed District Plan and Design Guides.
- National Policy Statement on Urban Development (NPS_UD) 2020
- Wellington Towards 2040: Smart Capital (2011)
- Central City Framework (2010)
- Draft Regional Growth Framework
- Draft Place & Movement Framework (2019)
- Te Atakura - First to zero (2019)
- Green Network Plan (due for completion Oct 2021);
- WCC Design Review Toolkit
- WCC Code of Practice for Land Development December 2012
- Our Capital Spaces;
- Our Natural Capital;
- Wellington Public Space Policy;
- Wellington Play Spaces Policy;
- Wellington Resilience Strategy;
- Accessible Wellington;
- Te Tauihu;
- The Public Art Policy (2012);
- The Trading in Public Places Policy (2006 but under review),
- Te Atakura.
- Wellington Design Manual (currently being scoped alongside the LGWM UDF).
- LGWM Development Concept Plans (Central City & Rail Precinct)
- LGWM Gehl Public Life Survey – 2004 and new version due for release in October 2021
- LGWM Heritage and Landscape Assessment
- LGWM Māori Cultural Heritage and Values Report
- Other standards referenced in this PDPS relevant to urban design such as 4.1 Design Standards; 5.4.1 Traffic Signals; 6.4.2.2 Stormwater; 6.4.3.1 Street Lighting and all other relevant guides and standards.

If there are structures the design team will need to refer to the Waka Kotahi bridge manual and if there is a need for a Bridge architect e.g. an iconic bridge then this should be noted in the PDPS also.

6.4 General Civil Components

6.4.1 Preliminary Pavement Treatments

6.4.1.1 Design Standards

The Pavement and Surfacing design is to be based on the following standards:

- Austroads Pavement Design – A guide to the Structural Design of Road Pavements 2004
- NZ Supplement to the Document, Pavement Design – A Guide to the Structural Design of Road Pavements (Austroads 2004), 2007
- NZ Transport Agency specifications (B, M, P and T series)
- NZTA - https://www.nzta.govt.nz/assets/resources/pavement-specification-guidelines-for-cycleways/Pavement-specification-guidelines-for-cycling-routes.pdf

6.4.1.2 Overview

Significant changes to pavements are not expected as the interim option is likely to be mainly a reallocation of road space. However, pavement considerations has been included in the preliminary design development. Preliminary pavement designs has been developed considering the expected:

- Traffic Loading
- Pavement design – Unbound, modified or bound
- Subgrade and subgrade improvement layer condition and strength parameters
- Pavement materials
- Surfacing
- Environmental factors affecting pavement design – Noise reduction, safety and skid resistance, drainage

Environmental factor considerations affecting the pavement design (for example noise reduction, safety, skid resistance, and drainage) will need to be undertaken which will inform the pavement allowances within the cost estimates.

Inputs will need to be provided to the geotechnical team to assist with drafting an investigation schedule to better understand costs and risks and inform the detailed design stage in locations where pavement may need to be widened.

6.4.1.3 Pavements Approach

There will be a need to have two different pavement systems for this element of work, an approach for infilling existing median islands/kerb buildouts that need to be removed and an approach for reinstatement adjacent to length of new kerbs.

Areas of pavement reinstatement that will be subjected to traffic will typically need to be a structural asphalt pavement, for both construction expediency and the expected traffic loadings. Pavement loading by GWRC buses that are operating under a HPMV permit, i.e. with higher axle loads than that are allowed with restriction will be considered in the detailed design phase.

This type of pavement is likely to be in the order of 175-200mm, made up of various Asphaltic Concrete (AC) layers depending on the underlying ground conditions. If the raised areas that are to be removed have been constructed over an existing pavement, it is recommended that a 150mm diameter pavement core is taken in order to ascertain the suitability of the existing pavement structure for the expected loading.

Reinstatement of the pavement adjacent to new kerbs can also be done with an asphalt pavement, with the width of reinstatement based on the future loading, i.e. reinstatement for a parking bay can be to a lower level of design compared to an area of reinstatement that will be part of a proposed traffic lane. Another factor that will influence the width of restatement will be the constructability of the pavement with respect to compactor sizes.

Due to the reconfiguration of the road space in the Thorndon Quay section, it is recommended that the carriageway and cycleways are resurfaced to eliminate all old road markings to avoid confusion with ghost markings. It appears that only limited areas of Hutt Road will require resurfacing due to layout changes.

New raised median islands/separators can be constructed on the existing pavement surface by cutting a key into the existing surface and the new kerb profile extruded into the key to avoid having to cut into the existing pavement beyond the extents of the raised feature.

Areas of new/widened footpath will need to be built to standard WCC footpath details (WCC Standards C.3.6). Likewise new cycleway pavements will be built to a standard equivalent to that of a WCC vehicle crossing (WCC C3.7a).

Whilst it is expected that all pavements, cycleways and footpaths will be surfaced with asphalt to provide a high amenity low maintenance cost effective surface, there is a preference to continue the concrete footpaths as per the new section between Tinakori Road and Kaiwharawhara Road intersections, especially for the Thorndon Quay section. This change in finish colour and texture clearly delineates the footpath from the cycleway and hence reduces the risks of users entering the wrong areas. It also will provide additional reinforcement for vehicles exiting onto the road to look out for pedestrians and cyclists. If this solution is to be followed structural crossings at all entrances and exits will need to be installed (WCC standard Drg 24/721).

6.4.2 Stormwater

The stormwater design approach is to retain the existing stormwater network, flow paths and inlets as much as is practicable.

Generally the project does not increase the impervious area, with existing sealed areas (parking lanes and bus lanes) being converted to sealed cycleways and footpaths, meaning that post-development runoff will not increase. The exception to this is between approximately CH4100 and CH4900 where the new footpath with extend into existing landscaped area.

6.4.2.1 Key Design Assumptions:

- Where possible, the existing catchments, flow paths, inlets and pipe system should be retained.
- The existing pipe system is assumed to have sufficient capacity. Capacity assessments of the existing system is not part of the preliminary design scope.
- Improvement to the stormwater system network is also not part of the design scope
- Condition assessment of stormwater network is also excluded
- As a consequence, no stormwater quality treatment has been included in the design.

6.4.2.2 Stormwater design criteria

The following design criteria are proposed, based on Austroads 6A, Wellington Water 2019 and NZTA 2016: Rainfall intensities will be as per Wellington Water 2019 for WCC with 20% allowance for climate change

Primary system (kerb and channel, sumps and pipes) are to be sized so the 10yr ARI (Average Recurrence Interval) event does not encroach on traffic lanes, but can encroach onto the shoulder, and can encroach into cycleways by up to 1 m width

Secondary system (overland flow) sized so that in the 100yr ARI flood event water depth does not exceed of 0.1 m and 2 m/s velocity on trafficable lanes with a minimum of one traffic lane free from flooding, with no limits on flooding over cycleways. (In a 100yr ARI event it is not anticipated that cyclists would be using the cycleways due to high rainfall and poor visibility.)

6.4.2.3 General Stormwater Philosophy

Stormwater system standards and specifications will be in accordance with the following organisations requirements, in order of precedence Wellington Water, WCC, and NZTA.

Raised pedestrian crossing on road and in cycleways would cut off overland flow paths, affecting both the primary and secondary systems. Raised crossings will be assessed and solutions developed on a case-by-case basis to allow overland flow through the following options:

- New sump connecting to existing pipe (primary flow only)
- Bubble up sump system discharging to the kerb and channel on downstream side
- Concrete “U” channel with grate discharging to the kerb and channel on downstream side

Existing sumps to be retained where possible, or replaced as close as possible to the existing location, and connected to the existing stormwater system.

Generally, in Thorndon Quay, the cyclepath and road are on grade with a raised safety buffer separating the two, and the stormwater system with consist of:

- Kerb and channel (e.g. standard WCC vertical kerb and channel) along the edge of traffic lane and cycle path, with regular kerb cut-downs through the kerb/raised safety buffer between the cycle path and traffic lane.
- Kerbs cuts through the raised safety barrier, to allow to stormwater flow across draining to existing/relocated sumps and the existing pipe system. (This assumes that the cycle path will have cross-fall in the same direction as the road as per the below typical section.)

Cycle path flood width to be checked for primary level of service, and where flood widths exceed 1 m consideration will be given to adding more sumps if practicable.

Walkways should continue to drain in the same manner as existing.

All stormwater sump grates, manhole covers, rodding eye/lamphole to be raised to new pavement levels where applicable

6.4.2.4 Section specific stormwater design philosophy

Hutt Road (CH1520 to CH5080)

Raised crossings at approx. CH1520, CH1930, CH3380 and CH5040 will be assessed and solutions developed on a case-by-case basis to allow overland flow.

On the west side of the road between approx. CH1640- CH1940 the kerb will move back towards the boundary, so sumps will need to be relocated to new kerb edge and reconnected to the existing stormwater system.

Within the project area between approx. CH1640 and CH5040 there is a centre island, however the road is in cross-fall and the island is located in the road crown (over the high point) and therefore would not affect the existing stormwater system.

Between approx. CH3565 and CH4835 on south side of the road the shoulder of the traffic lane is being replaced with an elevated cycle path and footpath.

- With no shoulder, this will reduce the flow that can be conveyed along the kerb and channel without encroaching on the traffic lane, effectively reducing the capacity.
- This would require additional sumps and laterals connecting into the existing stormwater pipe system (which is on the far side of the road in this location).
- The elevated cyclepath and walkway would also need to drain to the roadside kerb and channel.

Between approx. CH4100m and CH4900 on the south side of the road, the new footpath extends into existing landscaped area. This increase in impervious area will increase runoff, and therefore the stormwater system capacity will need to be assessed.

Thorndon Quay Road (CH140 to CH1520)

Raised crossings at approx. CH180, CH500, CH760, CH1060, CH1240 and CH1500 have been assessed and solutions will be developed on a case-by-case basis to allow overland flow.

Between approx. CH440m and CH740m the road is super-elevated (single cross-fall falling toward the west). Proposed cyclepath and walkway need to drain in the same manner as existing. This means that the cut downs in raised safely barrier will allow stormwater to runoff from the cyclepath across road to the existing stormwater sump and pipe network (rather than from the road into the cyclepath as in other locations).

Between approx. CH1260m and CH1340m the road super-elevated (single cross-fall falling toward the east) falling towards the cyclepath. This means that the kerb cut downs in the raised safety barrier will need to provide for runoff from the full road cross section, and hence more closely space kerb cut downs may be required than in the other areas.

6.4.2.5 Maintenance

- Maintenance of any existing/proposed assets needs to be considered for ease of access and safety of maintenance crew.
- Both bubble up sump system and concrete “U” channel and grate would need maintenance and inspections for blockages.

6.4.3 Street Lighting

6.4.3.1 Overview

With the road width remaining the same but changing in configuration the existing lighting will need to be assessed against the revised layouts. Currently lighting is predominantly on the western (landward) side of the route throughout, with lighting at the intersections being on both sides. As the kerb line on this side isn’t being revised significantly there should be limited need to relocate columns purely for clash purposes.

The project intersection(s) will need to be lit with appropriate highway lighting designed to the NZTA standards. The requirement for and proposed arrangement of any street lighting shall be confirmed with the LGWM partners at the detailed design stage.

6.4.3.2 Design Standards

The Street Lighting design is to be based on the following standards:

- NZ Transport Agency M/30 Specification and Guidelines for Road Lighting Design
- AS/NZS 1158 Lighting for Roads and Public Spaces
- "RightLight" Roading Lighting Guideline

6.5 Utility and Public Services

Significant impacts on utilities or services are to be identified as part of the project development. The LGWM utilities database was to be used to determine the location of utilities for preliminary design. Unfortunately, the data available was only up to Moore Street. Data for the rest of the project area is being collected by LGWM. A high-level desktop assessment of the most critical utility items and any potential impacts from the design will hence be undertaken as and when the data becomes available.

The location of the existing utilities will be cross referenced against the proposed road design to ascertain whether there is likely to be an impact on any existing utilities and if so if there is a need for any relocation or protection works to that utility or if modification can be made to the road design to avoid impacts.

The identified utility works will help to better understand costs and risks in locations where utilities are affected by the design.

6.6 Proposed Construction Methodology

The nature of the works is primarily relocation of kerb lines, some patch structural changes to suit the new alignments and then resurfacing and new lining. As such it should be relatively easy to split the works into linear sections for phasing. Associated works such as drainage, signage, streetlighting, landscaping and placemaking is yet to be developed.

6.6.1 Potential Phasing

The key constructability issues will be to accommodate and manage the high traffic volumes during construction. The project shall be broken up into construction areas such as the upgrade of existing roads/intersections (Thorndon Quay), and the upgrade of existing roads/intersections (Hutt Rd) with associated tie-ins to existing roads.

Performance criteria will be set for all traffic management plans including for sealing surfaces, minimum paved width, maximum delays for all traffic, particularly the traffic on SH1 and minimum standards for pedestrian and cyclist facilities in conjunction with the LGWM partners.

The detailed design shall develop a workable construction sequence including temporary intersection and road arrangements to demonstrate the feasibility and set baseline performance criteria for the traffic management.

6.7 Maintenance Requirements

This section will be developed through the design stages and will be dependent on the features installed but likely to include:

- Street Cleaning

- Landscape maintenance
- Signals Maintenance
- Stormwater systems maintenance
- Structures – Inspections and maintenance
- Regular Inspection

7 Preliminary Geotechnical Appraisal

The preliminary geotechnical appraisal report (PGAR) is appended to this report in Appendix D. The soil conditions along TQHR are summarised using historic data from the NZGD and Beca databases. The PGAR also provides an overview of key geotechnical issues.

There are three active faults in proximity to the TQHR route. Based on seismic hazards maps provided from Wellington City Council and previous studies, it is believed the existing route may be subject to fault rupture, tsunami, liquefaction, lateral spreading and earthquake induced slope stability. These geotechnical hazards are unaffected by the proposed improvements along the TQHR.

There are a number of historic geotechnical investigations along the entirety of the TQHR route, including boreholes, test pits, CPTs and hand augers. The boreholes indicate the site generally consists of reclaimed fill underlain by alluvium and marine deposits, with greywacke bedrock at depths greater than 15 metres below ground level. The thickness of these layers vary along the route.

Based on the current scope of works for the TQHR Project, proposed geotechnical investigations in advance of detailed designed are likely to consist of shallow test pits and pavement pits. Materials most importance to design will be “near surface”. A geotechnical site investigation programme can be developed once the preferred solution is developed and approved.

8 Property

It is currently proposed to keep within the existing legal boundary of Thorndon Quay and Hutt Road. The proposed Aotea Quay roundabout will extend outside the existing road boundary. Hence no land acquisition is considered necessary other than at this location.

The property impact for the Aotea Quay roundabout will be determined as the overall design progresses. The current defined impact is indicated within the sketch in Section 2.4.

9 Environmental and Social Responsibility Issues

Minimum standard Z/19 – Social and environmental Management will guide the environmental and social responsibility assessments, which for the detailed business case phase includes the following:

- Update the Environmental and Social Responsibility Screen
- Prepare preliminary technical assessments
- Prepare the consenting strategy
- Update and Implement Public Engagement Plan

10 Risk Assessment / Safety in Design

A risk workshop has been held in February 2021 during the preliminary design stage. The purpose was to identify and agree key risks to guide the development of the preliminary design. Project risks were populated as far as possible in real time during the workshop and then finalised following the workshop. A key output of this workshop was identifying and agreeing risks that stakeholders see as being of main concern. The risk register is included in the appendices.

Risk pricing will be undertaken in the @Risk software, using Monte Carlo analysis technique. This will contribute to measuring and monetising risks and benefits for the Economic Case and the allocation and management of risk budgets in the Financial Case.

The preliminary design will follow the NZTA Safety in Design (SiD) guidelines. On the 29 April 2021 a SiD workshop for the preliminary design phase was undertaken. A SiD register has been updated and included in Appendix E.

Appendix A

Minutes of Preliminary Design Standards Meeting

Minutes of Meeting

LGWM - TQHR - 8 March 2021 Prelim Design Standards Meeting

Held 8 March 2021 at 2pm

at Microsoft Teams

Present:	Hannah Hyde
	Simon Kennett
	Mike Pilgrim
	Charles Kingsford
	Kylie Hook
	Hillary Fowler
	Eric Whitfield
	Blaise Cummins
	Aoife Campbell
	Will Maguire
	Marcus Brown
Apologies:	Soon Teck Kong
	Gerry Dance
Distribution:	All

Item	Action
1 Introduction / Purpose ■ This meeting is a follow up to the meetings held in December 2020 with the partner org subject matter experts to discuss preliminary design standards for the Thorndon Quay and Hutt Road (TQHR) project. ■ Following the December 2020 meetings, the project team advanced preliminary geometric design and produced cross sections for the corridor. There are pinch points where there is competing demand for road space to accommodate all modes. ■ This meeting is to discuss key aspects of the cross section, trade-offs associated with available corridor width and to agree minimum desirable widths for the different modes. ■ Key areas for discussion included: – Cyclists using Hutt Road due to the (narrow) shared path width – Width of traffic lanes on Hutt Road – Cyclists travelling fast, 40kmh+ on path along Thorndon Quay and the risk of t-boning a car and pedestrian conflict risk – Width of bus lane. A width of 3.7m is in the middle of the dilemma zone where there is not enough room for cycle/bus to co-exist in the lane.	
2 Hutt Road ■ The design speed was discussed. Preliminary design should provide supporting measures to help with speed definition. The potential for a different northbound vs southbound speed was suggested, if they were separated by a median, however this was felt to cause confusion for the users. Current proposal is to go with 50kph up to the Onslow Rd Intersection (the more built-up section) and beyond Onslow Rd (where there are limited turn offs) it will rise to 60kph. Speeds to be discussed further and confirmed. ■ Road shoulders can be reduced to 0.3m wide from those shown on cross sections, or preferably removed.	

- Possible relocation of gantry on Western side of North end of Hutt Road was discussed to avoid pinch point but may not be required now with revised design parameters – depending on extents of "Gateway Concept".
- Kerblines on Hutt Road can be moved where necessary
- There are a couple of sections where the corridor is restricted at the northern end of Hutt Road. In these locations the median could be reduced to 0.5m wide (back-to-back kerbs), enough to restrict turns and separate northbound and southbound flows and hence not take excessive corridor width
- The minimum shared path width is recommended to be 4.0m
- The minimum cycle lane width where separated to be 3.0m
- Existing separation between cycleway and footpath by line marking on Hutt Road is to be adopted for proposed Hutt Road cycle/footpath facility (i.e. no level difference)
- Minimum traffic lane width (for standard lanes) to be 3.4m
- Special Vehicle lanes to be 3.5m wide but could be reduced to 3.2m at pinch points
- The 0.8m wide protective buffer should be provided on path (not in shoulder)
- Refuse, signs and other similar items proposed to be left on 0.8m wide cycle segregation
- A drop off facility is to be allowed for at day care centre near Kaiwharawhara intersection
- Fully signalising the Onslow Road junction may remove the southbound merge lane and hence free up space
- The possibility of widening the path to the East into KiwiRail land around the pinch point area of Onslow Road was discussed. Design team are looking into this option
- Where possible at driveways, consider increasing width of cycleway/footpath from 3m/2m to 3.5m/2.5m to allow for cyclist to move around car exiting businesses, potentially stopped on path awaiting a gap in traffic (Thorndon Quay and Hutt Road Business Section)

3 Thorndon Quay

- Along Thorndon Quay the bus lane can be reduced to 3.2m wide to discourage cyclists from riding parallel to buses in this lane (they should be either on the cycle path or in the main carriageway)
- Minimum traffic lane width (for standard lanes) to be 3.4m
- Shoulders were shown on the cross sections. It was noted that shoulders feel like a rural treatment and were not needed in a 40kph urban area. No shoulder required along Thorndon Quay
- A 0.5m raised safety buffer is to be provided between the cycleway and the bus lane/off-peak parking
- Agreed that the cycleway should be lower speed and that it was acceptable for cyclists to go on road if they wanted to travel faster due to 40km/h speed limit. A 20km/h cycleway design speed is suggested to mitigate risk from vehicle accesses and conflict with pedestrians
- The use of raised pedestrian crossings, changes in road texture/colour was considered useful elements to reduce cycle speeds on both carriageway and cycleway
- Visibility lines were highlighted as being critical for safety
- LED studs were discussed as a potential design option however should be considered with caution. It was noted there was a trial at the Caltex station on Hutt Road which gave false positives and false negatives. Project team to look into combining entries/exits where two exist on one property to reduce conflict points.
- Simon Kennett has cyclist speed data for Hutt Road and will provide to the project team

Minuted by: Eric Whitfield

Appendix B

Urban Design Principles

Preliminary Design // 20.04.21

LGWM Thorndon Quay Hutt Road

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Prepared For

LGWM

Document Control

Prepared by:
Emily Dalley

Approved by:
Shannon Joe

On behalf of Warren and Mahoney
Architects Limited

Document Revision Status

Revision A: 20.04.21
Preliminary Design Phase Report

Contact

Warren and Mahoney Architects New Zealand Ltd
Level 4, NZX Centre
11 Cable St
Wellington

Disclaimer

While Warren and Mahoney has endeavoured to summarise the Preliminary Design process in this document and appendices, the report format cannot represent the broad range and depth of information captured on the Preliminary Design Drawings, Specifications and Schedules. Approval of the specific issues contained in this report does not discharge the obligation of the client team to review the drawings and specifications in their entirety.

Contents

Site Plan

Urban Design Principles
Complementing the LGWM five priorities for the region's success and the community's urban design and transport principles - these have influenced the urban design aspects of the Thorndon Quay Hutt Road (TQHR) project and provides guidance in achieving and assessing the quality of developed and restored urban areas. This project is about people, enhancing communities and providing effective and efficient transport. This means prioritising modes of transport and allocation of space that supports moving people and accommodating freight.

Natural Identity
The streets within the TQHR project offer social and economic benefits for Wellington. The rawness of the coastal hills along the Wellington harbour is an important context to consider - the TQHR project has an opportunity to celebrate this natural identity.

People, Place + Transport
Pedestrians and a mix of diverse modes of transport aid in developing a sense of place for communities and neighbourhoods. Success is achieved when delivering transport and can also provide public space and 'pause' moments for people to share experiences, interact and socialise.
The project is framed within maximum widths of the existing road corridors. Sound urban design principles are essential and will help guide to the right solutions to meet the project's intent and vision.

The project will also look to:
- Consider and connect with the wider Wellington, its context and landscape
- Define streets and roads
- Shape streets to work with neighbourhoods and street users
- Define nodes that help characterise place and identity
- Encourage safe and accessible mixed mode transport
- Measure and evaluate through:
  - o Shift in physical and operational changes / improvements
  - o Changes in its use and function and its resulting impacts
  - o Determining if investments delivered desired outcomes (safety, quality of life, sustainability, economic, improved mobility etc)

Both quantitative and qualitative metrics are important. There are different methodologies in how to measure the above; these include before and after photos, survey and consultation with local patronage and communities and traffic count recorders.

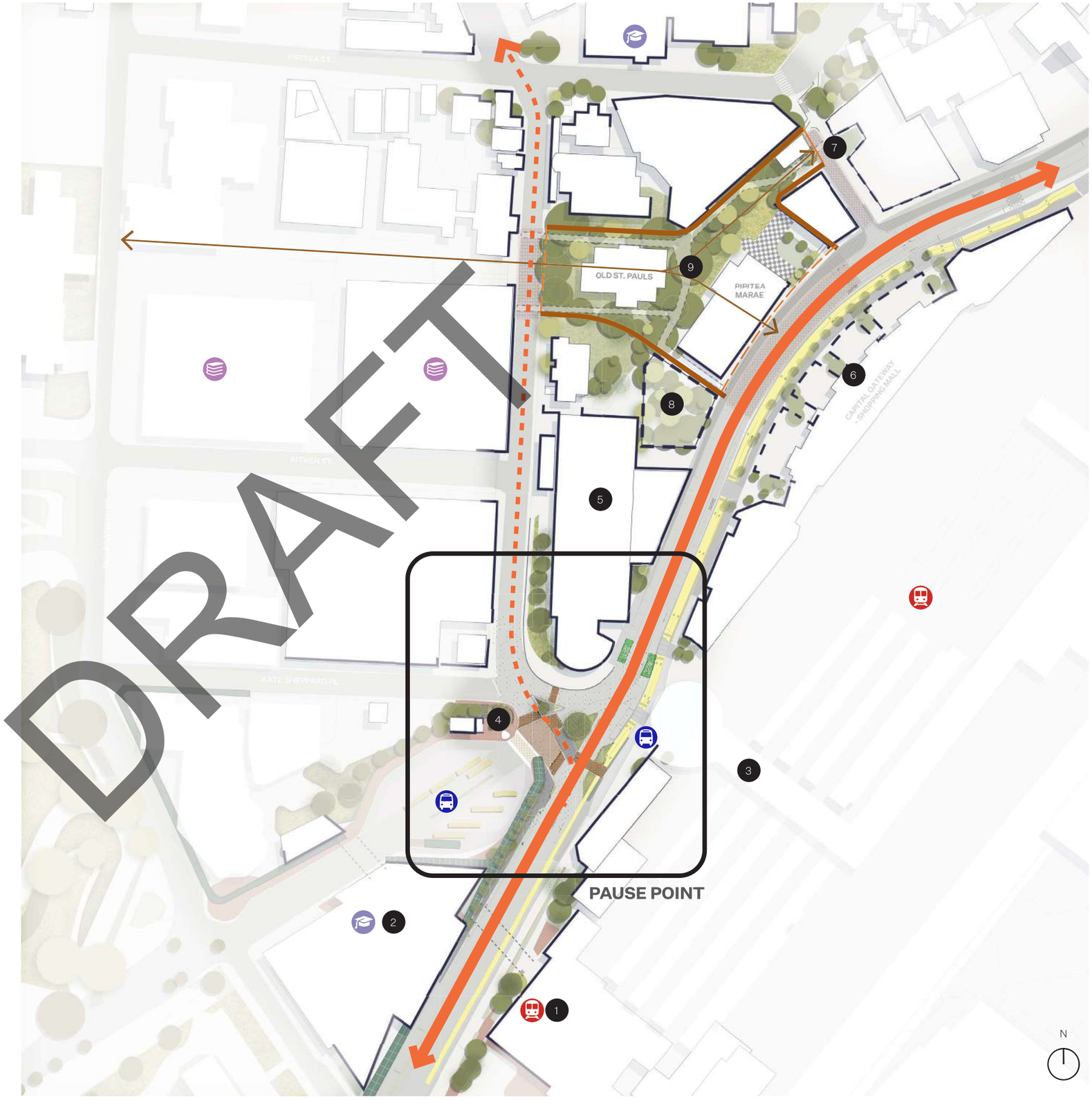
Nodes
The project has focussed on 3No. Nodes – Mulgrave Corner, Thorndon Quay Shops and Jarden Mile. These nodes are developed based on the existing concentration of activities and intensity. The focus is on people, place and transport as interconnected components. A completed site analysis around these nodes describes the current constraints and opportunities for development that this design has been based upon.

Node 01

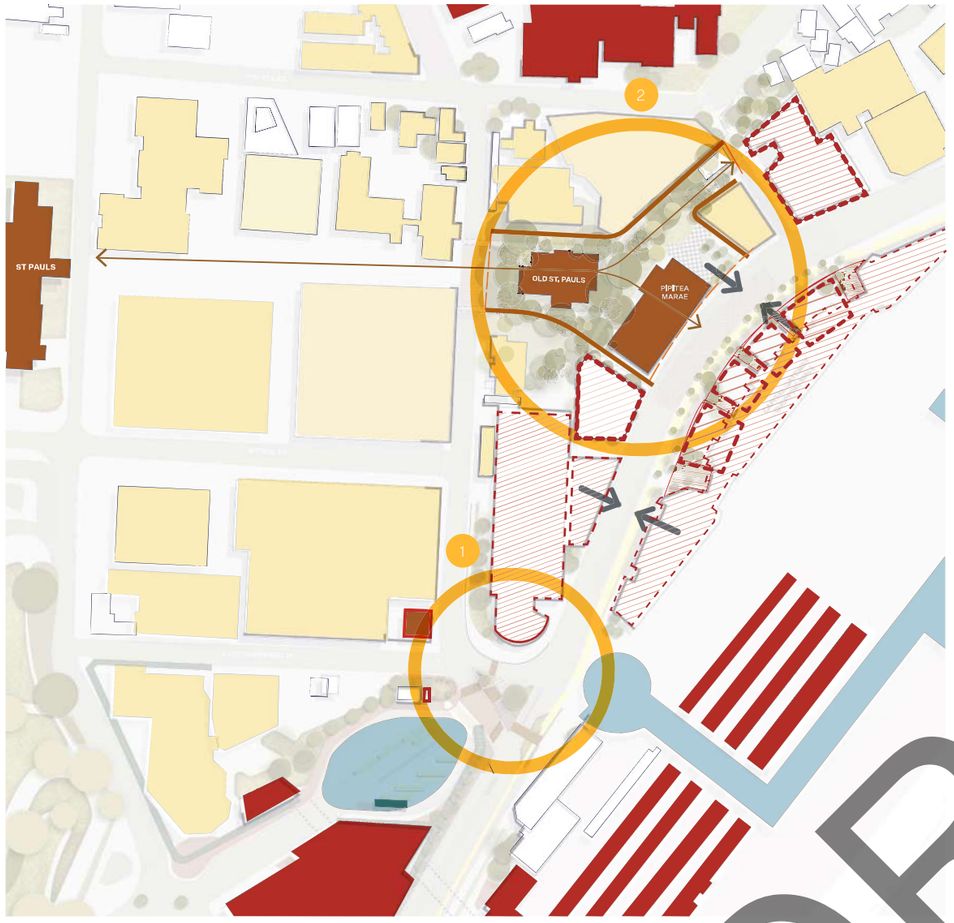
Mulgrave Corner

Located on the edge of the city centre, this node has high pedestrian activity from the Victoria University hub and the Wellington Railway Station. The intersection of Mulgrave and Thorndon Quay is often seen as the gateway into the city centre. The bus interchange poses significant challenges with people and bus conflicts. The design creates safe zones for pedestrains and their crossing points via visual surface treatments. Not-withstanding this the underlining problem remains the need to change the bus access location or relocate the bus interchange all together.

The extent of the node expands to include an opportunity to tie together Old St Paul's Church, the Pipitea Marae and their open spaces. The opportunity to create a 'cultural precinct' within this node by strengthening permeability via landscape pathways and open spaces to connect to Mulgrave St, Thorndon Quay and Moore St. The node is looking to the whole extent of the block where we would foresee the redevelopment of the existing Archives building and other properties in the near future turn into mixed use residential. The injection of people and activity will support the adjacent Wellington Girl's College. The node also not only strengthen Thorndon Quay but it enables Mulgrave Street to activate more and be a feeder into Thorndon and later connect back into the second node Thorndon Quay Shops.



1. Railway Station: Peak time 8am & 5pm
2. VUW Campus/Bus Exchange: Peak time 8am & 5pm
3. Stadium Platform: Event on
4. Potential pause spot
5. Potential Commercial/Mixed use development
6. Potential Commercial/ Retail Extension
7. Urban landscaping. Pedestrian oriented street: Peak time Students 8am & 5pm
8. Potential low green space or Commercial development
9. Cultural Precinct Walkway



Uses

At peak times (8am and 5pm), there is high pedestrian movement between the Wellington Girls' College, Victoria University Campus, Bus interchange and the Railway Station (circle 1). Old St Paul's Church and Pipitea Marae currently sits in the center of the node enveloped by greenery (circle 2). There is an opportunity to enhance the cultural dialogue with these key sites to celebrate Wellington's rich history by creating boundless edges that connect back to local streets.

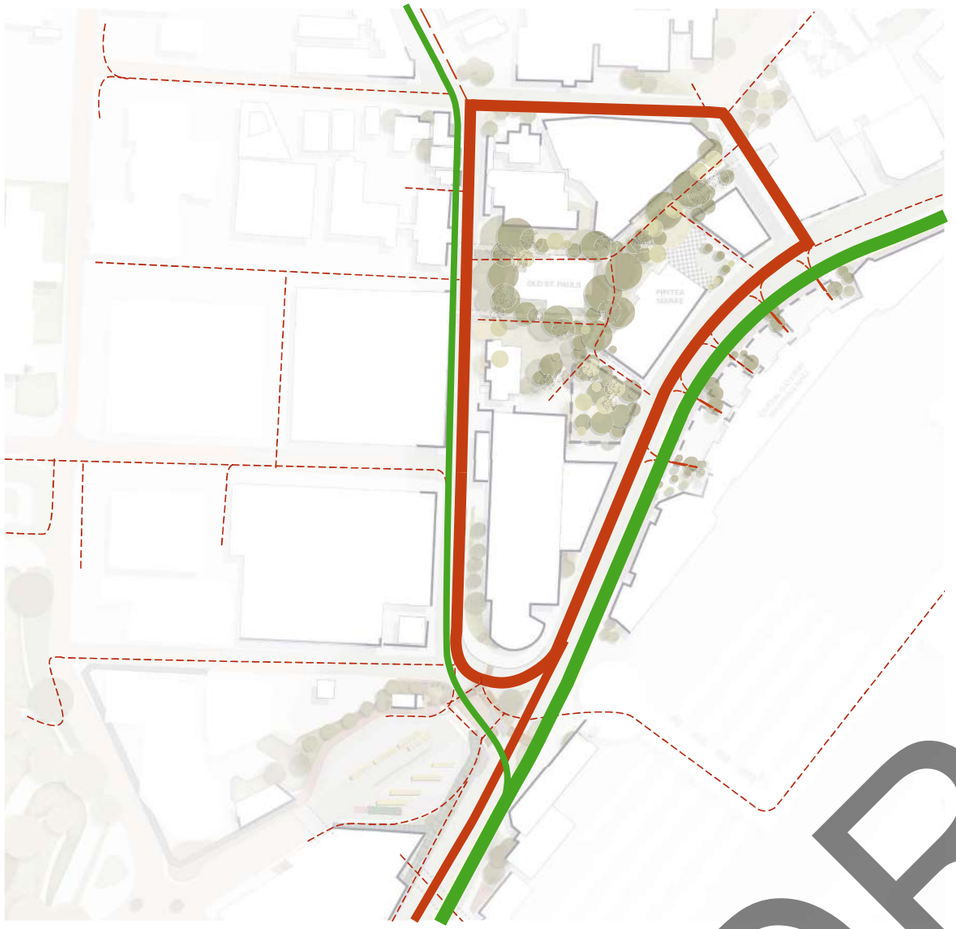
The bus interchange poses conflicts with pedestrians and buses.

- Public/ High Activity
- Commercial/ Retail
- Cultural Precinct
- High Activity in peak times
- Potential new Commercial/ Retail

Streetscape

The streetscape is instrumental to bind the railway, university, cultural, and business precincts together. Strengthening the Thorndon Quay arterial circulation route and secondary routes such as Mulgrave, Aitken and Pipitea Street connects the node with a strong weave of streets.

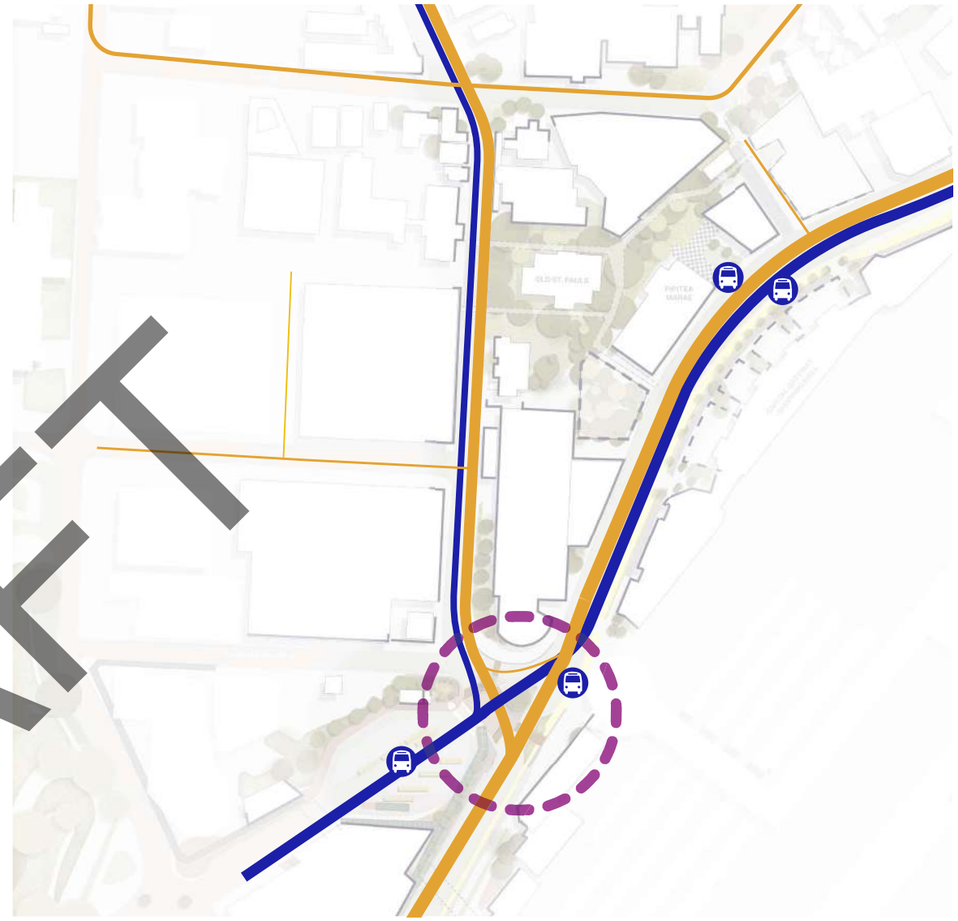
- Primary Road
- Secondary Road
- Developed Potential Link



Pedestrian & Cycle Movement

A high volume of pedestrians commute between Wellington Girls', Victoria University and the bus and rail stations creating pressure and vehicle conflict at the Mulgrave St intersection. Shifting the node to a pedestrian focused area will improve safety and improve connection to existing amenities such as Old St Paul's and Pipitea Marae.

- High Pedestrian movement
- Low Pedestrian movement/ Off
- Multi-Modal



Vehicle Movement

Shifting the Mulgrave corner node away from being a vehicle dominated area is instrumental for creating a safer, more connected, and vibrant node.

The proposal recommends the option to explore relocating the bus interchange or alternative access point, to remove existing conflicts with pedestrian crossings and vehicles.

- Bus Movement
- Vehicle Movement
- Pedestrian - Vehicle Conflict

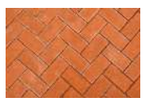
Node 01

Pause Point

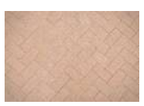
The node looks to bring green open space and paved ground treatment as the main system to calm and slow vehicles. As a highly active node with mixed modes of transport - legibility and a people first approach is the priority. The horizontal road treatment is a warmer / softer tone of colour and texture to contrast to the standard road asphalt. Highly legible wider pedestrian crossing points will be critical for safety and visibility to reduce conflicts with vehicles. Extensive zones of soft coloured pavers will diminish the overall car dominated environment while careful not to entice free off the pathway pedestrian movement.

Access into the bus interchange remains problematic and conflicts with natural pedestrian crossing. The design strong recommends a review of the bus interchange entrance and its manoeuvring routes or full relocation of its facilities.

1. Paved pedestrian crossings to highlight pedestrian focused zone:
   Stone with soft tone



2. Alternative treatment to asphalt:
   Soft tone similar but more subtle than the surrounding pedestrian crossings



3. Landscaping used to celebrate the gateway of Mulgrave St and Thorndon Quay.
   Landscaping used to reduce the width of the corridor, to give visual queues to slow down for pedestrians.

4. Congregation point with seating and potential a coffee kiosk to mark the gateway to Mulgrave Street: Greenery and paver with soft tone to connect with the character & heritage precinct

5. Raised shoulder with North bound cycle lane connecting:
   Low planting on edge

Node 02

Thorndon Quay Shops

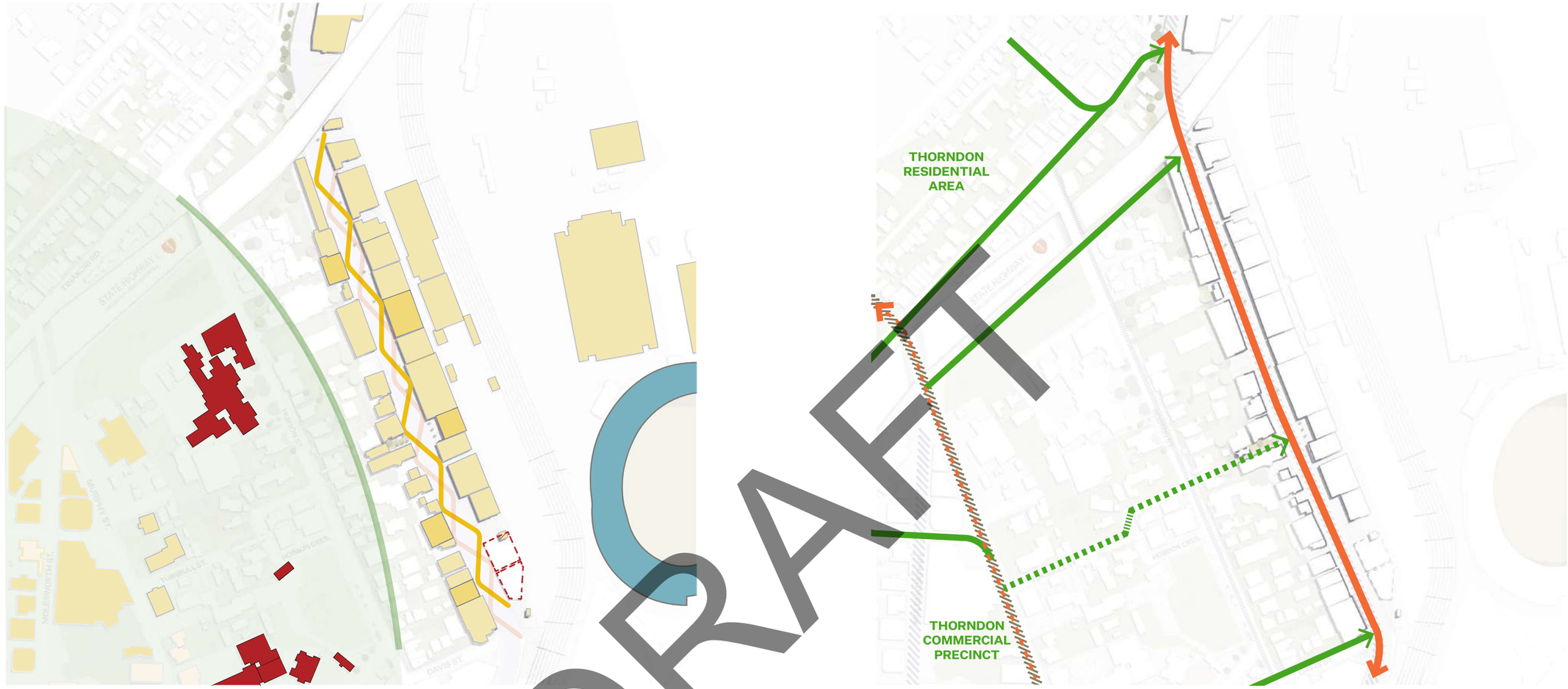
Thorndon Quay shops is prodominantly made up of light industry / retail outlets with little focus on community amenity. Some mixed use residential has been developed but the commercial strip remains lacking in pedestrian activity and lifestyle. Bordeaux Bakery has been a success story for the area and remains a popular attraction for Wellington. This project looks to create opportunities to create further success stories by building better streetscape, character and amenity to this area.

By defining this area rather than passing through, the design looks at gateways. The northern gateway in particular is challenging with the motorway overpass and its space beneath. We look at existing infrastructure as a canvas for more pronounced urban design moves such as art installation.

The introduction of ‘pause points’ along the strip will provide moments for congregation and open space. Its compact nature is from the constrained width of the strip and combining the various modes of transport into a comfortable people orientated environment.

Thorndon Quay Shops is disconnected to the residential areas in Thorndon. It is advantegous to bring more connection here and the design proposes a through site link from Hobson St to Thorndon Quay. Located mid way along the strip it provides pedestrain linkage to bring both areas including the schools together.

1. Queen Margaret College:
   Peak time 8am & 5pm
2. Wellington Girls’ College:
   Peak time 8am & 5pm
3. Sky Stadium: Event on
4. Three new pedestrian crossings/ pause points (+option)
5. Potential Southern Gateway commercial/ mixed use development
6. Potential Northern Gateway Art Installation
7. Potential through-site pedestrian link



Uses

The Thorndon Quay Node is lined with commercial, retail and a few residential buildings. Thorndon residential and commercial precinct sits adjacent to the long stretch of Thorndon Quay shops.

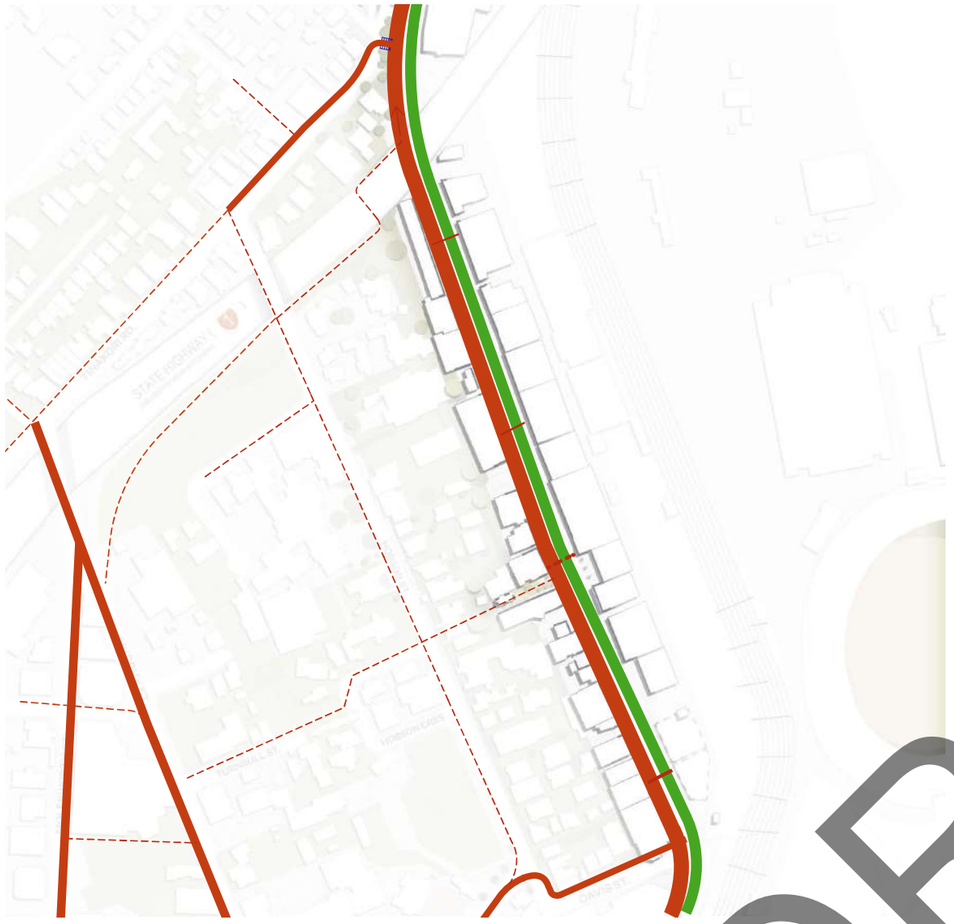
There is a strong disconnect between the two areas which a connection would be highly desirable.

- Public/ High Activity
- Commercial/ Retail
- Residential
- High Activity in peak times
- Potential new Commercial/ Retail

Streetscape

Thorndon Quay node stretches about 580m along the edge of the Thorndon suburb with access points at Tinakori Road, Davis Street, and a pedestrian walkway at the northern end by the State Highway bridge. Strengthening the streetscape to enable the residential and commercial areas of Thorndon to connect and engage with Thorndon Quay and its businesses will be instrumental in binding the node with its suburb.

- Primary Road
- Secondary Road
- Developed Potential Link



Pedestrian & Cyclist Movement

Giving more presence to pedestrians using finer grain elements such as street furniture, landscape buffers and pause points around crossings will improve connection with existing businesses and amenities such as Wellington Girls' College and Queen Margaret College. A potential through-site link is proposed half-way along the street length to give another access point to the node, complementing the access points at each end. Pause points also help encourage cyclists that within this node speeds must reduce and pedestrian awareness increase so to provide a safer enviornment for all to use.

- High Pedestrian movement
- Low Pedestrian movement/ Off
- Multi-Modal

Vehicle Movement

High volumes of private vehicles and public bus routes dominate the Thorndon Quay Shops node. To create a safer more pedestrian oriented space with more public engagement, the vehicles are required to reduce speed or stop at proposed pause points. Giving some more presence to pedestrians and cyclists will enable the node to shift away from a vehicle dominant street.

- Bus
- Vehicle

Node 02

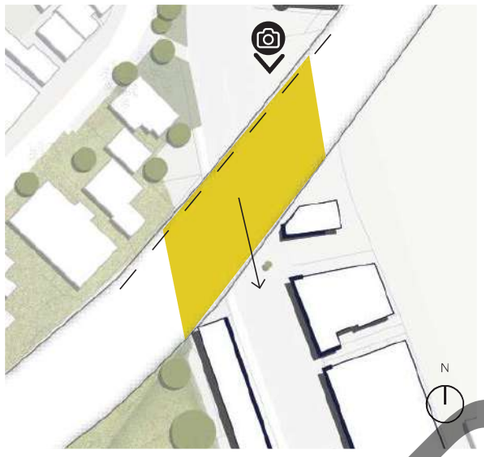
Gateway

The Gateway interventions are proposed to celebrate and mark each end of Thorndon Quay shops by creating a visual division that influences vehicles and pedestrians to reduce speed and engage with the finer grained urban environment. We see this as a catalyst to define Thorndon Quay Shops' identity and character while reasonating with the wider Wellington look and feel.

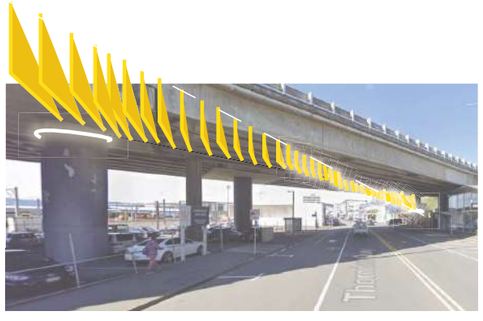
Suggested is the introduction of landscape and art. The art installations intend to establish dialogue between the brutal motorway infrastructure and the fluid connection from Wellington's green hills and Wellington's harbour on the East.

This technique has been successful in many global cities. A suggestion could be by using the underside of the State Highway 1 bridge that passes over the northern end of Thorndon Quay there is an opportunity to host urban artwork will act as both a gateway to the shops and revitalise the forgotten area under the bridge.

Conceptual Ideas



Northern Gateway



Precedents

Nelson Street Cycleway 'Light Path' - Auckland, New Zealand

Memorial Bridge - Christchurch, New Zealand

Waterview Connection - Auckland, New Zealand

Melbourne Gateway - Melbourne, Australia

Swan Street Bridge - Melbourne, Australia

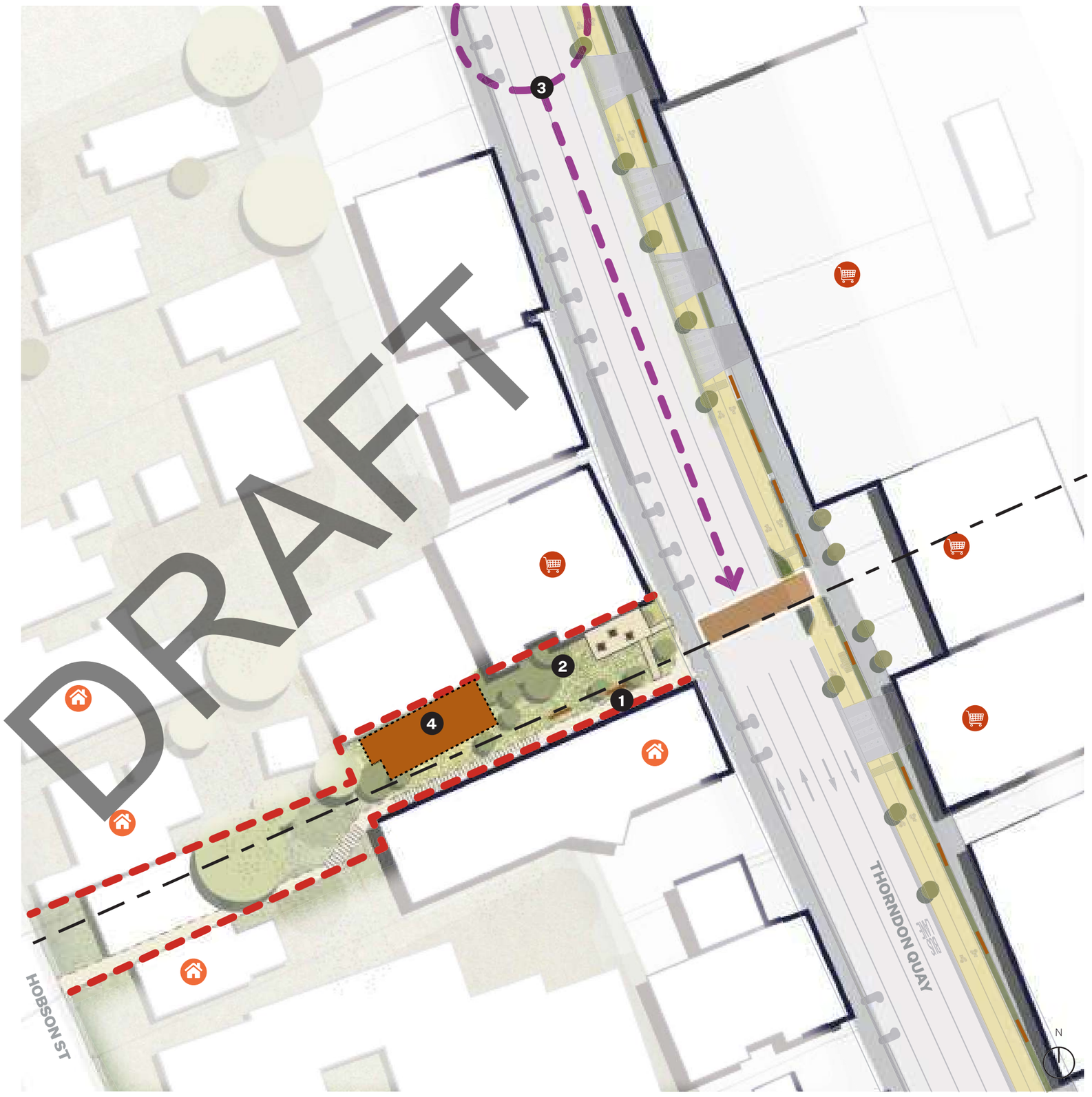
Bridge Area - Neuied, Germany

Node 02

Pause Point

A high level proposal to introduce a pause point to the centre of the Thorndon Quay strip with a proposed through site link to establish a pedestrian connection to the neighbouring Thorndon residential area. Currently no access is possible so acquisition of private land will be required to achieve the through site link. There is potential for small retail to be introduced to support the open space.

This proposal looks at relocating the mid crossing to this area (refer to item 3)



1. Potential through-site pedestrian link from Hobson St to Thorndon Quay
2. Landscaping proposed at pause point
3. Proposed pedestrian crossing outside Bordeaux Bakery to shift to alternative location complementing the potential pause point at the through-site link: Soft toned with landscaping
4. Potential public/ commercial development on the through-site lane

Node 03

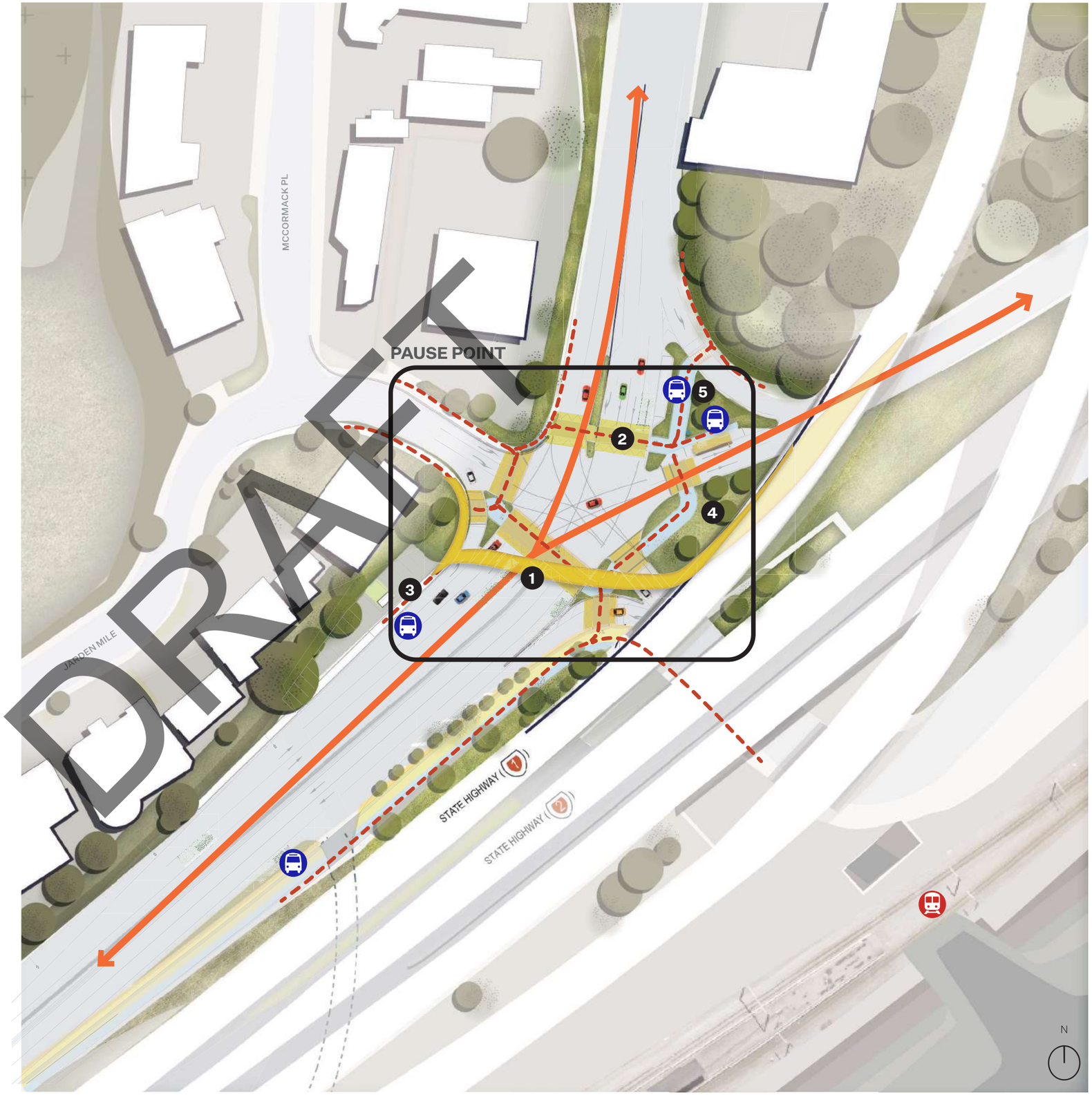
Jarden Mile

This node known to be extremely busy with vehicles and dominated by asphalt. The environment is felt to be unsafe to pedestrians and cyclists with freight also moving in this area.

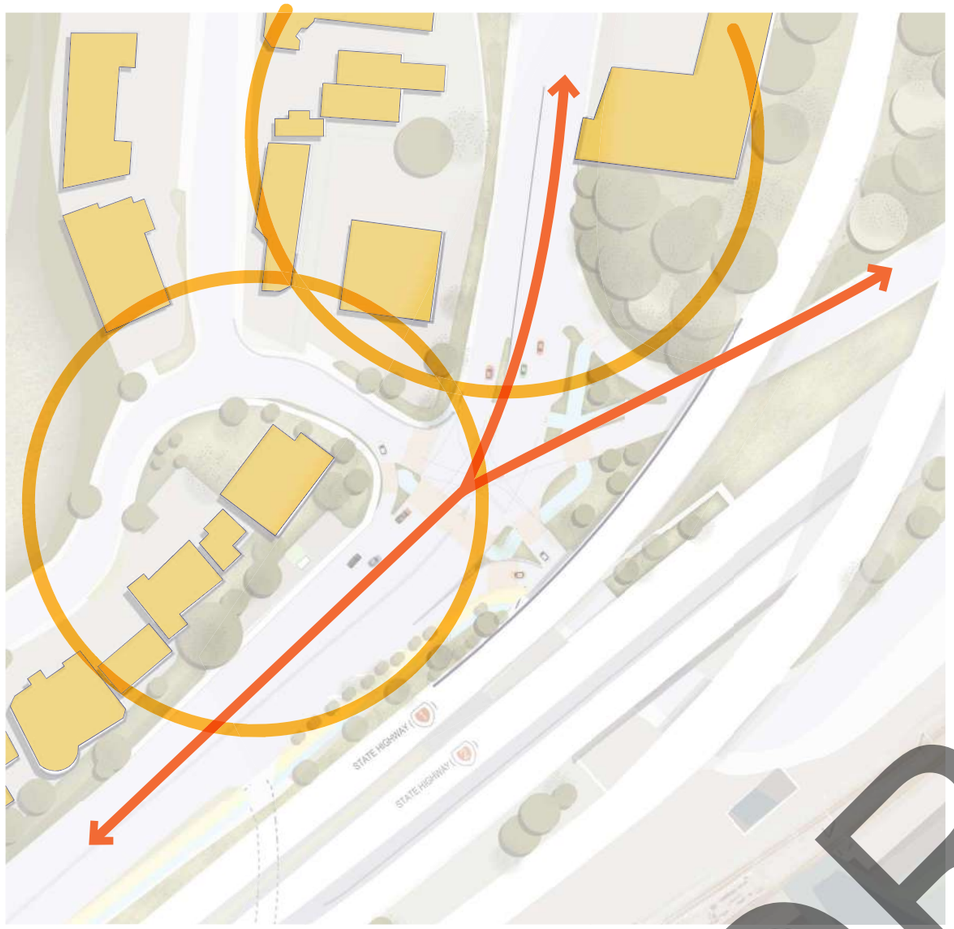
Commercial and industrial is located here and many bus passengers and cyclists are required to cross the busy road.

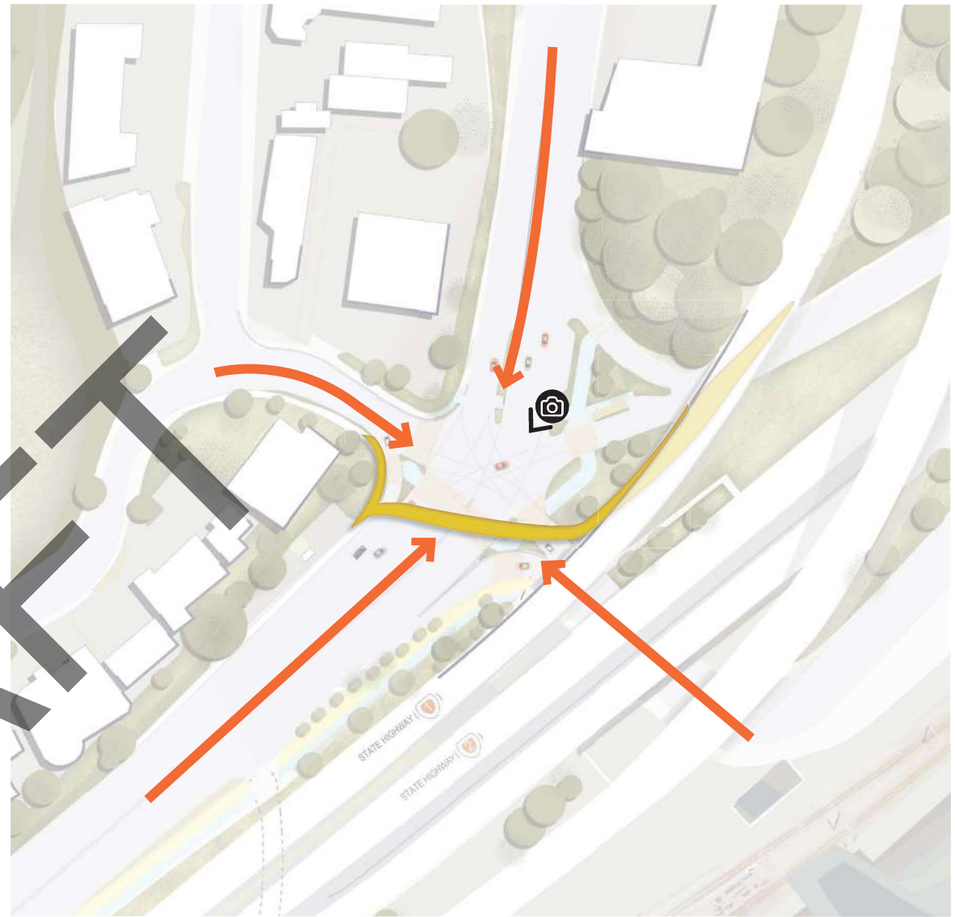
Landscape and art is proposed to define this area. A bold and powerful gateway will signal the entry to Wellington City and also create a sense of place for Jarden Mile. Texture and tone to the pavement crossings and significant landscaping to the edges will help to close in the space and create an environment and awareness of pedestrains that co-exist in this space.

We strongly believe horizontal treatment only will not suffice and propose significant art work be highly legible and mark this gateway. Similarly to the northern Thorndon Shops gateway proposal, working and connecting to existing motorway structure and potentially providing pedestrian shelter.



1. Gateway Art Installation clinging to the underside of State Highway 1 overpass. Shelter integrated into design: Yellow finish
2. Coloured pedestrian crossings: pastel yellow tone
3. Extended pedestrian footpath
4. Increased Greenery to connect with the surrounding landscape
5. Landscaped island with developed path in line of desire to pedestrian crossing





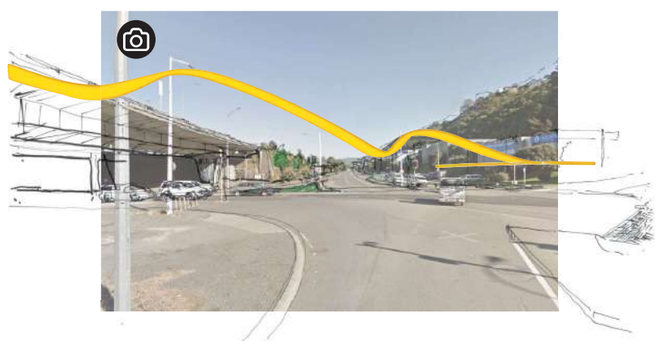
Uses

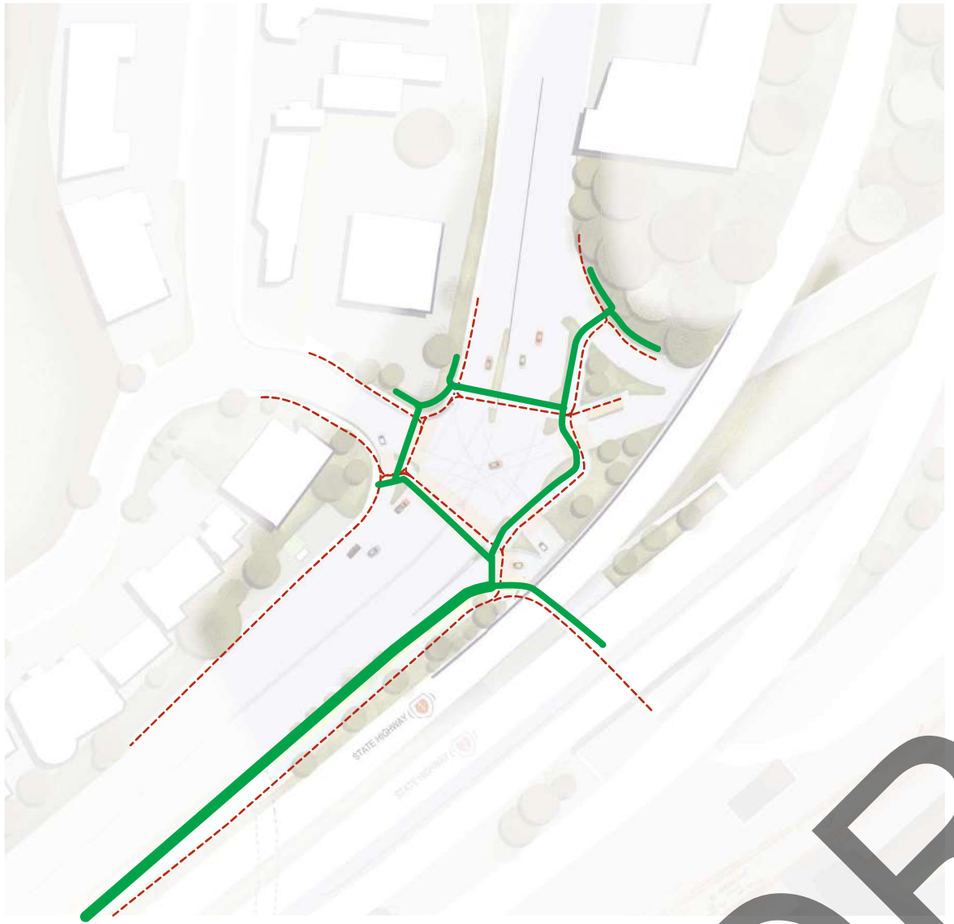
Commercial and retail businesses are located along Jarden Mile and further North in Ngaranga. Other than commercial businesses, this node is dominated by transport infrastructure as it is the junction where State Highway 1 and 2 converge to start Hutt Road.

Commercial/ Retail

Gateway

The gateway to be visible from all access routes. A unified design that is bold and defining for Jarden Mile node and for the greater Wellington region.





Pedestrian & Cyclist Movement

Highly legible pedestrians and cycling routes and crossing will be required in this node. It is envisioned that with the gateway proposal it will visually make vehicles aware of the other modes of transport in this area and slow down.

- High Pedestrian movement
- Low Pedestrian movement/ Off peak
- Developed Potential Pedestrian Movement
- Multi-Modal
- Pedestrian - Vehicle Conflict

Vehicle Movement

Through the realignment of vehicle lanes and increase in pedestrian points the area is more enclosed forcing greater awareness for vehicles thus improving safety.

- Bus
- Vehicle

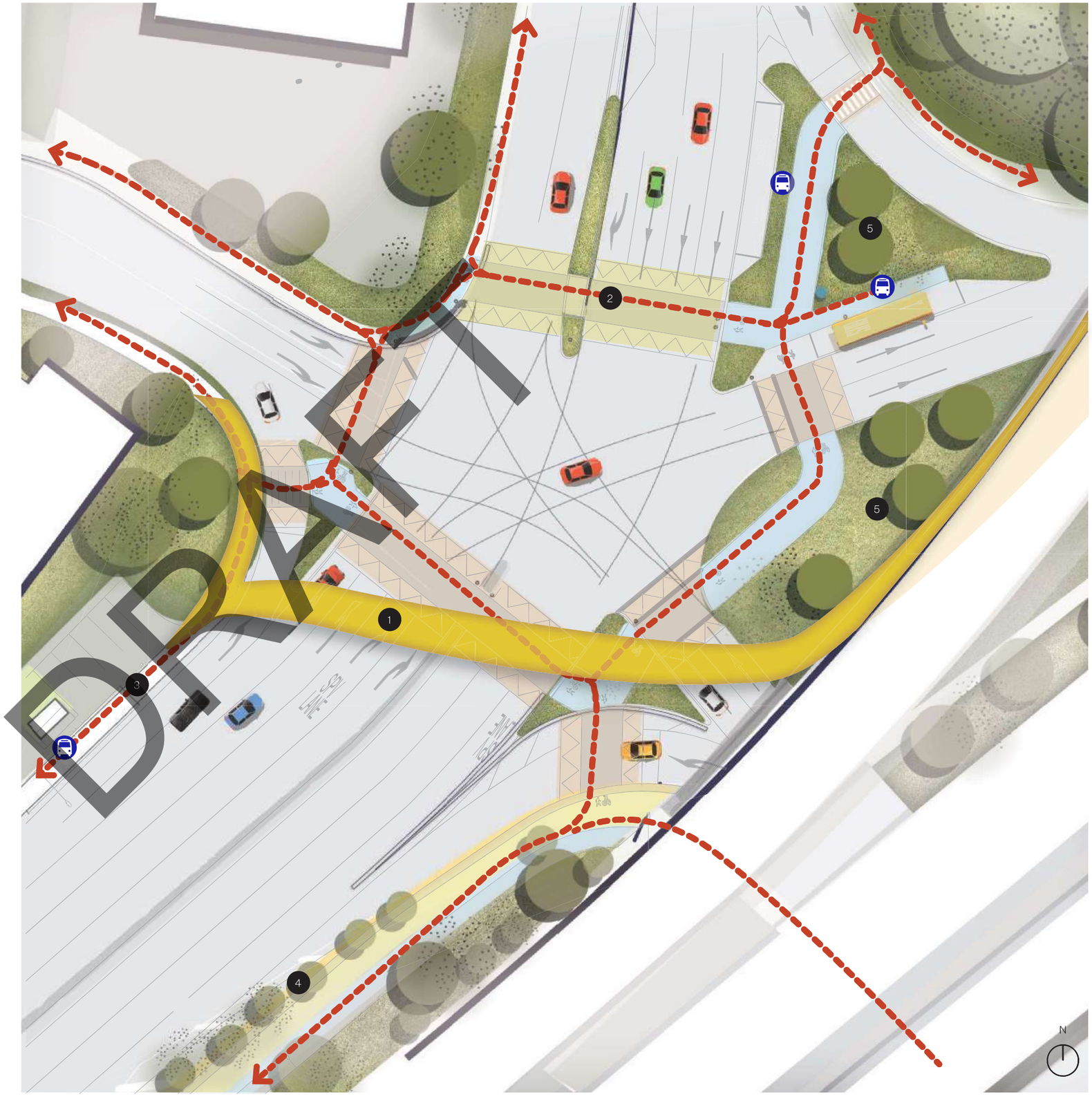
Node 03

Pause Point

Combined with the bold gateway art installation and texture/ tone pavement treatments, views from afar and experienced close up the domination of road is greatly reduced. The additon of landscaping around crossings and in between road corridors suggests a more calm and human environment.

Solid medians are introduced as stepping stones across a wide corridor to help reduce the perceived distance of travel.

Potential for new shelters to connect bus stops to the business area would be part of the gateway installation.



1. Gateway art installation
2. Coloured pedestrian crossings
3. Pedestrian footpath added
4. Planting along footpath
5. Developed islands with low planting

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17 April 2020

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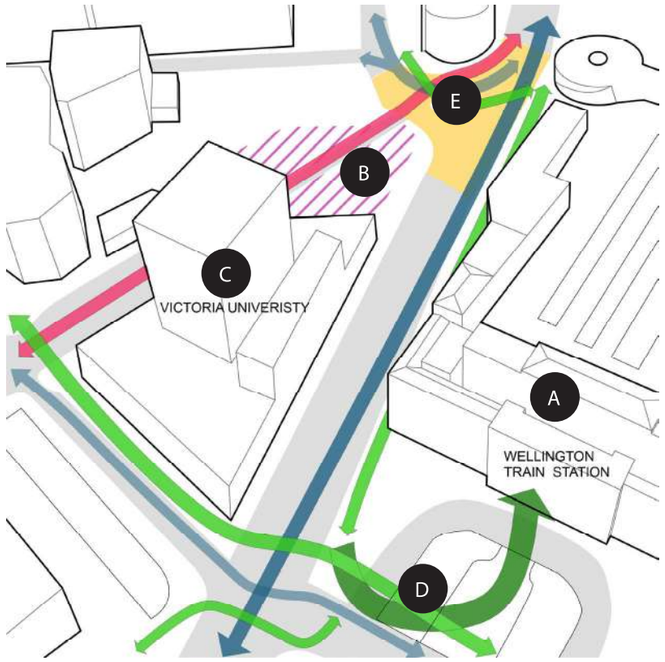
Nodal Points



Mulgrave Precinct

A Wellington Train Station sits at the north end of the CBD. It is the gateway into the city for many commuters and students.

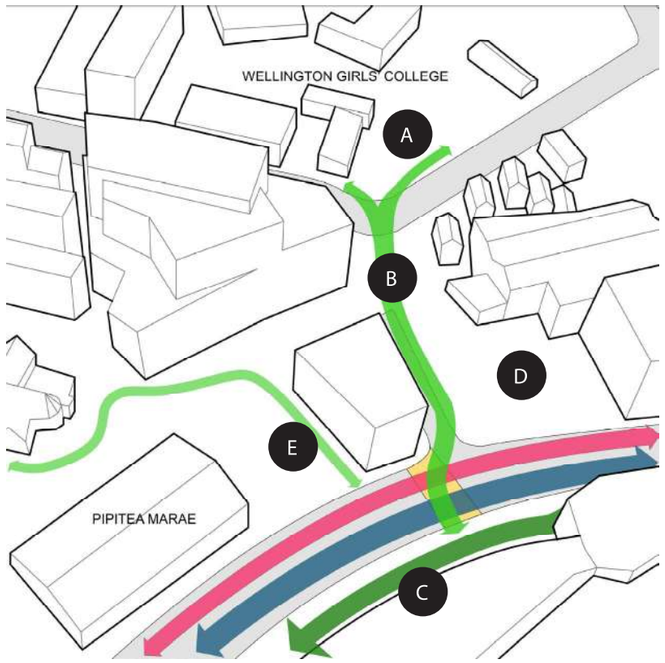
B Mulgrave Street Bus interchange lies at the north end of Lambton Quay - the end of the 'Golden Mile', which facilitates most public transit routes through the CBD.

C Victoria University's Pipitea Campus. It houses the schools of law and commerce and is tactically positioned in the government precinCt and adjacent to the train station.

D The space in front of the train station is one of the most heavily trafficked pedestrian spaces in the city.

E The transition from Featherston Street to Thorndon Quay forms a major intersection. Buses joing the main route north via Thorndon Quay here, sharing the road with cars and cyclists.

BUS INTERCHANGE
HEAVY INTERSECTION
PEDESTRIANS & CYCLISTS
VEHICLES
BUSES



Moore Street

A Wellington Girls' College is one of several schools in the Throndon area. Students make up many of the rush hour commuters.

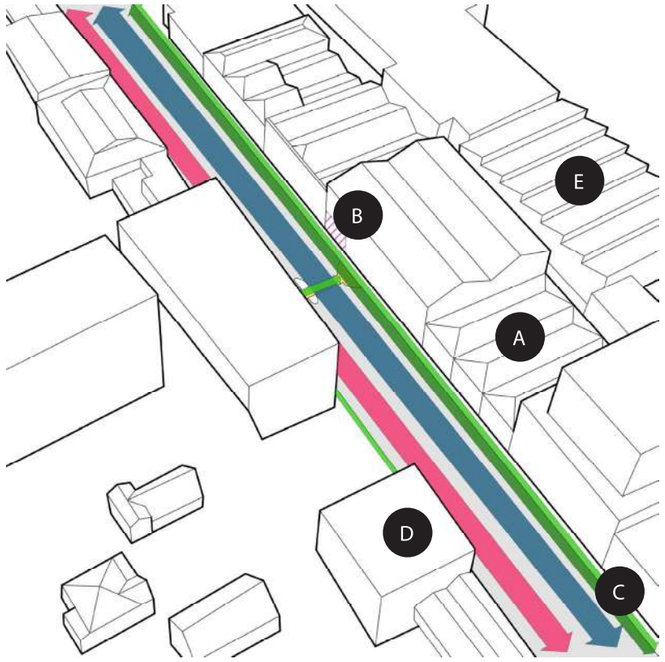
B Steps link the top of Moore Street to Pipitea Street. During the mornings and afternoons, students from nearby schools use this thoroughfare as a shortcut to the station.

C The eastern footpath of lower Thorndon Quay provides direct access to the Train Station.

D A carpark at the junction of Thorndon Quay and Moore Street is reminiscent of almost every open space found on the Quay - dedicated solely to the parking of vehicles.

E A pathway links Thordon Quay to Mulgrave Street via Pipitea Marae and Old St Pauls Cathedral. Small pockets of greenery scatter the edge. These are the only green spaces until the end of Thorndon Quay.

CROSSING
PEDESTRIANS & CYCLISTS
VEHICLES
BUSES



Thorndon Quay Shops

A The dense and high built fabric of the Thorndon Quay Shops is distinguished by a mostly industrial typology.

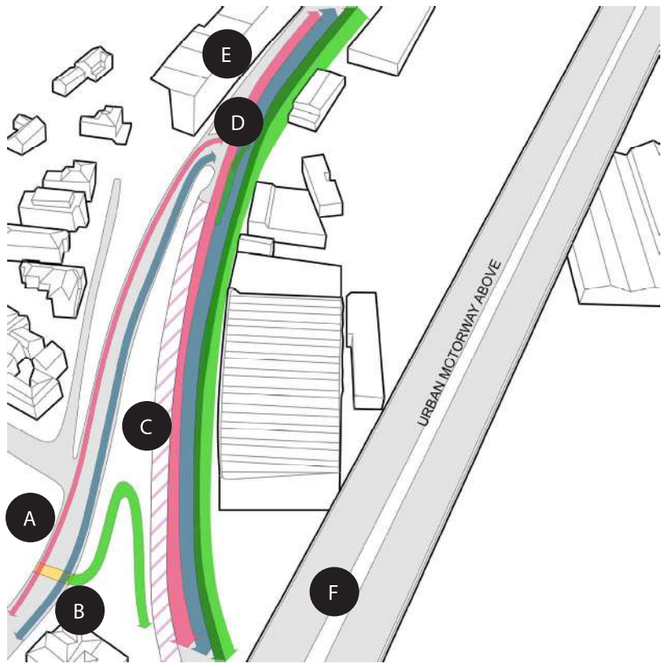
B The well-known Bordeaux Bakery is a rare draw-card along Thorndon Quay. It is one of few destinations accessed by foot. A well placed pedestrian crossing sits adjacent - the only safe crossing along this stretch of Thorndon Quay.

C The eastern side of Thorndon Quay includes an on-road cycleway. North bound cyclists share the path with vehicles with less dedicated space. However, a significant amount of parallel and angles parking is present on both sides of the road, all along the Quay.

D Retail along this section of Thorndon Quay consists mostly of homeware, appliance and vehicle service based businesses. They therefore attract private vehicles, and the vehicular realm is dominant over that of the pedestrian.

E Industrial yards and buildings behind Thorndon Quay back onto the railway yards and train tracks. They are not accessible.

NODE = BAKERY
CROSSING
PEDESTRIANS & CYCLISTS
VEHICLES
BUSES



Tinakori Road Intersection

A Tinakori Road links to suburban Thorndon. It is characterised by and known for its Edwardian and Victorian era residential villas.

B A pedestrian crossing across Tinakori Road links to a winding pathway down to Thorndon Quay under mature Pohutukawa trees.

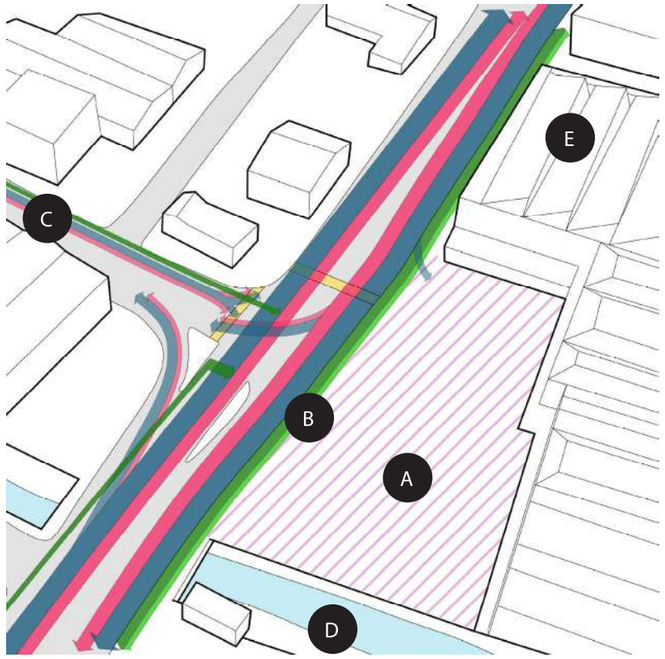
C Angled car parking begins at the Tinakori/Hutt Road intersection and continues south along the length of Thorndon Quay, with few breaks for bus stops.

D There is no pedestrian footpath along Tinakori Road to this intersection. At the intersection, cyclists are moved to the eastern side of Hutt Road and share a path in both directions. There is also a narrow pedestrian path.

E One of many bus stops on Hutt Road sits hard up against the enormous Kennards Storage Building. The pedestrian realm here is minnowed by the adjacent road and building. There is no shelter.

F The Wellington Motorway passes over the north extent of Thorndon Quay. It comes within touching distance of the adjacent building and shades the road below, asserting the dominance of the vehicular realm.

ANGLE CAR PARKING
CROSSING
CYCLEWAY
PEDESTRIAN PATHWAY
VEHICLES
BUSES



Kaiwharawhara Intersection

A — A large, open carpark accesses Spotlight - one of many big box retail sites along Hutt Road. Vehicles entering and exiting must cross the dual cycle way and pedestrian path.

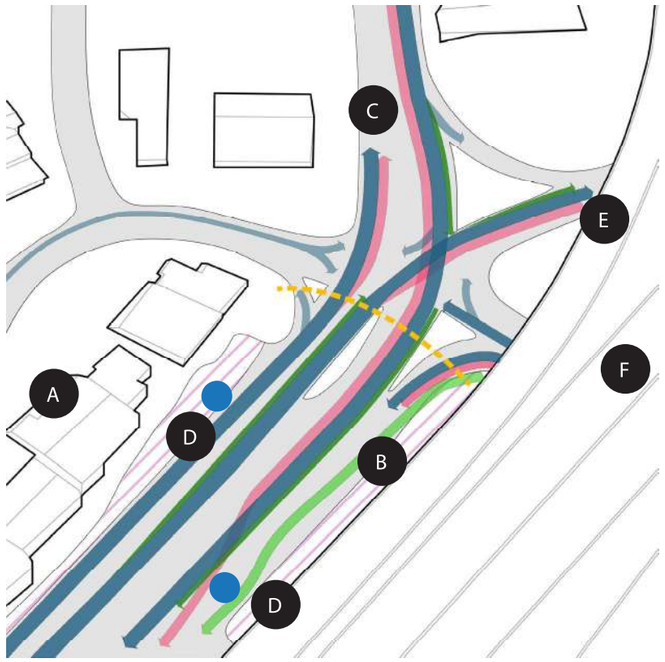
B — A dual cycle way runs the length of Hutt Road, from Thorndon Quay to Jarden Mile. A pedestrian path also exists. Pedestrians and cyclists must be cautious of vehicles crossing into the many sites.

C — Kaiwharawhara Road is a key access point to suburban Ngaio and Khandallah. Many daily commuters originate in these suburbs.

D — Kaiwharawhara Stream passes under Hutt Road before discharging into Wellington Harbour.

E — Like the Thorndon Quay Shops, big box retail in industrial buildings make up the fabric along Hutt Road. The urban fabric is less dense, however, with more yards and car parks.

- RETAIL AREA CAR PARK
- SAFE CROSSINGS
- CYCLEWAY
- PEDESTRIAN PATHWAY
- VEHICLES
- BUSES



Jarden Mile

A — Large industrial / plant factory buildings make up Jarden Mile. Private vehicles and trucks dominate the access to these buildings.

B — The dual cycleway ends at the Jarden Mile intersection. Hutt-bound cyclists must join the road here and share the road with vehicles, although there is a narrow cycle lane provided.

C — Traffic to Newlands, Johnsonville and further north peel off into Ngauranga Gorge. More clusters of industrial buildings are found here.

D — Bus stop locations. Pedestrians walk to intersection unsheltered to cross an unsignalised road that has heavy vehicular movement.

E — State Highway 1 joins Ngauranga Gorge north-bound. South bound traffic gets its first view of Wellington Harbour and the city here.

F — State Highway 2 continues towards the Hutt valley via a narrow strip of road between the hills and harbour.

- CAR PARKING & PEDESTRIAN ACCESS
- INFORMAL CROSSING
- CYCLEWAY
- PEDESTRIAN PATHWAY
- VEHICLES
- BUSES
- BUS STOP

Appendix C

Risk Register

	Project/Contract Description	*Thordon Quay Hutt Road*		NZTA Lead	*Hannah Hyde*
	Contract ID	*1909*		Supplier Lead	*Chris Dunlop*
	Contract Value	*To be inserted*		Supplier Risk Mgmt Specialist (if applicable)	*Tracy Couchman*
				Last Update	*3/11/2021*

Contract Risk Register

Risk identifier	Date raised (dd/mm/yyyy)	Risk Description (include whether this is a threat or an opportunity)	Risk Cause(s)	Risk Consequence(s)	Risk Owning Organisation	Risk Owner	Controls	Current Risk Likelihood	Current Risk Consequence	Consequence Category	Current Controlled Risk Level	Level of risk acceptable, when compared to Risk Tolerance Threshold (Y/N)	Planned Risk Trmt Actions *Note: If more than one treatment action, either:* *. Include numbers to identify separate treatments, or:* *. Refer to Actions Register on separate tab*	Treatment Owner(s)	Planned Treatment Implementation Date(s) (dd/mm/yyyy)	Risk Treatment Progress Updates	Residual (Target) Risk Likelihood	Residual (Target) Risk Consequence	Residual (Target) Risk Level	Risk status	Comments
1	17/03/2020	There is a threat the business case will not be completed as programmed	The cause of the threat is lack of resources (pandemic) to complete the required assessments and write up the business case, Assess the stakeholders for input or feedback, loss of key staff - sick or reassigned	The consequence of threat is public complaints / reputation, resources to manage and remedy, catch-up comms or additional construction, delayed benefits, costs to recover programme	Beca	Andy Lightowler	Mar 20 - Resourcing sharing across delivery partners as required, by agreement, reliable remote working system access / provisions Mar 21 - ongoing monitoring and project management, strong communication with management team	Unlikely	Moderate	Health & Safety	Medium					20/7/7 - Stage 1 technical deliverables completed as per programme	Rare	Minor	Low	Closed	16/04/20 - Linked to RID3, RID7 6/7/20 risk closed. Covid not risk to SSBC delivery anymore
2	17/03/2020	There is a threat that approvals take longer than planned	The cause of the threat is that the TWG and/or OIMS have a large number of projects requiring input and the TQHR project engagement is less than ideal.	The consequence of the threat is additional effort to chase TWC & OIM's, additional engagement, poor feedback or inputs, wrong decisions made, poor benefits / outcomes	LGWM	Hannah Hyde	17/04/20 - TWG / OIMS spreadsheet setting out workshops and deliverable reviews so that TWG and OIMS can manage their workload 1/12/20: TWG and OIM's now have a comments prioritisation register	Unlikely	Moderate	Delivery	Medium	Y		Paul McGimpsey		20/7/7 - HH has been proactively managing input from OIM's and TWG. Raised today that there is a possibility of a new group called 'TAG' which may have approval rights. 1/12/20: There is now a TAG group, but we don't need their formal endorsement.	Unlikely	Moderate	Medium	Live-Treat	20/6/7 - risk description updated
3	17/03/2020	There is a threat of the business case approval process is interrupted	The cause of the threat is the business case is more complex than expected, the approval process changes, Covid19 impacts	The consequence of the threat is additional investigation & effort, programme delays, additional stakeholder engagement, possible	Beca	Andy Lightowler	16/04/20 - Weekly team Leads meetings, Weekly client meetings, one on one with NZTA and TWG members. Engagement and Comms	Likely	Moderate	Delivery	High		16/04/20 - ACTION Tim Brown - Right size discussion for SSBC with NZTA IQA team, agreed methodology for MCA and Economic Appraisal prior with TWG and Project leads.	Neil Trotter	30/04/2020	20/7/7 - Engagement with partners is occurring over the options development and	Likely	Moderate	High	Closed	16/04/20 - Linked to RID1, RID7 1/12/20: updated to include wider approvals. To date there have been three approvals interruptions, SC, LLSL,
4	17/03/2020	There is a threat of Technical KPIs are not met	NA	NA	Beca	Eric Whitfield														Rejected	Risk not defined, closed
5	17/03/2020	There is a threat of not maximising the network benefits outcomes	The cause of the threat is poor single stage business case assessment, change to ILM scope, poor engagement by SSBC stakeholders, sacrifice benefits over	The consequence of threat is additional effort for rework & C&E programme, lost benefits, programme delays, stakeholder and public frustration, reputation, funding impacts, safety	Beca	Andrew Stewart		Possible	Moderate	Public/Media	Medium						Possible	Moderate	Medium	Closed	25/05/20 - closed as per Eric Whitfield
6	17/03/2020	There is a threat of a cost increase to the project budget & whole of life costs	The cause of the threat is market uncertainty (Covid), people availability, high post lockdown gear-up constraints, change of market forces, change in political funding decisions	The consequence of the threat is project does not proceed, increased costs, programme delays, benefits not realised, reputational impacts	Beca	Eric Whitfield		Almost certain	Moderate	Cost	High						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID10, RID59 12/05/20 - Combined RID10; Risk closed
7	17/03/2020	There is a threat of delay of the project shortlisting.	The cause of the threat is mis-alignment of problems/IO, and no ILM workshop (out of scope)	The consequence of the threat is public complaints/reputation, delayed programme.	GSP Ltd	Graham Spargo		Possible	Moderate	Cost	Medium						Possible	Moderate	Medium	Closed	02/04/2020 - Risk closed (ILM is out of scope, not just value for money approach - wider benefits realisation approach) 16/04/20 - Linked to RID1, RID3
8	17/03/2020	There is a threat of delays to the project	The cause of the threat is ramping-up delays with the partnering teams , opposing views not resolved (delays), duplicate effort across partners, confused comms & scope	The consequence of the threat is delay in programme, additional effort to resolve, complaints from stakeholders, confused engagement, benefits not realised, reputational impacts	Beca	Eric Whitfield		Possible	Moderate	Delivery	Medium									Closed	Pending Controls & Treatment information from Risk Owner 25/05/20 - Closed as per Eric Whitfield
9	17/03/2020	There is a threat of the Quick Wins list not being approved, or taking a long time for approval.	The cause of the threat is the Quick Wins not being agreed between (team members/client?), robust information not available to decision makers, decision makers are not prepped sufficiently or in a timely manner, incorrect decision makers	The consequence of the threat is programme delay, additional effort to correct issues, incorrect decisions - poor benefits or outcomes, stakeholder / public complaints, additional costs to resolve / rework	Beca	Caron Greenough	17/07/2020 - Quick Wins approved	Possible	Severe	Public/Media	High						Possible	Severe	High	Closed	16/04/20 - Linked to RID51, RID81, RID61 08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
10	17/03/2020	There is a threat of a cost increase for the project and whole of life costs	The cause of the threat is changing the funding priority (Covid, etc); market uncertainty (Covid), people availability, high post lockdown gear-up constraints, change of market forces (reduced construction resources in the market due	The consequence of the threat is some aspects not having adequate funding, project does not proceed, increased costs, programme delays, benefits not realised, reputational impacts, safety benefits not realised	LGWM	Hannah Hyde	25/05/20 - Robust business case methodology with input from stakeholders and partners. Knowledge of market costs. Contractor relationships	Likely	Minor	Cost	High	N	01/05/20 - ACTION: Eric Whitfield to speak with QS team, to understand market forces impact on business case economic case. SSBC to consider and document possible impacts	Shirley Mendoza Cruz	30/06/2020	20/7/7 - feedback is that market remains competitive, shovel-ready and other stimulus projects are slow to come to market	Possible	Severe	High	Live-Treat	16/04/20 - Linked to RID6, RID10, RID59 1/12/20: this risk will be reviewed for whole of project costs at next risk workshop 12/05/20 - RID6, RID59 combined 7/7/20 - residual risk likelihood reduced
11	17/03/2020	There is a threat the network is not a seamless integrated solution (journey for road users)	The cause of the threat is making assumptions or not have clarity of scope regarding the bus exchange integration for the shortlisted options within the project	The consequence of the threat is network integration, future proofing and resilience is compromised, potential rework to solve issues (redesign), programme delays, additional costs, stakeholder	Beca	Eric Whitfield	01/05/20 - Engaging with Greater Wellington re planned transport provisions - ongoing discussions	Likely	Moderate	Cost	High						Possible	Minor	Medium	Closed	17/03/20 - Linked to RID20 12/05/20 - Combined RID20, Risk closed
12	17/03/2020	There is a threat that the Investment Objectives are not achieved	The cause of the threat is not reviewing the Investment Objectives thoroughly to manage compliance with the RMA, lack of engagement with key stakeholders, lack of	The consequence of the threat business case fails, all recommendations for improvements are not accepted, protracted RMA	Beca	Eric Whitfield	16/04/20 - ongoing assessment and discussion with TWG / Stakeholders regarding investment objects	Possible	Moderate	Delivery	Medium		01/05/20 - ACTION - Eric Whitfield to provide regular communication with client and LGWM OIM's and TWG	Eric Whitfield	30/05/2020		Unlikely	Moderate	Medium	Closed	20/06/07: Closed as similar to risks 93 and 12 re investment objectives and project objectives.
13	17/03/2020	There is a threat of business owners objecting the cycleway, as they will loose parking for customers	The cause of the threat is the intentions and design of the cycleway not being cleared communicated with business owners during design stage.	The consequence of threat is public complaints and reputation, redesign.	Beca	Nathan Baker		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID77, RID 73, RID76, RID91, RID14 20/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined; Risk closed
14	17/03/2020	There is a threat of property owners objecting the new placement of bus stops/shelters.	The cause of the threat is a lack of engagement with property owners during design stage.	The consequence of threat is public complaints and reputation.	Beca	Nathan Baker		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID77, RID 73, RID76, RID91, RID13 20/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate
15	17/03/2020	There is a threat of the Urban Design benefits are not realised	The cause of the threat is the business case does not explore the urban design benefits sufficiently, key stakeholder inputs are missed, key data is not gathered - investigated, the business case approval declined urban design elements,	The consequence of the threat is solution does not meet social distancing requirements, costs and delays to remediate, complaints, benefits not realised, reputational impacts, not future proofed	Beca	Mark Sneddon		Likely	Moderate	Delivery	High						Likely	Moderate	High	Closed	20/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined; Risk closed

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	Contract ID	*1909*		Supplier Lead	*Chris Dunlop*
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16	17/03/2020	There is a threat the preferred option is not aligning with the Placemaking Framework and Amenities Strategy / Urban Design	The cause of the threat is that placemaking has not been given priority and the project options have an engineering focus, rather than aligning with city aspirations. Recognition of different areas of character in different	The consequence of the threat is public complaints, difficulty for approval, benefits not realised, future network impacts and maintenance issues, programme delays, costs, reputational impacts, cultural and community	Beca	Tom Abbot	25/05/20 - Engagement with partners on placemaking strategy. Urban design and placemaking input at early in options development	Almost certain	Moderate	Cost	High	N	02/03/21 - ACTION: Develop with Key stakeholder engagement, the placemaking/urban design framework for TQHR. Feed into the Prelim Design 03/11/21 - Retest above in next design phase	Tom Abbot / Will Maguire	30/11/2021	20/7/20 - Shannon Joe has met with WCC urban design team to discuss placemaking and amenity on the project. WCC support short list options.	Almost certain	Moderate	High	Live-Treat	16/04/20 - Linked to RID17 08/05/20 - RID16, RID17 combined 20/06/07 - changed owner to project team 1/12/20: no agreed placemaking
17	17/03/2020	There is a threat of inconsistency of strategy between TQHR with surrounding land of projects	The cause of the threat is recognition of different areas of character in different ways, the various projects do not have a consistent placemaking and amenities strategy, poor comms, poor decision making, poor engagement, strategy not	The consequence of the threat is public complaints, benefits not realised, inconsistent journey, safety impacted, maintenance issues, programme delays, costs, reputational impacts, environmental compliance impacts	Wellington City Council	Emily Alleway		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID16 08/05/20 - RID16, RID17 combined, Risk closed
18	17/03/2020	There is a threat that moving buses off the motorway will not meet the same standards as the motorway.	The cause of the threat is that all day travel speeds on the corridor will need to be competitive with the bus on the motorway. Facilities for driver breaks will also need to be provided.	The consequence of threat is public complaints and reputation, redesign or corridor.	Beca	Eric Whitfield		Possible	Moderate	Health & Safety	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID46, RID39, RID40 08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
19	17/03/2020	There is a threat of poor journey outcomes on the wider corridor	The cause of the threat is the lack of clarity of the corridor requirements for cycle, bus, over-dimension, Centre-point area / Aotea Quay 4th lane impacts	The consequence of threat is poor journey outcomes, benefits not realised, reputational impacts, costs and delays to remedy	Beca	Neil Trotter	16/04/20 - (Tim Brown Note) The role of the corridor has already been established in that it is a key cycling and bus corridor, over-dimension corridor, primary access to	Possible	Moderate	Delivery	Medium		1/05/20 - ACTION: Neil Trotter to make sure role of corridor including using the Place and Movement Framework is consistent through the options assessment process during business case development.	Neil Trotter	30/05/2020		Unlikely	Moderate	Medium	Closed	25/05/20 - closed as per Eric Whitfield
20	17/03/2020	There is a threat network is not a seamless integrated solution (journey for road users)	The cause of the threat is a lack of integration with the bus priority programme, lack of investigation, lack of stakeholder inputs, making assumptions or not have clarity of scope regarding the bus exchange and ferry terminal integration for the shortlisted options; constraints of Aotea Overbridge, and links outside of the	The consequence of threat is poor corridor connectivity, benefits not realised, complaints, reputational impacts, costs to remedy, future proofing and resilience compromised, potential rework to solve issues (redesign), programme delays, stakeholder complaints, dis-jointed	AECOM	Tim Brown	16/04/20 - Communication with the Bus Priority Programme team to clearly understand their programme of works, and how it could dovetail with Thorndon Quay	Likely	Moderate	Delivery	High		16/04/20 - ACTION: Eric Whitfield to communicate with client and LGWM OIM's to raise as an issue 1/5/20 -ACTION - Neil Trotter to consider this during alternatives and options assessment.	Eric Whitfield Neil Trotter	30/05/2020 30/05/2020		Unlikely	Moderate	Medium	Closed	17/03/20 - Linked to RID11, RID23 12/05/20 - combined RID11, RID23 16/04/20 - (Tim Brown Note - This is a bus service planning issue, not an infrastructure one, unless there is a scope change whereby there is a new route proposed to connect to the Ferry Terminal)
21	17/03/2020	There is a threat of harm to peds & cyclist	The cause of the threat is lack of pedestrian or cycling crossing facilities at Ngauranga intersection.	The consequence of threat is harm to road users, complaints, costs to rework BC / designs, benefits not realised, reputational impacts	AECOM	Tim Brown	16/04/20 - Business case process followed - user requirements, options, assessment (filtering, then MCA) to come down to a preferred	Possible	Severe	Health & Safety	High						Unlikely	Moderate	Medium	Closed	25/05/20 - Closed as per Eric Whitfield
22	17/03/2020	There is a threat of the project does not align with the Place and Movement Framework	The cause of the threat is the business case does not explore all user requirements on the network - eg Peds & Cyclists (multi-modal), align with NZTA NOF (Place & Movement Framework), gaps or	The consequence of threat is poor BC and decisions, benefits not realised, stakeholder impacts, costs to remedy, programme delays, reputational impacts	AECOM	Tim Brown		Possible	Moderate	Delivery	High		16/04/20 - ACTION: - Hannah Hyde to provide the project leadership group with the NOF. This is to enable team to look for potential conflicts with other guiding document s/ principles	Hannah Hyde	30/06/2020	20/7/7 - It was raised today by HH that WCC have not adopted the Place and Movement Framework so status is	Unlikely	Moderate	Medium	Closed	17/03/20 - Linked to RID28 12/05/20 - RID28 combined 20/6/7 - updated risk description 1/12/20: closed. Captured in urban design risk above (placemaking)
23	17/03/2020	There is a threat the corridor journey is not integrated for road users	The cause of the threat is the constraints of Aotea Overbridge, and links outside of the study area are not considered, lack of engagement / data to close out in the BC	The consequence of threat is a dis-jointed journey to access ferry terminal, media / reputational impacts, ongoing economic effects, costs and delays to remedy	Beca	Neil Trotter	16/05/20 - (Tim Brown Note - This is a bus service planning issue, not an infrastructure one, unless there is a scope change whereby there is a new route proposed to connect to	Likely	Moderate	Stakeholders	High						Possible	Moderate	Medium	Closed	17/03/20 - Linked to RID23 12/05/20 - Combined RID20, Risk Closed
24	17/03/2020	There is a threat benefits from integration of safe systems are not realised	The cause of the threat is not investigating, documenting and designing in safe systems (e.g. Lighting)	The consequence of threat is lack of investigation at BC stage, requirements not captured, lack of early engagement, decision making & funding	Beca	Marcus Brown		Possible	Moderate	Health & Safety	Medium									Closed	Pending Controls & Treatment Information from Risk Owner 25/05/20 - Closed as per Eric Whitfield
25	17/03/2020	There is a threat of reduced access from Ngauranga Station to Jarden Mile.	The cause of the threat is the lack of inclusion into the design.	The consequence of threat is public complaints, user safety impacts, journey connectivity, reputational impacts	Beca	Eric Whitfield	16/04/20 - 'Status quo access' provisions to Ngauranga Station	Likely	Moderate	Delivery	High						Possible	Moderate	Medium	Closed	08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
26	17/03/2020	There is a opportunity of increased network efficiencies	The cause of the opportunity is the Kaiwharawhara Intersection approach benefiting future freight logistics on the corridor, improved requirements and design	The consequence of opportunity is improved economic efficiencies, journey benefits, safety improvements	AECOM	Tim Brown	'16/04/20 - Communications and engagement plan – specifically the PRG to capture requirements for design and implementation	Possible	Moderate	Delivery	Medium		''1/5/20 - ACTION - Tim Brown to bring this option into the alternatives and options assessment	Tim Brown	30/05/2020		Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID32
27	17/03/2020	There is a opportunity to increase network efficiencies with Ngauranga Kiss and Ride	The cause of the opportunity is the Kiss and Ride at Ngauranga Intersection approach benefiting road users on the corridor, improved requirements and design	The consequence of opportunity is improved economic efficiencies, journey benefits, safety improvements	AECOM	Tim Brown	16/04/20 - Communications and engagement plan – specifically the PRG to capture requirements for design and implementation	Possible	Moderate	Delivery	Medium		1/5/20 - ACTION - Tim Brown to bring this option into the alternatives and options assessment	Tim Brown	30/05/2020		Possible	Moderate	Medium	Closed	20/6/7 - opportunity description updated
28	17/03/2020	There is a threat the investment objectives are not achieved	The cause of the threat is gaps or conflicts between framework and guidance principles	The consequence of threat is benefits not realised, additional costs to remedy, safety impacts to road users, reputational impacts	Beca	Eric Whitfield		Likely	Moderate	Public/Media	High						Unlikely	Severe	Medium	Closed	17/03/20 - Linked to RID22 12/05/20 - RID22 combined, Risk Closed
29	17/03/2020	There is a threat of duplication of activity across programmes	The cause of the threat is that the project scope is unclear within the LGWM programme & schedule of regional programmes, of works being unclear with	The consequence of the threat is mis-aligned scope (gaps, overlapping scope), public confusion re engagement, additional effort /	LGWM	Hannah Hyde	Coordination with other LGWM workstreams	Possible	Moderate	Delivery	Medium						Unlikely	Moderate	Medium	Closed	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83; Risk closed
30	17/03/2020	There is a threat the network does not meet the required level of resilience (future-proofed, event - Quake etc)	The cause of the threat is a lack of coordination during design with resilience strategy consultants, lack of investigations to understand issues and requirements, lack of expert inputs, lack of engagement (eg - maintenance, future needs / volumes)	The consequence of the threat is a network that does not withstand required quake levels, future traffic volumes not met, additional future works, maintenance cost impacts, delays to programme to resolve /	Wellington City Council	Emily Alleway		Possible	Severe	Stakeholders	High		08/05/20 - ACTION - Emily Alleway to speak with Mike Meudouca at WCC, LQHR business case considers the WCC Network Resilience strategy requirements	Emily Alleway	30/05/2020		Unlikely	Moderate	Medium	Closed	25/05/20 - Risk closed as per Eric Whitfield
31	17/03/2020	There is a threat of benefits not being realised and safety impacts to network users	The cause of the threat is constraints of infrastructure already existing on the corridor	The consequence of the threat is additional assessment of structural features on the network (additional effort), programme delays, benefits not realised, reputational impacts	Beca	Eric Whitfield		Possible	Moderate	Delivery	Medium		1/5/20: Eric Whitfield to discuss with LGWM prior to Stage 2 to allow for adequate survey and data collection prior to developing designs.	Eric Whitfield	1/05/2020	Closed	Possible	Moderate	Medium	Closed	08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
32	17/03/2020	There is a threat the Kaiwharawhara station is not accessible from the network corridor	The cause of the threat is a lack of clarity in the project scope, and the network corridor does not connect into key infrastructure assets	The consequence of the threat is that the design may not align with the requirements of the project scope.	Beca	Eric Whitfield		Possible	Moderate	Delivery	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID26 08/05/20 - Risk closed, refer to RID 26 as per Eric Whitfield and Hannah Hyde
33	17/03/2020	There is a threat the network does not meet the required future proofed level of service	The cause of the threat is the business case does not provide the required	The consequence of the threat is redesign to meet growth strategy	Beca	Neil Trotter	08/07/2020 - Long list and short list options reviews progressing -	Likely	Moderate	Delivery	High		16/04/20 - ACTION: Neil Trotter to latest growth strategy and forecast demand for	Neil Trotter	8/05/2020		Possible	Moderate	Medium	Closed	25/05/20 - Risk closed as per Eric Whitfield
34	17/03/2020	There is a threat the preferred option is not resilient to climate change (slip failure, tidal inundation and the like)	The cause of the threat is that the preferred option is not aligned to the climate change plan, lack of integration with Wellington Lifelines project, lack of	The consequence of the threat is the corridor is not future proofed, additional costs to retrofit solutions, additional future costs to maintain	Beca	Caron Greenough	25/05/20 - This project is not making any infrastructure changes related specifically to climate change mitigation	Unlikely	Minor	Health & Safety	Low						Unlikely	Minor	Low	Closed	16/04/20 - Linked to RID48 08/05/20 - Risks combined 20/06/07 - This project is not making any infrastructure changes related

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				Last Update	*3/11/2021*

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35	17/03/2020	There is a threat of the overall network solution is not fit for purpose	The cause of the threat is there is currently a lack of integration between the programmes - integrating with the NZTA and LGWM Programme (Golden Mile, City	The consequence of the threat is public complaints and reputation, cost implications, programme delays,	LGWM	Hannah Hyde		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83; Risk closed
36	17/03/2020	There is a threat the corridor is not available for construction of the TQHR project.	The cause of the threat is there will be works on State Highway 1 from other capital project or major maintenance works beside the corridor restricting access for the TQHR construction	The consequence of the threat delay to the project programme, additional effort for reprogramming, contract penalties to NZTA for contractor delays, resourcing availability window	LGWM	Hannah Hyde	'17/04/20 - LGWM programme shared with NZTA	Unlikely	Moderate	Delivery	Medium						Unlikely	Moderate	Medium	Closed	20/6/7 - combined with Risk 38 and closed
37	17/03/2020	There is a threat of poor investment outcomes	The cause of the threat is lack of knowledge sharing between other programmes -large road projects such as TG, PP2O, and N2P cycleway, lack of regional coordination, not exploring sufficiently in the BC to inform good decision making	The consequence of threat is poor user journeys, lost economic benefits, reputational impacts	Beca	Eric Whitfield		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
38	17/03/2020	There is a threat of lack of coordination with other regional projects having an effect on the programme progression of the corridor.	The cause of the threat is the wider effects in the area of the reassignment traffic to other/alternative routes during the gorge lane closure.	The consequence of threat is programme delays, complaints, reputational impacts, safety impacts for road users	LGWM	Hannah Hyde	25/05/20 - Coordination with other Waka Kotahi and partner programmes. 01/11/21 - Petone cycle way coordination via Hannah Hyde via LGWM	Possible	Moderate	Delivery	Medium	Y					Unlikely	Moderate	Medium	Live-Treat	12/05/20 - Risk owner changed from Tim Brown to Hannah Hyde as per Eric Whitfield instructions 01/11/21 - Controls updated, treatment closed Linked to Risk 117
39	17/03/2020	There is a threat of lack of clarity on the inclusion of the bus interchange.	The cause of the threat is the bus interchange being out of scope for both the Golden Mile and TQHR, lack of inter project comms between to two programmes	The consequence of the threat is that the end design may not be fit for purpose - redesign needed, programme and cost impacts, additional effort to remedy, stakeholder & public complaints	Wellington City Council	Gunther Wild		Likely	Moderate	Cost	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID39, RID18, RID46, RID40 17/04/20 - Transfer from Hannah Hyde to Gunther Wild - WCC led (Station precinct design is being led by WCC, MRT project for LGWM is the funnel for
40	17/03/2020	There is a threat of the Lambton Bus interchange having an impact on the corridor.	The cause of the threat is redesign of the bus interchange.	he consequence of the threat is that the end design may not be fit for purpose - redesign needed.	Wellington City Council	Gunther Wild		Possible	Minor	Stakeholders	Medium						Possible	Minor	Medium	Closed	16/04/20 - Linked to RID39, RID18, RID46, RID40 17/04/20 - Transfer from Hannah Hyde to Gunther Wild - WCC led; Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83; Risk closed
41	17/03/2020	There is a threat of other project changes having an impact of final results.	The cause of the threat is the possible changes to the Interisland ferry terminal, change in government funding / priorities post Covid, lack of clarity re other capital projects scope and interdependencies to TQHR, Kiwirail/Centreport Future Developments, Lambton bus interchange, WCC coordination with Wellington Water, roading maintenance, GasCo, TelCo, etc, mis-communication re maintenance programmes	The consequence of the threat is public complaints and reputation damage. Redesign needed, additional effort & rework, programme delays and cost impacts, benefits not optimised or realised..	LGWM	Hannah Hyde	25/05/20 - Coordination with LGWM and partner programmes. 03/11/21 - further design progress with Prelim design, and understandign of this project interdependancies with other projects	Possible	Moderate	Stakeholders	Medium	Y					Rare	Moderate	Low	Live-Treat	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83 20/6/7 - owning org changed to LGWM 03/11/21 - Controls updated, ranking reduced
42	17/03/2020	There is a threat of complaints and confusion regarding the transitional strategy	The cause of the threat is there is not a clear strategy for the transitional, lack of ongoing comms & engagement re the strategy, businesses are not prepared for the disruption - no continuity plans to	The consequence of threat is that the construction strategy may require extra planning - delays, business slowdown, additional effort re comms & engagement	Wellington City Council	Gunther Wild		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	17/04/2020 - Transferred from Hannah Hyde to Gunther Wild 08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
43	17/03/2020	There is a threat of the constraints on the corridor	The cause of the threat is a lack of integration and coordination with Wellington Water, roading maintenance, GasCo, TelCo, etc, mis-communication re maintenance programmes	The consequence of the threat is the construction programme clashes with maintenance programmes, delays to constructions & costs of delays, revised comms and additional costs to manage, reputational impacts	LGWM	Hannah Hyde		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83; Risk closed
44	17/03/2020	There is a threat of the construction programme not being completed as scheduled.	The cause of the threat is not having adequate resources for the construction and a lack of contractors to build projects, Covid19 impacts on "ability to work" (lockdown), conflicts with other major construction programmes & government drive for "shovel ready" projects	The consequence of threat is public complaints, delays benefits, increased costs (market forces), change of funding priorities - SSBC Investment decision changes	LGWM	Hannah Hyde	'16/04/20 - Project is in the NLTP - Contractors will have visibility of timing and scale	Unlikely	Moderate	Delivery	Medium		16/04/20 - ACTION: Hannah Hyde - Early conversations with Contractor to notify of project and seek interest. Potential look at innovative procurement processes to reduce tender costs and time - inputs into economic case	Hannah Hyde	30/06/2020		Unlikely	Moderate	Medium	Closed	16/04/20 - Mark Sneddon Note: Currently plenty of capacity in contractor industry but may come under pressure is closedown extended. May be competing with shovel ready CIP projects. 12/05/20 - Transferred from Mark
45	17/03/2020	There is a threat of the project not aligning with other city programmes.	The cause of the threat is a lack of integration with Planning for Growth, MUFT, Bus Interchange, N2P, and other LGWM projects.	The consequence of the threat is that the design is not fit for purpose - redesign and integration required, redesign needed, additional effort & rework, programme delays and cost impacts, benefits not optimised or realised	LGWM	Hannah Hyde		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83; Risk closed
46	17/03/2020	There is a threat of the proposed bus capacity does not meet required volumes or route schedules	The cause of the threat is asset infrastructure or network design does not support a future proofed public transport system to meet demand	The consequence of threat is additional private vehicles on the network (congestion), complaints, future roading improvements (cost); reputational impact; environmental	Greater Wellington Regional Council	Dave Humm		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID39, RID18, RID40 08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
47	17/03/2020	There is a threat of not knowing what projects may be happening in or near the corridor, and their impact.	The cause of the threat is utility companies doing work in or near the corridor, and the impact/constraints on constructing data collection.	The consequence of the threat is that the work of other projects may cause a delay to the programme, benefits not realised, additional effort / rework.	LGWM	Hannah Hyde		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47, RID83; Risk closed

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48	17/03/2020	There is a threat of future growth will cause stormwater issues.	The cause of the threat is that stormwater management is not taken into account in design.	The consequence of the threat is that it is not integrated into the design - redesign required.	Beca	Mark Sneddon		Possible	Moderate	Environmental	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID34 08/05/20 - Risks combined and closed
49	17/03/2020	There is a threat of safety benefits not being realised for cyclists and pedestrians on the network	The cause of the threat is a lack of integration of safety technology around cycle safety and pedestrians, poor design, lack of engagement & consultation with	The consequence of the threat is the user complaints, possible user harm, loss of future benefits through tech-roads, objectives not achieved	Beca	Marcus Brown		Possible	Moderate	Health & Safety	Medium									Closed	Pending Controls & Treatment information from Risk Owner 25/05/20 - Risk closed as per Eric Whitfield
50	17/03/2020	There is a threat of the harm to pedestrians and cyclists network users	The cause of the threat is the design does not meet the safe system approach	The consequence of the threat is the design does not meet objectives, public complaints, harm to users, reputation, retro fit safety improvements (cost)	Beca	Marcus Brown	25/05/20 - Safe systems approach. Industry practice regarding designing for peds and cyclists	Possible	Moderate	Health & Safety	Medium						Unlikely	Moderate	Medium	Closed	Pending Controls & Treatment information from Risk Owner 20/6/7 - risk closed as considered
51	17/03/2020	There is a threat that Quick Wins benefits are not realised	The cause of the threat is the underground services quick wins initiative is not integrated into the design	The consequence of the threat is benefits are not realised, project delivery efficiencies are lost, additional costs, complaints & reputational	Beca	Caron Greenough	08/07/2020 - Quick Wins approved	Possible	Moderate	Delivery	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID81, RID9, RID61 08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
52	17/03/2020	There is a threat of poor / mismanaged property acquisition activity	The cause of the threat is the LGWM Development / property team is yet to be established, lease opportunity to leverage land owners not realised, miscommunication of requirements, strategy does not meet project requirements	The consequence of the threat is lost opportunity for land acquisition, high expectations - market costs for land, additional costs to progress purchases, complaints / reputational impacts	LGWM	Hannah Hyde	17/04/20 - NZTA property purchase procedures will be followed when / if required at later stages of the project. (No planned purchases noted) 1/12/20: likely that WCC would need to purchase as roundabout will be WCC asset.	Unlikely	Minor	Public/Media	Low	Y					Unlikely	Minor	Low	Live-Parked	16/04/20 - Linked to RID14, RID53 20/6/7 - changed to live-parked until property impacts are known 1/12/20: review in next workshop for pre-imp phase. Identify owner and process 6/7/21: consequence lowered as Kiwirail are willing to lease land for AQ roundabout
53	17/03/2020	There is a threat of property acquisition being compromised.	The cause of the threat is that not enough guidance justification is documented and challenged.	The consequence of the threat is public complaints and reputation causing a delay for the programme, costs to remedy	Beca	Andrew Stewart	17/04/20 - NZTA property purchase procedures will be followed when / if required at later stages of the project.	Likely	Moderate	Public/Media	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID14, RID52 17/04/20 - Transferred from Hannah Hyde to Andrew Stewart; Risk merged with RID52 Risk closed
54	17/03/2020	There is a threat of poor business case outcomes	The cause of the threat is a lack of ensuring to obtain the latest information, data collection being out of date or inaccurate, lack of interdependent project inputs	The consequence of the threat is decision making flawed, design rework to correct, reduce benefits, complaints, reputational impacts	AE COM	Tim Brown		Possible	Moderate	Delivery	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID58, RID56, RID54, RID55, RID 57 17/04/20 - Duplicate risk with RID57 - closed as per Neil Trotter
55	17/03/2020	There is a threat the business case justification does not meet expectations of all LGWM partners	The cause of the threat is inadequate data analysis, lack of detailed (deep dive) investigations, lack of site or ground investigations at the correct phases, in accurate data, data gaps	The consequence of the threat is the business case is not based on sound information, incorrect assumptions are made, the project outcomes / benefits are not realised, additional effort and rework, cost & programme impacts, reputational impacts, potential RMA breaches, property acquisitions issues	Beca	Andy Lightowler	25/05/20 - Follow the Waka Kotahi business case development process. Engagement with partners, OIMs, IQA 08/07/2020 - Ongoing data analysis, stakeholder engagement; Strategic Case approved; IQA 01/11/21 - Consultation and Engagement re commencing	Unlikely	Moderate	Delivery	Medium	N				20/7/7 - project team continue to follow the published guidance.	Unlikely	Moderate	Medium	Live-Treat	16/04/20 - Linked to RID54, RID56, RID57, RID58 08/05/20 - Related risks combined and closed, RID55 open 01/11/21 - Update control note, treatment closed
56	17/03/2020	There is a threat of a lack of data understanding affecting decisions and investment.	The cause of the threat is a lack of accurate data.	The consequence of threat is missing information in the design - design not fit for purpose.	Beca	Neil Trotter	08/07/2020 - Accurate parking data received, modelling processing - July / August)	Possible	Severe	Delivery	High						Possible	Severe	High	Closed	16/04/20 - Linked to RID54, RID55, RID57, RID58 08/05/20 Related risks combined and closed as per Eric Whitfield and Hannah
57	17/03/2020	There is a threat of not obtaining the required level of evidence for the size of the problem.	The cause of the threat is lack of accurate data and evidence.	The consequence of the threat is missing information in the design - design not fit for purpose.	Beca	Neil Trotter	08/07/2020 - Long list and short list options reviews progressing - informal acceptance at this stage; modelling of data progressing to support evidence based decisions on options	Possible	Moderate	Delivery	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID54, RID55, RID56, RID58 08/05/20 Related risks combined and closed as per Eric Whitfield and Hannah Hyde
58	17/03/2020	There is a threat the preferred option is based on incorrect assumptions / data in the SSBC	he cause of the threat is a lack of data to support assumptions and decisions for options	The consequence of threat is missing information in the design - design not fit for purpose, loss effort & rework; reputation; costs and programme delays to remedy	Beca	Neil Trotter	08/07/2020 - Long list and short list options reviews progressing - informal acceptance at this stage; modelling of data progressing to support evidence based decisions on options	Possible	Moderate	Delivery	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID54, RID55, RID56, RID57 08/05/20 Related risks combined and closed as per Eric Whitfield and Hannah Hyde
59	17/03/2020	There is a threat the project is over budget & programme	The cause of the threat is high demand on consultancy services (Covid impacts), reduce construction resources in the market, high demand due to accelerated shovel ready activity	The consequence of the threat is delays to programme, increased costs of resources and materials	Beca	Eric Whitfield		Likely	Moderate	Cost	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID10, RID6 12/05/20 - Combined RID10, RID59; Risk closed
60	17/03/2020	There is a threat of the project extent is incorrect and economics planning not capturing the entire project.	The cause of the threat is the economics focus is transport economics only, does not include other aspects of the full project & network requirements (urban	The consequence of the threat is the outcomes are not fit for purpose, poor decision making, benefits not realised, stakeholder and user complaints	Beca	Neil Trotter	08/07/2020 - programme integration progressing via engagement with other LGWM programme teams; Rail project	Possible	Severe	Delivery	High		01/05/20 - ACTION - Neil Trotter to define the extent of any additional data requirements for the SSBC (Parking data received, chasing up bays in ped data etc)	30/06/2020			Possible	Moderate	Medium	Closed	25/05/20 - Risk closed as per Eric Whitfield
61	17/03/2020	There is a threat benefits are not realised	The cause of the threat is a lacking ability to justify the quick wins and recommendations, poor quick win identification or justification in the BC, lack of data to support case, change of funding priority (Covid) (Over LCLR limits)	The consequence of threat is lost safety improvement benefits, lost economic benefits, complaints, reputational impacts	Beca	Caron Greenough	08/07/2020 - Quick Wins approved	Possible	Moderate	Delivery	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID51, RID81, RID9 08/05/20 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk

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62	17/03/2020	There is a threat the Marae parking arrangements does not meet the user requirement	The cause of the threat is informal parking arrangements with WCC would be affected by the project, the new facilities are not designed to user requirements, insufficient funds to provide all user requirements (compromises), gaps in requirements data, lack of stakeholder engagement with both Iwi and Councils and Roading authority	The consequence of threat is unhappy stakeholders and complaints, infringement notices, harm to users, future remedial works (cost and programme), reputation	Beca	Nathan Baker	09/07/20 - SEB Bishop LGWM leading IWI engagement, including Pipitea Marae	Likely	Minor	Stakeholders	Medium	N	25/05/20 - ACTION: engagement with iwi and the council (progressing) 1/12/20: we need to determine what their requirements are 01/11/21 - Commence detailed design - will include marae in Q2 2022	Michael Flyger	30/11/2021		Possible	Moderate	Medium	Live-Treat	17/04/20 - Transferred from Rachel Dahlberg to Nathan Baker 1/12/20: likelihood changed to high, consequence minor 01/11/21 - Update treatment & action owner
63	17/03/2020	There is a threat of having a delay to the programme.	The cause of the threat is a delay in engagement with Mana Whenua, due to being slower than other stakeholders.	The consequence of threat the design may not include engagement from Mana Whenua - redesign required.	Beca	Nathan Baker		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID64, RID65 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks - Combined RID63, RID64, RID65; risk closed
64	17/03/2020	There is a threat of Iwi Relationships being compromised.	The cause of the threat is that Pipitea Marae is on the corridor as well as existing relationships with WCC.	The consequence of threat is public/Iwi complaints and reputation.	Beca	Nathan Baker		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID63, RID65 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks - Combined RID63, RID64, RID65; risk closed
65	17/03/2020	There is a threat of a delay to the programme due to poor engagement with iwi.	The cause of the threat is a lack of engagement with Iwi in early stages of the programme; delay in engagement with Mana Whenua, due to being slower than other stakeholders; Pipitea Marae is on the corridor as well as existing relationships with WCC.	The consequence of threat is programme delay and key engagement information is lacking. Also public complaints, design may not include engagement from Mana Whenua - redesign required	Beca	Nathan Baker	25/05/20 - comms and engagement plan developed and implemented 09/07/20 - Seb Bishop LGWM leading IWI engagement, including Pipitea Marae	Unlikely	Moderate	Stakeholders	Medium	N	1/12/20: there has been meeting with iwi partnership working group 01/11/21 - Iwi engagement planned for detailed design stage recommencing - Q4 2021	Nathan Baker	30/12/2021		Possible	Moderate	Medium	Live-Treat	16/04/20 - Linked to RID63, RID64 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks - Combined RID63, RID64, RID65 20/6/7 - risk description updated 6/7/21: likelihood lowered as LGWM now involved in engagement, assessed options against mana whenua values 01/11/21 - Treatment updated
66	17/03/2020	There is a threat the project does not meet with RMA requirements	The cause of the threat is a lack of recording of some notable trees, and features around Mulgrave Street, cultural areas, historical features	The consequence of the threat is breach of RMA, cultural friction / delays, additional engagement, media, reputational impacts, delays and additional costs	Beca	Nathan Baker		Possible	Severe	Environmental	High						Possible	Severe	High	Closed	16/04/20 - Linked to RID67 12/05/20 - RID 67 Combined; Risk Closed
67	17/03/2020	There is a threat of RMA / construction delays	The cause of the threat is a lack of engagement with Heritage NZ & IWI, lack of archaeological &Iwi expertise impacts into business case & early investigations, key significance areas not identified (including notable trees, and features around Mulgrave Street, cultural areas, historical features)	The consequence of the threat is a delay to the programme, breach of RMA, Waitangi commitments not met, cultural friction, rework of C&E and investigations, cost and programme delays, reputational impacts	Beca	Paul McGimpsey	25/05/20 - RMA considerations in options assessment 01/11/21 - Prelim design SID review and RMA considerations assessment	Unlikely	Severe	Environmental	Medium	N	08/05/20 - ACTION - Emily Alleway to speak with Mark Lindsey at WCC regarding the RMA requirements to support the development of the business case 20/7/20 - ACTION - update social and env screen in Stage 2, for recommended option 01/11/21 - ACTION - SID review and noting heritage buildings along corridor to ensure they are identified through out design and construction programmes - next SID Q1 2022	Paul McGimpsey	1/12/2021	20/7/21 - social and env screen completed on short list options. No significant RMA issues are expected at present. Detailed assessment will be completed on recommended option.	Unlikely	Moderate	Medium	Live-Treat	16/04/20 - Linked to RID67 12/05/20 - RID 66 Combined 1/12/20: review at beginning of stage 2, next risk workshop 01/11/21 - Treatment update
68	17/03/2020	There is a threat of the road being inappropriate for emergency services.	The cause of the threat is the new road layout	The consequence of threat is the design is not fit for purpose - redesign required.	AE COM	Tim Brown		Likely	Moderate	Health & Safety	High						Likely	Moderate	High	Closed	16/04/20 - RID 68 & 70 combined; RID68 closed; linked to RID70
69	17/03/2020	There is a threat of the project not being completed as programmed.	The cause of the threat is not being prepared for working through emergencies (eg: Covid) - a project continuity plan outlining responses / actions	The consequence of the threat is the project programme will not be able to continue if certain emergencies occur, delays, additional costs, additional C&E, reputational impacts	GSP Ltd	Graham Spargo		Likely	Moderate	Delivery	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID70, RID68 08/05/2020 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
70	17/03/2020	There is a threat of the corridor not being adequate for the specialist users of the corridor (Wellington Free Ambulance and Fire Station, Overwidth vehicles, police, accident response etc)	The cause of the threat is the corridor does not provide sufficient width for various vehicle user types, lack of stakeholder requirements gathering, lack of data, not captured in BC, not captured in design development	The consequence of threat is safety issues for road users, compounding access issues, complaints, costs to remedy, ongoing future issues, reputational impacts	AECOM	Tim Brown	25/05/20 - use of industry practice design standards 01/11/21 - Prelim SID review	Unlikely	Severe	Stakeholders	Medium	Y	25/05/2020 - ACTION - Engagement with emergency service providers for detailed design phase 01/11/21 - SID workshop for detailed design - Q2 2022; DD engagement phase with emergency services on corridor	Will Maguire	30/04/2022	20/7/21 - continue to engage with emergency services during the development of a recommended option.	Unlikely	Moderate	Medium	Live-Treat	16/04/20 - Linked to RID68, RID69 01/11/21 - Treatment updated
71	17/03/2020	There is a threat of a delay in the programme, due to the community being reluctant to engage.	The cause of the threat is that the community have previously been engaged for the project - both in 2015 and 2017, and some of the previous engagement is no longer relevant (out of date).	The consequence of threat is the design lacking information - engagement from key stakeholders missing	Beca	Nathan Baker		Likely	Moderate	Public/Media	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID72, RID88, RID89, RID90 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined RID71, RID72, RID88, RID89; risk closed

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	Contract ID	*1909*		Supplier Lead	*Chris Dunlop*
	Contract Value	*To be inserted*		Supplier Risk Mgmt Specialist (if applicable)	*Tracy Couchman*
				Last Update	*3/11/2021*

Contract Risk Register

Risk identifier	Date raised (dd/mm/yyyy)	Risk Description (include whether this is a threat or an opportunity)	Risk Cause(s)	Risk Consequence(s)	Risk Owning Organisation	Risk Owner	Controls	Current Risk Likelihood	Current Risk Consequence	Consequence Category	Current Controlled Risk Level	Level of risk acceptable, when compared to Risk Tolerance Threshold (Y/N)	Planned Risk Trmt Actions *Note: If more than one treatment action, either:* *. Include numbers to identify separate treatments, or:* *. Refer to Actions Register on separate tab*	Treatment Owner(s)	Planned Treatment Implementation Date(s) (dd/mm/yyyy)	Risk Treatment Progress Updates	Residual (Target) Risk Likelihood	Residual (Target) Risk Consequence	Residual (Target) Risk Level	Risk status	Comments
72	17/03/2020	There is a threat of not having adequate engagement with key stakeholders.	The cause of the threat is that some stakeholders (e.g. Kiwirail) may not be interested in engaging.	The consequence of threat is the design is not fit for purpose - delay and redesign needed.	Beca	Nathan Baker		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID71, RID88, RID89, RID90 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined RID71, RID72, RID88, RID89; risk closed
73	17/03/2020	There is a threat of coordination with community resulting in a lack of support.	The cause of the threat is that the community may not support the short listed options.	The consequence of threat is delay to the programme, and design cost, community confidence reduced.	Beca	Nathan Baker		Possible	Severe	Public/Media	High						Possible	Severe	High	Closed	16/04/20 - Linked to RID77, RID14, RID76, RID91, RID13 20/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined; Risk closed
74	17/03/2020	There is a threat other project does not deliver on	The cause of the threat is lack of	The consequence of the threat	Wellington	Emily Alleway		Likely	Moderate	Stakeholders	High									Closed	Pending Controls & Treatment
75	17/03/2020	There is a threat of the community not	The cause of the threat is key messages	The consequence of the threat is a lack	Beca	Nathan Baker		Likely	Moderate	Public/Media	High						Likely	Moderate	High	Closed	17/04/20 - Transferred from Hannah
76	17/03/2020	There is a threat of other issues impacting the ability of LGWM to actively engage with	The cause of the threat is other prominent issues in the community such as the bus	The consequence of threat is the design not being fit for purpose and	Beca	Nathan Baker		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID77, RID14, RID73, RID91, RID13
77	17/03/2020	There is a threat of the community residents and retailers resisting the loss of car parking.	The cause of the threat is that options are likely to affect car parking in the corridor.	The consequence of threat is resident and retailer complaints, delay in programme regarding feedback	Beca	Nathan Baker		Likely	Moderate	Public/Media	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID76, RID14, RID73, RID91, RID13 20/04/20 - Transferred from Zoe
78	17/03/2020	There is a threat of a lack of public support having a delay on the programme.	The cause of the threat is conflicting messages from Councillors and influencers	The consequence of threat is public complaints	Beca	Nathan Baker		Possible	Severe	Public/Media	High						Possible	Severe	High	Closed	16/04/20 - Linked to RID79, RID80, RID81, RID84, RID85, RID86, RID87
79	17/03/2020	There is a threat of a delay to the programme.	The cause of the threat is long term impacts for residents and retailers not being clearly communicated.	The consequence of threat is the design is not suitable for long term options - redesign required.	Beca	Nathan Baker		Possible	Moderate	Public/Media	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID78, RID80, RID81, RID84, RID85, RID86, RID87 17/04/20 - Transferred from Zoe
80	17/03/2020	There is a threat of the public not being supportive of the project.	The cause of the threat is too much engagement across the programme leading to public confusion.	The consequence of threat is that the end design does not achieve the objectives - redesign needed. Public complaints and reputational risks also.	Beca	Nathan Baker		Likely	Moderate	Public/Media	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID78, RID79, RID81, RID84, RID85, RID86, RID87 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate
81	17/03/2020	There is a threat of the Quick Wins feedback and support causing a delay in the programme	The cause of the threat is that the limited budget will have some form of impact.	The consequence of threat is the Quick Wins list not being fit for purpose - reassessment required.	Beca	Caron Greenough	08/07/2020 - Quick Wins approved	Possible	Severe	Public/Media	High						Possible	Severe	High	Closed	16/04/20 - Linked to RID78, RID79, RID80, RID84, RID85, RID86, RID87, RID51, RID9, RID61 08/05/20 - Closed as per Eric Whitfield and Hannah Hyde - not TQHR risk
82	17/03/2020	There is a threat of an uncertainty about the future of the programme	The cause of the threat is changes to the elected team and officials working on the WCC wider strategy programme (change of approach, requirements or funding), lack of communication or conflicted decision making between officials, change in	The consequence of the threat is misaligned messaging, misaligned decision making, programme delays, misaligned C&E, effort and cost to rework, reputational impact, potentially loss benefits	Wellington City Council	Gunther Wild		Likely	Moderate	Stakeholders	High									Closed	Pending Controls & Treatment Information from Risk Owner 25/05/20 - Risk closed as per Eric Whitfield
83	17/03/2020	There is a threat of other project developments having an impact on the project programme.	The cause of the threat is the uncertainty of developments happening around Kiwirail and Centreport.	The consequence of the threat of public complaints and reputation re the end design may not be fit for purpose - redesign needed; additional effort & rework, programme delays and cost impacts, benefits not optimised or realised	LGWM	Hannah Hyde		Possible	Moderate	Stakeholders	Medium						Possible	Moderate	Medium	Closed	17/04/20 - Duplicate Risks combined RID29, RID35, RID40, RID41, RID43, RID45, RID47; Risk closed
84	17/03/2020	There is a threat of the programme not meeting the expectations/needs of all stakeholders - retailers high risk.	The cause of the threat is that certain stakeholders have a greater influence than most.	The consequence of threat is reputation and public complaint, and a programme delay to get input from all stakeholders.	Beca	Nathan Baker		Likely	Moderate	Stakeholders	High						Likely	Moderate	High	Closed	16/04/20 - Linked to RID78, RID79, RID80, RID81, RID85, RID86, RID87 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined RID78, RID79, RID80, RID84, RID84, RID85, RID86, RID87; Risk closed
85	17/03/2020	There is a threat of the extent of engagement causing a delay to the programme.	The cause of the threat is that the extent of engagement doesn't follow AP2 principles.	The consequence of threat is the design not being fully informed, causing a programme delay.	Beca	Nathan Baker		Possible	Moderate	Public/Media	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID78, RID79, RID80, RID81, RID84, RID86, RID87 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined RID78, RID79, RID80, RID84, RID84, RID85, RID86, RID87; Risk closed
86	17/03/2020	There is a threat of problems and opportunities not being accurately identified.	The cause of the threat is a focus on only opportunities, and problems not being confirmed.	The consequence of threat is the design not being fully informed, causing a programme delay.	Beca	Nathan Baker		Possible	Moderate	Public/Media	Medium						Possible	Moderate	Medium	Closed	16/04/20 - Linked to RID78, RID79, RID80, RID81, RID84, RID85, RID87 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined RID78, RID79, RID80, RID84, RID84, RID85, RID86, RID87; Risk closed

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87	17/03/2020	There is a threat of community and stakeholder expectations are not met or unrealistic	The cause of the threat is a lack of consideration of previous information and engagement, focus on only opportunities, and problems not being confirmed, lack of or too much engagement, certain stakeholders have a greater influence than most (loudest voice), extent of engagement doesn't follow AP2 principles.	The consequence of threat is a time delay to the programme, and information being duplicated, higher costs, problems and opportunities not being accurately identified, not meeting the expectations/needs of all stakeholders - retailers high risk; public confusion, long term options not suitable	Beca	Michael Flyger	25/05/20 Review of previous engagement processes and outcomes and incorporation into the project comms and engagement plan and strategic case 09/07/20 - Engagement strategic progressing with LGWM to support July shortlist public engagement activity	Likely	Moderate	Public/Media	High	N				20/7/7 - There is a plan in place for the upcoming engagement round, including the type of and scale of information to be included, as well as visualisations 20/2/11 - shortlist option engagement delayed until March/April 2021 21/11/5: Stakeholder meetings set up beginning Vovember 2021	Possible	Moderate	Medium	Live-Treat	16/04/20 - Linked to RID78, RID79, RID80, RID81, RID84, RID85, RID86 17/04/20 - Transferred from Zoe Thompson to Nathan Baker; Duplicate risks combined RID78, RID79, RID80, RID84, RID84, RID85, RID86, RID87
99	1/12/2020	There is a threat that the current recommended option does not proceed	The cause of the threat is project cost exceeds programme budget expectations	Project does not proceed or is scaled down	LGWM	Hannah Hyde	01/11/21 - Prelim design reviews & feedback into detailed design phase, ROC costs tested	Rare	Severe	Stakeholders	Low	Y					Rare	Moderate	Low	Live-Treat	01/11/21 - Controls updated
100	1/12/2020	There is an opportunity to implement parts of the project early	The cause of the opportunity is parts of the project are at different stages of development (previously designed by WCC).	The consequence is early realisation of benefits and reputational benefit	LGWM	Hannah Hyde		Rare	Moderate	Public/Media	Low	Y					Likely	Moderate	High	Live-Treat	1/12/20: revisit during prelim design and next risk workshop 6/7/21: likelihood raised as AQ now likely to go ahead of TQHR 01/11/21 - Treatment updated, risk ranking updated
101	2/03/2021	There is a threat of loss of trade for local business owners along the corridor wider area	The cause of the threat is the design solution does not accommodate easy access into businesses to do "trade"; lack of engagement, poor design solutions -	The consequence of the threat is complaints from impacted parties, costs to redesign / construct, reputation, delays to outcomes, loss of	LGWM	Hannah Hyde		Possible	Moderate	Public/Media							Unlikely	Minor	Low	Closed	19/03/21 - Instructed to merge RID 91 & 101, close 101
102	2/03/2021	There is a threat the desired safety and journey solutions can not be delivered within the corridor width	The cause of the threat is insufficient corridor width for full design standards (eg: link to Davis St); conflicting requirement for safety and urban design	The consequence of the threat is the solution does not meet user requirements, safety outcomes (IO's), or future proof the corridor	Beca	Will Maguire		Likely	Severe	Stakeholders	Critical		02/03/21 ACTION: Prepare Design plan to treat corridor width issues at key locations	Blaise Cummins	30/03/2021		Possible	Moderate	Medium	Closed	6/7/21: risk closed as min widths for modes included in prelim design, as per discussions with partner orgs
103	2/03/2021	There is a threat Utilities / Underground services are not identified	The cause of the threat is due diligence not completed, inaccurate As Built data, new assets included over course of project delivery	The consequence of the threat is design rework for new assets to "accommodate" UG services, relocation of services to accommodate design requirements, lost costs, reduces safety	Beca	Will Maguire	02/03/21 - Services investigations progressing with design development 01/11/21 - full survey completed including "lifting lids" approach	Possible	Moderate	Cost	Medium	N	01/11/21 - SID review for detailed design, survey data into design	Will Maguire	30/04/2022		Rare	Moderate	Low	Live-Treat	01/11/21 - Treatment update, risk ranking reduced
104	2/03/2021	There is a threat of conflict access points onto the corridor	The cause of the threat is the number and nature of business driveway / accesses on the corridor cross over other modes -	The consequence of the threat is vehicle / ped / cycle crashes as business owners access their premises	Beca	Will Maguire	02/03/2021 - Corridor and access ways design reviews, HSID reviews - identify access way clashes to	Likely	Moderate	Delivery	High	N	02/03/21 - ACTION: Progress design HSID access to design solution access points that do not clash with other modes such as Peds /	Will Maguire	30/04/2022		Unlikely	Moderate	Medium	Live-Treat	01/11/21 - Treatment update, risk ranking increased
105	2/03/2021	There is an opportunity to improve the Hutt Road and Thordon Quay Egress / access	The cause of the opportunity is to gain landowners agreement to combine business accessways	The consequence of the opportunity is reduced access points, improved safety for other modes, improved traffic flows	Beca	Will Maguire		Possible	Minor	Delivery	Medium	Y	02/03/21 - ACTION: Progress assessment of area, progress improved design solutions for access way points 03/11/21 - Discussion with urban design team	Will Maguire	1/03/2022		Likely	Moderate	High	Live-Treat	Linked to RID 70 Specialist users access on corridor (Fire, Ambulance, first responses, wide vehicles) 03/11/21 - treatment updated
106	2/03/2021	There is a threat the solution does not enable safe access / egress to existing key assets/facilities (pump stations, fire station) for maintenance and	The cause of the threat is the lack of investigation, stakeholder engagement / feedback, lack of HSID design assessment,	The consequence of the threat is the restriction of access to key facilities; time / costs to move assets (pump	Beca	Will Maguire	02/03/21 - Early identification of key assets / facilities; HSID design reviews, stakeholder engagement	Unlikely	Severe	Delivery	Medium	Y	02/03/21 - ACTION: Progress design investigations for facilities on the corridor; investigate "future consented" new assets /	Will Maguire	1/03/2022		Unlikely	Moderate	Medium	Live-Treat	Linked to RID 70 Specialist users access on corridor (Fire, Ambulance, first responses, wide vehicles)
107	2/03/2021	There is a threat of poor safety solutions at Davis St / Tinakori Rd	The cause of the threat is right turning traffic causing traffic delays (no right turn bay area) and cyclist access across main corridor	The consequence of the threat is poorly designed, or lack of right turning facilities, lack of turning stacking space - traffic disruption, safety of road users, cost to redesign and remediate in future	Beca	Will Maguire	02/03/21 - Early identification of known issue, progress HSID design improvements 03/11/21 - Davis St intersection design confirmed (no right turn); Tinakori Rd - traffic light solution confirmed (controlled intersection) &	Rare	Moderate	Delivery	Low	Y					Rare	Minor	Low	Live-Treat	Linked to RID 70 Specialist users access on corridor (Fire, Ambulance, first responses, wide vehicles) 03/11/21 - controls updated, treatment closed, ranking reduced
108	2/03/2021	There is a threat the intersection design approach / philosophy changes	The cause of the threat is the intersection modelling identifies design issues that require late design changes	The consequence of the threat is incorrect design assessments in the model, future design phases incorrect, additional late costs for rework or	Beca	Will Maguire	02/03 - Design approach in review pending outcome / decision 03/11/21 - design model reviewed, philosophy agreed and applied to	Unlikely	Severe	Delivery	Medium	Y	03/11/21 - ongoing awareness and watching brief for improvement through SID and design process	Will Maguire	Ongoing		Rare	Moderate	Low	Live-Treat	03/11/21 - Treatment updated
109	2/03/2021	There is a threat of data gaps - such as lack of survey data; Ped counts; Business economics data / Metrics	The cause of the data gaps is insufficient information provided to the project team from external sources, lack of budget to fund investigations / on site surveys at the	The consequence of the threat is the design does not tie-in with the existing on-site reality; incorrect assumptions made in the business case, designs	Beca	Will Maguire		Possible	Moderate	Delivery	Medium	Y	03/11/21 - ongoing awareness and watching brief for improvement through SID and design process	Will Maguire	Ongoing		Unlikely	Minor	Low	Live-Treat	03/11/21 - Treatment updated
110	2/03/2021	There is a threat of additional tree related maintenance costs on the corridor or tree removals	The cause of the threat is existing trees on the corridor in the "wrong" location for the new design, poor choice of trees or	The consequence of the threat is public complaints from tree removals, additional maintenance for culvert	Beca	Eric Whitfield		Likely	Minor	Public/Media	Medium		02/03/21 - ACTION: Manage tree selection and tree placement are detailed to reduce future impacts from trees, reduce any tree	Blaise Cummins	30/05/2021		Rare	Insignificant	Low	Closed	19/03/21 - Jardin Mile area outcomes included in core scope as investment objective. Risk closed
111	2/03/2021	There is an opportunity to improve the Jardin Mile area outcomes	The cause of the opportunity is to improve the urban design solution to the design process	The consequence of the opportunity is Improved safety outcomes for users and amenity usability	Beca	Will Maguire	03/11/21 - Prelim design solution completed, SID review, NZTA approval of prelim design	Almost certain	Minor	Stakeholders	Medium	Y	03/11/21 - Progress improvements through detailed design phase - urban design to improve look and feel of area	Will Maguire	30/04/2022		Likely	Moderate	High	Live-Treat	03/11/21 - Control update, treatment update, ranking increased (O)
112	2/03/2021	There is an opportunity to improve engagement for TQHR project with other regional programmes	The cause of the opportunity is to work with other C&E teams to improve sequencing of engagement and messaging	The consequence of the opportunity is improved engagement with the wider community and road users, improved outcomes	LGWM	Hannah Hyde		Unlikely	Minor	Public/Media	Low		02/03/21 - ACTION: - TQHR team work with wider key stakeholders to leverage C&E activity - progress C&E with other projects / programmes	Hannah Hyde	Ongoing through programme		Likely	Minor	Medium	Closed	Linked to RID 38 - Lack of coordination with other regional projects / programmes 19/03/21 - Duplicate risk with RID 38; close risk 112
113	2/03/2021	There is a threat critical heritage buildings, places of significance, cultural, protected flora / fauna species are not identified & managed	The cause of the threat is lack of cultural investigations, lack of council plans inputs / assessments or data provided, lack of user requirements assessments, lack of archaeological investigation during design phase	The consequence of the threat is breach of consents, / regulations / legal requirements; impact of value of buildings; cultural value impacts to key stakeholders; loss of critical historical values; loss of historical earth deposits	LGWM	Hannah Hyde	GIS Model layer to ringfence heritage , cultural values, Social and environment screening, heritage assessment in scope	Unlikely	Moderate	Legal/Compliance	Medium	N	02/03/21 - ACTION: Investigate the shared path - does this now go on the southern side of Hutt Road towards the Onslow Rd connection?; Investigate historic horse trough that juts out into the road berm at this point on the northern side- and is quite rare.	Paul McGimpsey	30/03/2022		Rare	Moderate	Low	Live-Treat	03/11/21 - reduce risk ranking Linked to RID 89 - lack of stakeholder engagement for specialist groups Note: We can mitigate this to a large extent by doing assessments of historic, archaeological and cultural heritage
114	2/03/2021	There is a threat the current corridor configuration will change before design & construction completed	The cause of the threat is changing assets on the corridor including changes to quake prone buildings, new buildings / infrastructure already consented is built	The consequence of the threat is late corridor design changes; impacts to asset owners; cost; reputation; programme delays	Beca	Andy Lightowler	03/11/21 - watching brief - "no real alternative options" to mitigate	Rare	Moderate	Delivery	Low	Y					Rare	Moderate	Low	Live-Parked	03/11/21 - control update, treatment closed, ranking reduced, parked
115	2/03/2021	There is a threat other transport mode requirements are omitted from the project	The cause of the threat is lack of stakeholder engagement and user requirements, poor design investigations,	The consequence of the threat is different user types can not use the corridor safely, complaints, costs and	Beca	Will Maguire	02/03/21 - Survey of "access requirements " completed	Unlikely	Severe	Public/Media	Medium	Y	02/03/21 - ACTION: Progress further investigations to corridor solutions accommodate other transport modes	Will Maguire	30/02/2022		Rare	Minor	Low	Live-Treat	03/11/21 - Controls updated, treatments updated, ranking reduced
116	2/03/2021	There is a threat the Cost Estimates for Business Case not accurate to support funding application	The cause of the threat is insufficient design to inform costs / lack of investigation & stakeholder engagement	The consequence of the threat is incorrect funding / business case decisions, design solutions	Beca	Andy Lightowler	02/03/21 - design development and stakeholder requirements feeding into funding case	Unlikely	Severe	Cost	Medium	Y	03/11/21 - Future cost estimate at detailed design phase to test accuracy of business case costs	Shirley Mendoza Cruz	30/06/2022	Costings based on preliminary design, risk items have been	Unlikely	Moderate	Medium	Live-Treat	03/11/21 - Controls updated, treatment updated Linked to RID 10 - Project and whole of
117	2/03/2021	There is a threat other projects/activities that could influence scope of TQHR project.	The cause of the threat is project / programme requirements / outcomes from Te Ara connection at Jardin Mile, MUFT,	The consequence of the threat is poor safety and journey outcomes, reputation, costs and delays to	LGWM	Hannah Hyde		Unlikely	Severe	Delivery	Medium						Unlikely	Minor	Low	Closed	Following sites listed in the WCC Plan: TThorndon Quay Pt Lot 1 DP 11041 Railway Locomotive and Rolling Stock
118	28/06/2021	There is a threat that individual property requirements such as refuse collection, driveways operation, driveway ramp are omitted from scope of project	The cause of the threat is insufficient design, investigation & stakeholder engagement to confirm requirements, lack of agreed solutions	The consequence of the threat is individual user and stakeholder requirements are not met, increased cost	Beca	Will Maguire	Stakeholder feedback and submissions from May/June engagement. 03/11/21 - detailed stakeholder engagement - business by business approach; SID review, realign &	Rare	Moderate	Cost	Low	Y					Rare	Minor	Low	Live-Treat	03/11/21 - Controls updated, treatment closed, rankign reduced

	Project/Contract Description	*Thordon Quay Hutt Road*		NZTA Lead	*Hannah Hyde*
	Contract ID	*1909*		Supplier Lead	*Chris Dunlop*
	Contract Value	*To be inserted*		Supplier Risk Mgmt Specialist (if applicable)	*Tracy Couchman*
				Last Update	*3/11/2021*

Contract Risk Register

Risk identifier	Date raised (dd/mm/yyyy)	Risk Description (include whether this is a threat or an opportunity)	Risk Cause(s)	Risk Consequence(s)	Risk Owning Organisation	Risk Owner	Controls	Current Risk Likelihood	Current Risk Consequence	Consequence Category	Current Controlled Risk Level	Level of risk acceptable, when compared to Risk Tolerance Threshold (Y/N)	Planned Risk Trmt Actions *Note: If more than one treatment action, either: . Include numbers to identify separate treatments, or: . Refer to Actions Register on separate tab*	Treatment Owner(s)	Planned Treatment Implementation Date(s) (dd/mm/yyyy)	Risk Treatment Progress Updates	Residual (Target) Risk Likelihood	Residual (Target) Risk Consequence	Residual (Target) Risk Level	Risk status	Comments
119	28/06/2021	There is a threat that the preferred option / corridor cross section cannot be achieved through the Onslow Road intersection	The cause of the threat is that the proposed prelim design layout and signal phasing is not approved by WCC	The consequence of the threat is the preferred option is not able to be implemented through Onslow Road, objectives not met (on this local section), increased cost	Beca	Will Maguire	WCC representatives have been involved in scope and road safety audit discussions 03/11/21 - Prelim SID; Safety Audit; Prelim approved by NZTA	Unlikely	Severe	Delivery	Medium	Y	03/11/21 - Progress survey for area to confirm design is acceptance (tight alignment in area) - via AE COM	Craig Pitchford	30/12/2021	03/11/21 - Survey fee estimate provided (refer AECOM)	Rare	Severe	Low	Live-Treat	03/11/21 - controls updated, treatment updated, ranking reduced
120	2/07/2021	There is a threat that the design of the Aotea Quay roundabout will require rescoping	The cause of the threat is insufficient investigation and stakeholder engagement during SSBC, as the previous WCC design was changed in short notice following RSA	The consequence of the threat is increased cost, delivery delays	Beca	Will Maguire	LGWM discussions with Kiwirail, new concept agreed through RSA process 03/11/21 - Additional optioneering completed (pending decision)	Likely	Moderate	Cost	High	N	03/11/2021 - GWRC to complete further modelling of approved option - AE COMM activity. Further engagement with Kiwirail / Port	Craig Pitchford	30/12/2021	03/11/2021 treatment updated and reassigned	Possible	Minor	Medium	Live-Treat	03/11/21 -controls updated, treatment updated
121																				Live-Treat	
122																				Live-Treat	
123																				Live-Treat	
124																				Live-Treat	
125																				Live-Treat	
126																				Live-Treat	

Appendix D

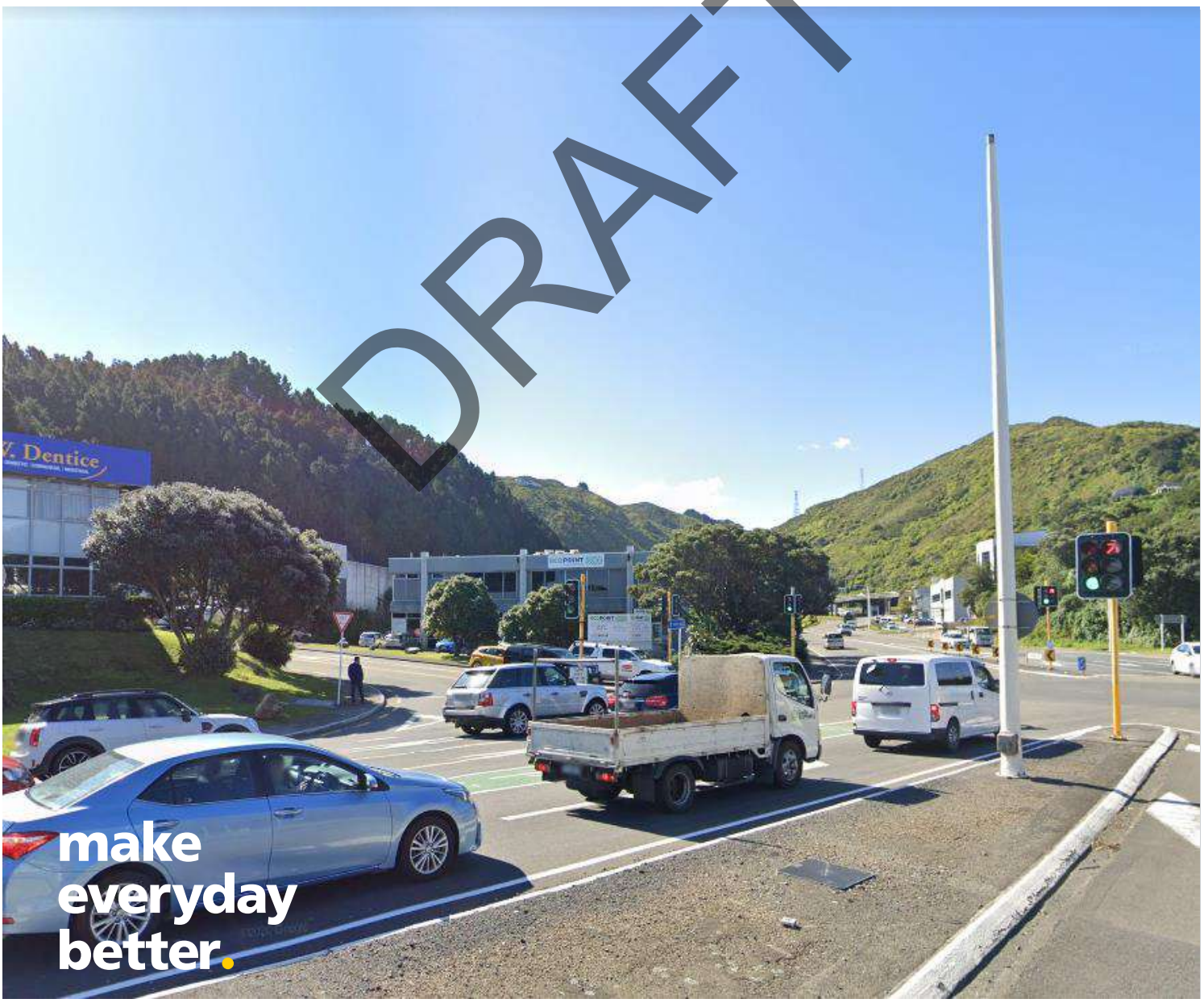
Preliminary Geotechnical Appraisal Report

Thorndon Quay Hutt Road

Preliminary Geotechnical Appraisal Report

Prepared for Let's Get Wellington Moving
Prepared by Beca Limited

20 April 2021



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Revision History

Revision Nº	Prepared By	Description	Date
1	Olivia Ross		20/04/2021

Document Acceptance

Action	Name	Signed	Date
Prepared by	Olivia Ross		20/04/2021
Reviewed by	Philip Robins		20/04/2021
Approved by	Eric Whitfield		20/04/2021
on behalf of	Beca Limited		

Contents

Appendices

1 Scope of this Appraisal

This preliminary geotechnical appraisal summarises soil conditions along the Thorndon Quay to Hutt Road (TQHR) project area as part of the Preliminary Design Philosophy Statement.

We have prepared this Preliminary Geotechnical Appraisal Report (PGAR) to provide an overview of the key geotechnical issues of influence on the proposed improvements along the TQHR project area. No intrusive geotechnical investigations have been undertaken. The data has been gathered from the NZGD and Beca databases.

2 Project Description

The TQHR project is one of Let's Get Wellington Moving (LGWM's) Early Delivery Projects. The objective of the project is to encourage the use of public transport through the central city, improve safety, and create a better environment for pedestrians and cyclists. The interim scope includes a number of changes to the road corridor, including additional lanes and road furniture as well as speed and layout alterations, which will each help achieve the project objectives.

3 Regional Geology

3.1 Stratigraphy

The published geological map for the area surrounding the TQHR route is shown in Figure 1 below. The map indicates that the area is expected to be underlain by reclamation fill, further underlain by alluvium, with greywacke basement rock at some depth (Begg & Johnston, 2000).

The active Wellington Fault runs alongside the route of TQHR, with an intersection near the Thorndon overbridge area.

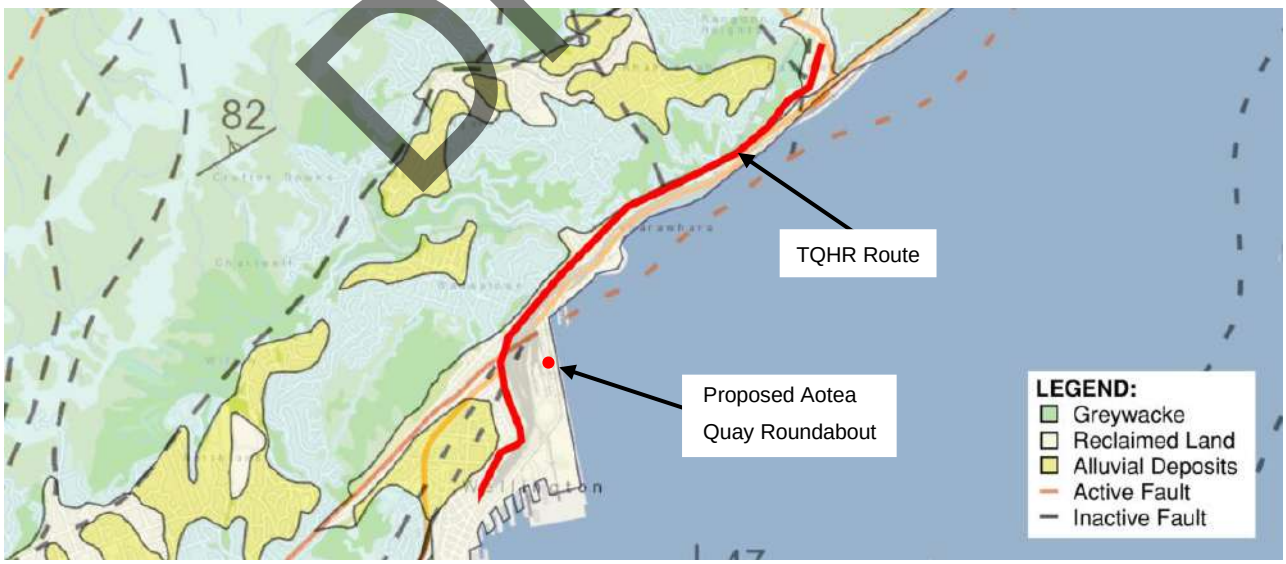

Figure 1. Geology and Fault Lines Surrounding Site (Begg & Johnston, 2000).

Figure 2 illustrates regions of Wellington Harbour where land was reclaimed. The Thorndon Quay section of TQHR follows the border between reclaimed land and existing land. According to Murashev & Palmer, 1998, the fill can be expected to vary from end-tipped quarried rock to pumped hydraulically placed marine silts and sands, extending up to 17 metres below ground level.

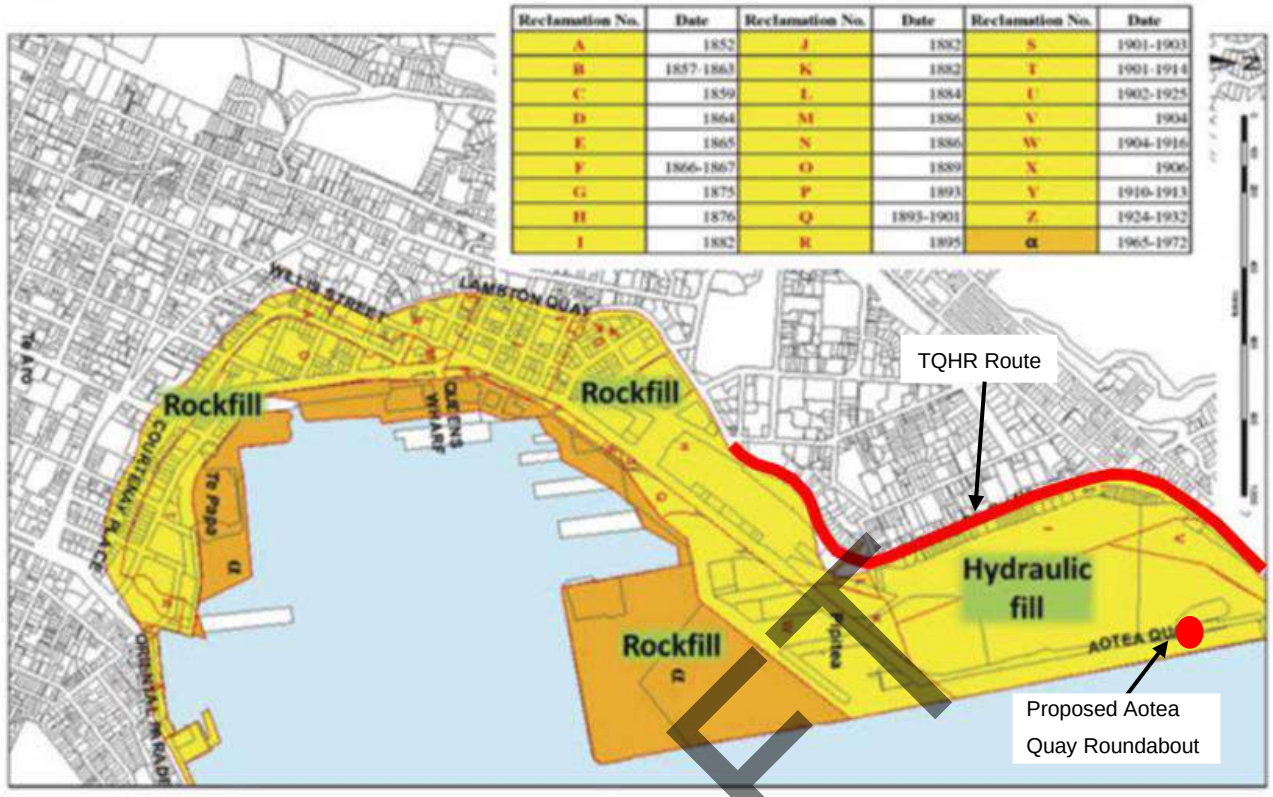

Figure 2. Wellington Reclamations (Wotherspoon, Taylor, Palmer, & Chiaro, 2016).

3.2 Geomorphology

The TQHR project area extends along a relatively flat strip of land, neighbouring the foot of greywacke hills. It can be separated into four distinct regions: Hutt Road/Jarden Mile intersection, Hutt Road, Thorndon Quay and Aotea Quay Roundabout.

The Hutt Road/Jarden Mile intersection is located at the base of Ngauranga Gorge. South-East it is confined by Wellington Harbour and State Highway 1, while to North-East and South-West it is confined by steep greywacke hills.

To the west, Hutt Road is immediately confined by a steep greywacke hill and to the east it is confined by State Highway 1 and Wellington Harbour.

Thorndon Quay is located in an urban environment and bounded by retail and commercial properties, with State Highway 1 slightly further to the east. It is confined to the north by a steep greywacke hill, and the relatively flat reclaimed land continues to the south.

Aotea Quay Roundabout is at the northern end of Aotea Quay. It is immediately confined to the East by a narrow strip of CentrePort and Wellington Harbour and by Mainfreight Transport Yard to the West. To the north it is confined by the Thorndon Quay overbridge.

4 Seismic Hazards

Based on the seismic risk associated with the location of TQHR, the seismic hazards outlined below will be considered in the following sections:

- Fault Rupture
- Tsunami

- Liquefaction
- Lateral Spreading
- Earthquake Induced Slope Stability

4.1 Fault Rupture

The TQHR route is located in proximity to three active faults. Table 1 outlines key characteristics of these fault lines.

Table 1. Fault Lines and Characteristics Near TQHR Area (Stirling, McVerry, & Berryman, 2002).

Fault	Recurrence Interval of Rupture (yrs)	Characteristic Magnitude	Approx. Distance from TQHR (km)
Wellington Fault	600	7.5	1
Ohariu Fault	2,200	7.5	6
Shepherds Gully Fault	3,500	7.4	10

As stated in Section 2.1, the active Wellington Fault intersects the TQHR route near the Thorndon overbridge area. It passes from SW-NE through Thorndon Quay and continues roughly parallel to the remaining Hutt Road section of TQHR. Therefore, risk of fault rupture is a concern for the Thorndon section only.

4.2 Tsunami

Due to the low-lying nature of the TQHR area, the entirety of the route will be subject to tsunami risk. Figure 3 identifies evacuation zones depending on the risk level, according to GWRC.

The project area is predominately located in the yellow evacuation area, with the southern end of Thorndon Quay, the Kaiwharawhara intersection and the Aotea Quay Roundabout located in the orange area.

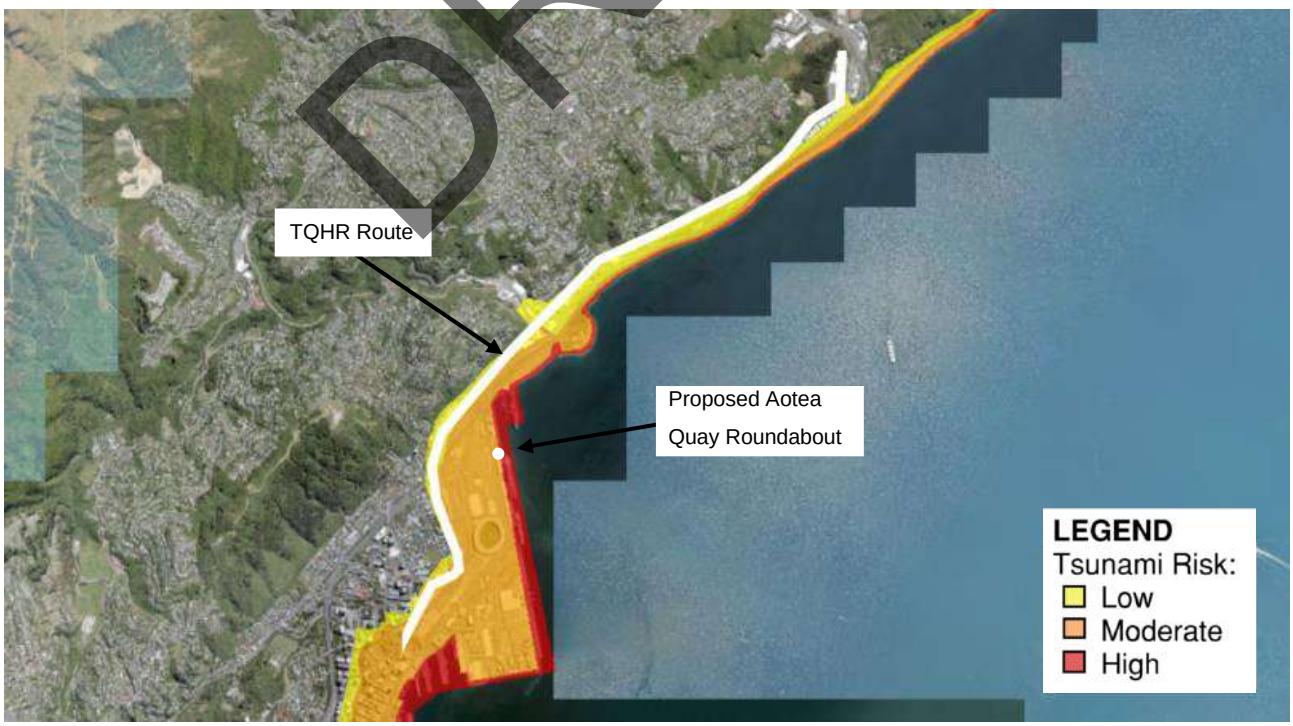

Figure 3. Tsunami Evacuation Zones Map (ESRI, 2021).

4.3 Liquefaction

4.3.1 Definition

Liquefaction describes the short-term loss of strength of a loosely packed sandy soil during an earthquake or other dynamic loading. Liquefaction occurs when the soil particles are disturbed and densify during the dynamic loading, temporarily raising pore water pressures and reducing the effective stress between particles to near zero. This causes the affected soil to behave essentially like a liquid until the excess pore pressures are dissipated.

Liquefaction can have a number of significant effects where it occurs, including large lateral displacements affecting coastal or river bank slopes (termed lateral spreading), post liquefaction settlements (due to the densification of the affected sandy layers and loss of material to the surface) and bearing capacity failures of shallow founded structures underlain by liquefiable soils.

4.3.2 Potential Risk

Zones of potential liquefaction risk along TQHR has been evaluated by GWRC and is presented in Figure 4. The risk for TQHR varies from low to very high, with the southern end being exposed to higher risk.

Figure 4. Liquefaction Hazard Zoning Map (ESRI, 2021).

Liquefaction potential of reclaimed land at the Wellington waterfront was assessed by Murashev, Palmer 1998. The study identified the sand hydraulic fills as having a high potential for liquefaction while the Holocene beach sands have a comparatively low potential for liquefaction. Of these reclamation fills, the hydraulic fill is located nearest to Thorndon Quay and Aotea Quay Roundabout.

4.4 Lateral Spreading

4.4.1 Definition

Unsaturated soils above the groundwater table are assumed not to be susceptible to liquefaction. However, if liquefaction occurs at shallow depth in a saturated soil, the overlying unsaturated soil may move toward a free face or over gently sloping ground in a semi-intact fashion; this process is known as lateral spreading.

Rupturing of the ground will tend to occur at the crest of the spreading movement, and compression at the toe of the movement.

4.4.2 Potential Risk

Previous studies and reports provide indications on the likelihood and magnitude of lateral spreading expected in the Thorndon to Ngauranga area. A report for the Ngauranga to Aotea project found a site within 20 metres of the reclamation slope could be estimated to have several hundred millimetres to metres of lateral spreading movements under shaking levels of PGA 0.25g to 0.32g (Beca, 2015). Evidence of lateral spreading was also found by the QuakeCoRE-GEER post-earthquake reconnaissance efforts at CentrePort Wellington following the November 2016 Kaikoura earthquake. Lateral spreading movements were found in the order of 1 metre or greater at the edge of reclamation ground deformation, in areas of both rock and hydraulic fill (Cubrinovski, et al., 2017).

While it is difficult to quantify the expected magnitude of lateral spreading, the reports identified above indicate risk of lateral spreading does exist and should be considered in design.

4.5 Earthquake Induced Slope Stability Hazard

GWRC have identified areas which are subject to varying earthquake induced slope stability hazards. These are shown in Figure 5 below, with the TQHR route shown in white. The zoning indicates that Hutt Road/Jarden Mile intersection and the Hutt Road sections are most at risk to earthquake induced slope stability, with the southern and northern ends of Hutt Road showing the greatest vulnerability.

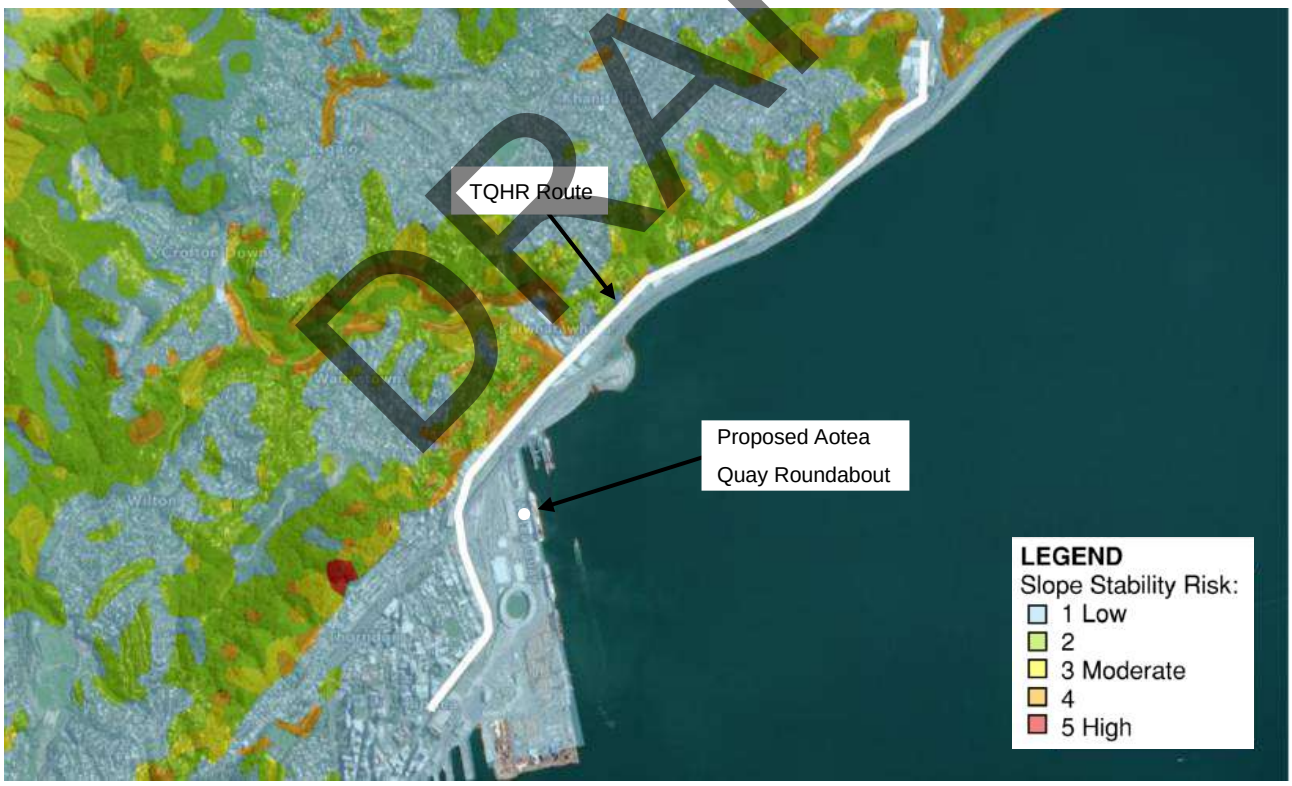

Figure 5. Earthquake Induced Slope Stability Hazard Zoning Map (ESRI, 2021).

5 Historical Geotechnical Investigations

5.1 Previous Studies

Below is a list of previous studies undertaken near the TQHR area.

Table 2. Previous Studies in Proximity to TQHR Project Area.

Title	Company	Date
Geotechnical Issues Associated with Development on Wellington's Waterfront	Beca Carter Hollings & Ferner Ltd	September 1998
Wellington Urban Motorway Thorndon to Petone – Summary of Existing Geotechnical Data and Interpretation	Beca Infrastructure Ltd	March 2010
Geotechnical Investigation and Design Report – Woolstore Design Centre, Thorndon	Tonkin and Taylor Ltd	March 2012
77 Thorndon Quay Seismic Strengthening – Preliminary Geotechnical Report	Beca Carter Hollings & Ferner Ltd	September 2012

5.2 Past Geotechnical Investigations and Observations

The following sections identify relevant historic investigations in close proximity to the TQHR route. These include boreholes, test pits, CPTs and hand augers. Details and copies of the relevant geotechnical investigations are included in Appendix A, B, C and D for Hutt Road/Jarden Mile Intersection, Hutt Road, Thorndon Quay and Aotea Quay Roundabout, respectively.

5.2.1 Hutt Road/Jarden Mile Intersection

Figure 6. Historical Investigations along Hutt Road/Jarden Mile Intersection of TQHR.

Fill was seen to reach the deepest depth near this section where it extended between 2-8 metres below ground level (bgl). BH_106077 and BH_106076 (investigations closest to site) tended to have slightly shallower fill, extending to around 4.5 metres bgl. The fill is underlain by marine and alluvial deposits. Greywacke was generally encountered at 11-15 metres bgl. However, two exceptions include BH_106073 where no greywacke was encountered and BH_106078 where it was encountered at two metres bgl.

5.2.2 Hutt Road

Figure 7. Historical Investigations along Hutt Road Section of TQHR.

The reclaimed fill beneath Hutt Road is expected to extend 3-4 metres bgl and is underlain by marine and alluvial deposits. Greywacke was generally encountered at depths ranging from 23-27 metres bgl, with the exception of BH_150986 where it was encountered at 15 metres bgl.

5.2.3 Thorndon Quay

Figure 8. Historical Investigations along Thorndon Quay Section of TQHR.

Information from the investigations identified above indicate the reclamation fill below Thorndon Quay reaches a depth of approximately 2-4.5 metres bgl. This fill is underlain by marine deposits and alluvium. There was no greywacke encountered in any boreholes and hence is expected to be found at any depth greater than 28 metres bgl.

5.2.4 Aotea Quay Roundabout

Figure 9. Historical Investigations along Aotea Quay Roundabout section of TQHR.

The Aotea Quay roundabout area is expected to have reclaimed fill extending to approximately 5.5-8.5 metres bgl. Marine deposits and alluvium is then identified as underlaying this material. Greywacke was not encountered in boreholes, so can be expected to be present at depths greater than 25 metres bgl.

6 Proposed Geotechnical Site Investigation

Based on the current scope of works for the TQHR Project, proposed geotechnical investigations in advance of detailed design are likely to consist of shallow test pits and pavement pits. Materials most importance to design will be “near surface”. A geotechnical site investigation programme will be developed once the preferred solution is developed and approved.

7 Applicability

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client’s use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

8 References

Beca. (2015). *Ngauranga to Aotea Quay ATM - Stages 2 & 3 (report prepared for Fletcher Construction Limited).* Beca.

Begg, J., & Johnston, M. (2000). *Geology of the Wellington Area. Institute of Geological and Nuclear Sciences 1:250,000 Geological Map. 10. 1-70.* Lower Hutt, New Zealand: Institute of Geological & Nuclear Sciences.

Cubrinovski, M., Bray, J., de la Torre, C., Olsen, M., Bradley, A., Chiaro, G., . . . Wotherspoon, L. (2017). Liquefaction Effects and Associated Damages Observed at the Wellington Centreport from the 2016 Kaikoura Earthquake. Bulletin of the New Zealand Society for Earthquake Engineering. *Vol. 50, No.2*.

ESRI. (2021). *Wellington Seismic Hazards*. Retrieved from Wellington Maps: https://wcc.maps.arcgis.com/apps/MapSeries/index.html?appid=7466e589bafa47f38e91484fe44cd8dc

Murashev, A., & Palmer, S. (1998). Geotechnical Issues Associated with Development on Wellington's Waterfront. *IPENZ Transactions* (pp. 38-46). IPENZ.

Stirling, M., McVerry, G., & Berryman, K. (2002). A New Seismic Hazard Model for New Zealand. *Bulletin of the Seismologist Society of America, Vol 92, No 5*, 1878-1903.

Wotherspoon, L., Taylor, M., Palmer, S., & Chiaro, G. (2016). Characterisation of Cyclic Behaviour and Liquefaction Resistance of Wellington Reclamations with Gravelly Soils. *NZ Geomechanics News*.

A

Appendix A – Historic Investigations: Hutt Road/Jarden Mile Intersection

A.1 Previous Geotechnical Investigations in Proximity to Hutt Road/Jarden Mile Intersection.

NZGD ID	Consultant	Year	Location	Type	Depth (m)
BH_106077	Opus	2014	South of Hutt Road/Ngauranga Gorge intersection	Machine Borehole	13.35
BH_106076	Opus	2014	Hutt Road/Ngauranga Gorge intersection	Machine Borehole	18.68
BH_106074	Opus	2012	SH1, east of intersection	Machine Borehole	13.40
BH_106075	Opus	2014	SH1, east of intersection	Machine Borehole	15.28
BH_106078	Opus	2014	SH1, east of intersection	Machine Borehole	10.35
BH_106073	Opus	2012	SH1, east of intersection	Machine Borehole	19.14

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BOREHOLE LOG

HOLE NO. **BH103**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751883 E 5432125 N	R.L.: 3 m	SHEET: 1 of 2
LOCATION: Hutt Road Adjacent to Underpass	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 13.35 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Fill	Sandy GRAVEL with minor clay; brown, loose, moist, non-plastic.	1								Gravel is fine to 5 cm, subangular. Sand is medium. Matrix is sticky.		0	JV	JetVac					
		2		5	3/3//1/2/1/1							31	SPT						
	Sandy GRAVEL/Gravelly SAND; light brown, loose, dry. -									Gravel is fine to coarse (up to 3 cm), subangular. Sand is medium. Core loss between 2.53-3.0 m		48	SC					12/03/2014 ▼	
	Sandy GRAVEL with minor clay; dark brown-grey, loose, moist to wet.	3		9	3/3//2/2/3/2					Contact is unknown due to lost core. Gravel is fine to medium (up to 2 cm), subangular. Sand is fine to medium. Sticky matrix.		44	SPT						
		4										100	SC					4.15m (PM) 10/03	
Alluvial Deposits or ?Fill?	Silty GRAVEL with some sand; mottled orange-brown and red-brown, dense, dry.			37	2/2//3/8/12/14					Gravel is mostly fine and coarse (up to 4 cm), subangular to subrounded. 4.3 - 4.4 m recovered mostly as gravel; ~5 cm, grey.		65	SPT						
	Minor clay, low plasticity.	5										100	SC	Sonic Percussive Drilling				5.0m (AM) 11/03	
		6		33	6/5//10/11/5/7					Very dense appearance, looks like residual soil, extremely to very weak rock.		69	SPT						
	Sandy GRAVEL with some clay; brown, dense, moist, wet in places, low plasticity matrix.	7								Contact in SPT sample. Gravel is fine to 5 cm, some larger fractured gravel up to 8 cm, angular. Sticky matrix.		100	SC						

NOTES

Water Levels during drilling:
10/3/14 pm reading: 4.15 m (BOH - 12.0 m)
11/3/14 am reading: 5.0 m (BOH - 12.0 m)
12/3/14 pm reading: 2.8 m (Piezometer BOH - 7.0 m)
11/4/14 reading: 2.87 m (Piezometer BOH - 7.0 m)

STARTED: 10/03/2014		FINISHED: 11/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH103
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH103**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751883 E 5432125 N	R.L.: 3 m	SHEET: 2 of 2
LOCATION: Hutt Road Adjacent to Underpass	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 13.35 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Alluvial Deposits or ?Fill?	Sandy GRAVEL with some clay; brown, dense, moist, wet in places, low plasticity matrix.	8		30	11/8//7/10/ 7/6					Contact in SPT sample. Gravel is fine to 5 cm, some larger fractured gravel up to 8 cm, angular. Sticky matrix.		62	SPT			106 mm			
												100	SC						
	Mottled with blue-grey sand and gravel.	9		50+	5/12//11/ 15/15/9 = 60mm					Minor iron staining.		91	SPT						
	Highly to completely weathered blue-grey gravel.																		
	Silty GRAVEL, light brown, very dense, dry to moist.	10		50+	8/6//5/12/ 33					Gravel can be crushed to silt sized particles.		100	SC						
												61	SPT						
	Sandy GRAVEL with minor clay; mottled light brown and dark brown, very dense, areas of high plasticity but mostly low. Becomes dry at base.	11								Core is highly deformed - stuck in sonic barrel. Material is 'baked' in places and fractured. Could also be residual soil deposits.		100	SC						
Greywacke Bedrock	GRAVEL with minor clayey matrix; mottled dark and light grey, very dense, dry, low plasticity. Altered and sheared SILTSTONE; with slickensided and polished gravels. Possible Fault Zone	12		50+	8/2//31/19 = 40mm		EW HW			Gravel is fine to 3 cm, some larger rock fragments, angular.		90	SPT						
												100	SC						
		13		50+	4/4//20/25/ 5 = 40mm							62	SPT			106 mm			
		14																	

Sonic Percussive Drilling

NOTES

Water Levels during drilling:
10/3/14 pm reading: 4.15 m (BOH - 12.0 m)
11/3/14 am reading: 5.0 m (BOH - 12.0 m)
12/3/14 pm reading: 2.8 m (Piezometer BOH - 7.0 m)
11/4/14 reading: 2.87 m (Piezometer BOH - 7.0 m)

STARTED: 10/03/2014		FINISHED: 11/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/ AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH103
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH102**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751976 E 5432182 N	R.L.: 3 m	SHEET: 1 of 3
LOCATION: Hutt Road Compound	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 18.675 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Fill	Sandy GRAVEL with minor silt; brown, loose to medium dense, moist.	1								SPT was not undertaken as ground was highly disturbed. Gravel is fine to 10 cm, angular. Sand is fine.		0	JV	JetVac					
Fill	Clayey, sandy GRAVEL; grey-brown, loose, dry, moderate plasticity, high plasticity in places. -	2								Gravel is fine to coarse (up to 3 cm), subangular. Sand is fine to medium.		67	SC						
Fill	Clayey, sandy GRAVEL; grey-brown, loose, dry, moderate plasticity, high plasticity in places. Less matrix material.	3		7	2/2//1/1/3/2					Gravel is fine to 3 cm, subangular. Sand is fine to medium.		44	SPT						
		4										100	SC						
Fill	GRAVEL with sand and clay to clayey sandy GRAVEL; blue-grey, loose, dry, moderate plasticity, high plasticity in places.									Gravel is fine to 3 cm, subangular. Sand is fine to medium.									
Alluvial Deposits	GRAVEL with some clay and sand; blue-grey, medium dense, moist, low plasticity.	5		17	5/6//4/3/5/5					Gravel is fine to coarse (up to 3 cm). Sand is fine to medium. Brown clay coating. Possibly same as unit above but matrix is more washed out.		62	SPT						
												100	SC	Sonic Percussive Drilling					
		6		27	7/8//7/7/6/7							71	SPT						
Alluvial Deposits	GRAVEL with some sand and clay; brown, moist, medium dense, low plasticity.	7								Gravel is fine to medium (up to 2 cm) to 2 cm, subangular. Sand is medium. Sticky matrix.		100	SC						

12/03/2014
11/03/2014
10/03/2014

NOTES

Water Levels during drilling:
5/3/14 pm reading: 2.2 m (BOH - 7.5 m)
6/3/14 am reading: 3.6 m (BOH - 7.5 m)
10/3/14 pm reading: 4.1 m (Piezometer BOH - 9.0 m)
11/3/14 am reading: 4.2 m (Piezometer BOH - 9.0 m)
12/3/14 am reading: 3.6 m (Piezometer BOH - 9.0 m)
11/4/14 reading: 2.8 m (Piezometer BOH - 9.0 m)

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

STARTED: 6/03/2014		FINISHED: 7/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/ AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH102
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH102**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751976 E 5432182 N	R.L.: 3 m	SHEET: 2 of 3
LOCATION: Hutt Road Compound	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 18.675 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Alluvial Deposits	GRAVEL with some sand and clay; brown, moist, medium dense, low plasticity.	8		32	3/5//7/9/10/6					Gravel is fine to medium (up to 2 cm) to 2 cm, subangular. Sand is medium. Sticky matrix.		89	SPT	Sonic Percussive Drilling		106 mm	3.6 m 6/03		
	Becomes sandy and blue-grey.											100	SC						
	Becomes brown.	9		27	8/9//8/6/6/7							44	SPT						
	Sandy GRAVEL with minor clay; brown, medium dense, wet.									Contact is located in SPT sample. Gravel is up to 3 cm, subrounded, fractured. Sand is medium to coarse. Sticky matrix.									
	Sandy GRAVEL with minor clay; brown, medium dense, wet.	10								Gravel is up to 3 cm, subrounded, fractured. Sand is medium to coarse. Sticky matrix.		100	SC						
				35	2/6//8/7/10/10							71	SPT						
	More sandy.	11								Clay coating.		100	SC						
		12		45	7/12//8/14/14/9							84	SPT						
	Sandy GRAVEL; brown becoming blue-grey, dense, wet.	13								Gravel is fractured, subangular to subrounded, up to 5 cm. Mostly <2 cm. Sand is medium.		86	SC						
	Silty CLAY to clayey SILT becoming gravelly and silty SAND. Firm to stiff, moist, moderate plasticity. Becomes more dense with depth.			26	5/6//9/6/5/6					Pockets could be silty, sandy GRAVEL. Mottled brown organics throughout. Gravel is fine to 2 cm, subangular to subrounded. Sand is medium to coarse.		58	SPT						
		14										100	SC						
	Residual soil to completely weathered, grey-brown SANDSTONE; very weak.					EW	RS			Alluvial soil deposits from surrounding hills, could be a boulder fragment.									

NOTES

Water Levels during drilling:
5/3/14 pm reading: 2.2 m (BOH - 7.5 m)
6/3/14 am reading: 3.6 m (BOH - 7.5 m)
10/3/14 pm reading: 4.1 m (Piezometer BOH - 9.0 m)
11/3/14 am reading: 4.2 m (Piezometer BOH - 9.0 m)
12/3/14 am reading: 3.6 m (Piezometer BOH - 9.0 m)
11/4/14 reading: 2.8 m (Piezometer BOH - 9.0 m)

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

STARTED: 6/03/2014		FINISHED: 7/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH102
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

Scale 1:25.0

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

NZGD ID: BH_106076

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BOREHOLE LOG

HOLE NO. **BH102**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751976 E 5432182 N	R.L.: 3 m	SHEET: 3 of 3
LOCATION: Hutt Road Compound	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 18.675 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Wellington Greywacke	Residual soil, brown SANDSTONE; extremely weak [sandy GRAVEL; very dense, moist, some clay infill has high plasticity].	16		50+	35/5 = 2 mm					Possible gradual transtion to bedrock.		86	SPT			106 mm			
	Becomes more clayey, less dense at ~16.3 m.											84	SC						
				50+	13/14//16/ 12/12/10 = 45 mm	EW	RS					90	SPT	Sonic Percussive Drilling					
	Residual soil, brown SANDSTONE; extremely weak [sandy GRAVEL; brown, very dense, dry].	17								Gravel is fine to 10 cm, highly weathered. Sand is very fine and friable.		100	SC						
	Residual soil, dark grey SANDSTONE; extremely weak [GRAVEL with some silt and sand; dark grey, very dense, moist].	18		50+	18/6//8/17/ 27					Gravel is fine to 2 cm, subangular. Sand is fine.		88	SPT						
				50+	4/12//15/10 = 50 mm							80	SC			106 mm			
		19																	
		20																	
		21																	
		22																	

NOTES

Water Levels during drilling:
5/3/14 pm reading: 2.2 m (BOH - 7.5 m)
6/3/14 am reading: 3.6 m (BOH - 7.5 m)
10/3/14 pm reading: 4.1 m (Piezometer BOH - 9.0 m)
11/3/14 am reading: 4.2 m (Piezometer BOH - 9.0 m)
12/3/14 am reading: 3.6 m (Piezometer BOH - 9.0 m)
11/4/14 reading: 2.8 m (Piezometer BOH - 9.0 m)

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

STARTED: 6/03/2014		FINISHED: 7/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/ AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH102
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

NZGD ID: BH_106076

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BOREHOLE LOG

HOLE NO. **BH2**

PROJECT	CO-ORD.	R.L.	SHEET
Ngauranga 1/C Reinforced Earth Walls	1751873 E 5432031 N	Approx. 4m	1 of 2
LOCATION	**REF. GRID**	**DATUM**	**HOLE LENGTH**
Ngauranga Interchange	NZTM	MSL	13.4 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Fill	GRAVEL with trace sand and silt, dark brown. Dry.									Medium to coarse, sub-angular to angular gravel clasts.			BULK	Rotary percussive (concentrix)					
	Silty SAND with some gravel, brown. Dense, dry.	1		43	10//8/12/10/13					Fine to medium sand. Fine, angular gravel clasts.		100	SPT						
	GRAVEL with some sand, trace silt, brown. Dry.									Medium to coarse, sub-angular to angular gravel. Fine sand.			BULK						
	Gravelly SAND with minor clay, brown. Medium dense, moist.	2 / 2		18	17//6/4/3/5					Fine to coarse sand. Fine to medium, angular to sub-angular gravel clasts.		67	SPT						
	Sandy GRAVEL with trace clay, brown. Moist.									Medium to coarse, angular to sub-angular gravel clasts. Fine to coarse sand.			BULK						
	GRAVEL with some sand, trace clay, brown. Medium dense, wet.	3		18	7//4/5/6/3					Poorly graded, fine to coarse, sub-angular to angular gravel clasts. Coarse sand.		49	SPT						PSD
	Sandy GRAVEL with minor clay, brown. Moist.									Fine to medium, angular to sub-angular gravel clasts. Fine sand.			BULK						
	No Sample Recovery.	0 / 4		5	8//2/2/0/1					No Sample Recovery.		0	SPT						
	GRAVEL with some sand and silt/clay, brown. Saturated.									Fine to medium, sub-angular to angular gravel clasts. Fine to medium sand.			BULK						
	As above, trace silt. Very loose, wet.	5		2	2//1/1/0/0							44	SPT						PSD
	No Sample Recovery.									No Sample Recovery.			BULK						
	Sandy GRAVEL with minor silt, dark brown. Loose, saturated.	-2 / 6		5	3//1/1/1/2					Fine to medium sand. Medium, angular to sub-angular gravel clasts.		22	SPT						PSD
	GRAVEL with some sand, trace silt, dark brown. Wel.									Fine to medium angular gravel. Fine sand.			BULK						
	Sandy GRAVEL with some silt, light brown. Loose to medium dense, saturated.	7		10	4//2/2/2/4					Fine to coarse sand. Fine to coarse, angular to sub-angular gravel clasts.		44	SPT						PSD

NOTES

1) Coordinates taken with handheld GPS, accurate to +/- 6m.
2) PSD = Particle Size Distribution Test

STARTED 5/10/2012	FINISHED 5/11/2012
DRILLER Nathan	DRILLING CO. Grifftiths
INCLINATION/ AZIMUTH -90° / Vertical°	DRILLING RIG Tracked
LOGGED T. Binczyk	CHECKED E. Gkeli
CLIENT John Wood Consulting Ltd.	JOB NO. 5-C2261.00

BH2

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 NGAURANGA 1C REINFORCED EARTH WALLS.GPJ OPUS WLG REV080408.GDT 13/6/12

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH2**

PROJECT	CO-ORD.	R.L.	SHEET
Ngauranga 1/C Reinforced Earth Walls	1751873 E 5432031 N	Approx. 4m	2 of 2
LOCATION	**REF. GRID**	**DATUM**	**HOLE LENGTH**
Ngauranga Interchange	NZTM	MSL	13.4 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL
Holocene Marginal Marine Deposits	No Sample Recovery.				No Sample Recovery.			BULK				
								BULK				
	GRAVEL with trace silt, blue-grey. Dense, wet.	-4 / 8	32	11//7/7/8/10	Coarse, angular to sub-angular gravel clasts.		9	SPT				
	GRAVEL with some sand, trace silt, blue-grey. Wet.				Fine to medium, angular gravel clasts. Fine sand.			BULK				
	Gravelly SAND with some silt, blue-grey. Very dense, wet.	9	50+	12//14/20/16 for 40mm	Fine to medium, angular gravel clasts. Fine to coarse sand.		65	SPT				
	No Sample Recovery.				No Sample Recovery.			BULK				
	GRAVEL with some sand and silt, blue-grey. Very dense, wet.	-6 / 10	50+	37//50 for 20mm	Fine angular gravel clasts. Fine sand.		100	SPT				
	GRAVEL with some sand, blue grey. Wet.				Well graded, fine to coarse, angular gravel. Fine sand.			BULK				
	GRAVEL with some sand and silt, blue-grey. Very dense, wet.	11	50+	28//20/20/10 for 30mm	Fine to medium, angular gravel clasts. Fine sand.		97	SPT				
	GRAVEL with some sand, blue-grey. Wet.				Fine to medium, angular gravel. Fine to coarse sand.			BULK				
	GRAVEL with some silt, blue-grey. Very dense, wet.	-8 / 12	50+	31//50 for 30mm	Fine to medium angular gravel.		100	SPT				
Rakaia terrane	Moderately weathered, blue-grey ARGILLITE, highly fractured. Recoverd as GRAVEL with some silt.	13			Fine, angular argillite gravel.		35 / 42	HQ	Rotary triple tube wireline coring			
	E.O.H. 13.40 m: Target Depth Reached.	-10 / 14										

PIEZOMETER DETAILS	LABORATORY TESTING

DIP: 0 degrees 90

NOTES

1) Coordinates taken with handheld GPS, accurate to +/- 6m.
2) PSD = Particle Size Distribution Test

STARTED	FINISHED
5/10/2012	5/11/2012
DRILLER: Nathan	DRILLING CO.: Grifftiths
INCLINATION/ AZIMUTH: -90° / Vertical°	DRILLING RIG: Tracked
LOGGED: T. Binczyk	CHECKED: E. Gkeli
CLIENT: John Wood Consulting Ltd.	JOB NO.: 5-C2261.00

BH2

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 NGAURANGA 1C REINFORCED EARTH WALLS.GPJ OPUS WLG REV080408.GDT 13/6/12

Scale 1:25.0

NZGD ID: BH_106075

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BOREHOLE LOG

HOLE NO. **BH101**

PROJECT	CO-ORD.	R.L.	SHEET
Ngauranga Walls Seismic Assessment	1751916 E 5432056 N	3 m	1 of 3
LOCATION	**REF. GRID**	**DATUM**	**HOLE LENGTH**
Railway Land - Effluent / Disposal Site	NZTM	MSL	15.275 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Fill	Sandy GRAVEL; brown, medium dense, dry.	1								Gravel is fine to ~15 cm, angular. Sand is medium to coarse.		0	JV	JetVac			3.4 m 6/03		
	Sandy, clayey GRAVEL; grey-brown, medium dense, moist, moderate plasticity.	2		27	2/6//7/7/6/7					Contact is unknown due to lost core in JetVac sample. Gravel is fine to coarse (up to 3 cm), angular and unweathered.		69	SPT	Sonic Percussive Drilling					
	Core loss between 1.95-2.5 m											48	SC						
	Becomes dense.	3		39	2/5//10/14/ 9/6							98	SPT						
	Clayey GRAVEL with some sand; brown, dense, moist to wet, very low plasticity.									Gravel is fine to 3 cm, angular. Sand is fine. Matrix is sticky.									
	Becomes medium dense, moist, moderate plasticity.	4								Matrix no longer sticky.		96	SC						
	Core loss bewteen 4.95-5.4.	5		13	5/4//5/2/3/ 3							44	SPT						
Alluvial Deposits	GRAVEL with minor sand and silt; grey-brown, loose to medium dense, moist, non-plastic.	6		10	3/2//1/4/2/ 3					Contact is unknown due to lost core. Gravel is fine and coarse (up to 5 cm), angular-subangular and unweathered.		58	SC						
										Gravel up to 3 cm.		56	SPT						
	Clayey GRAVEL with some sand; brown, medium dense, moist to wet, moderate to high plasticity.	7								Gradational contact. Gravel is fine to coarse (up to 3 cm), angular to subangular. Sand is fine. Matrix is sticky.		100	SC						

NOTES

Water Levels during drilling:
5/3/14 pm reading: 2.1 m (BOH - 10.5 m)
6/3/14 am reading: 3.4 m (BOH - 10.5 m)
6/3/14 pm reading: 1.8 m (BOH - 15.275 m)
11/4/14 reading: 3.78 m (BOH - 7.0 m)

STARTED 5/03/2014	FINISHED 6/03/2014
DRILLER Tim Johnson	DRILLING CO. Griffiths Drilling
INCLINATION/ AZIMUTH -90°	DRILLING RIG Sonic
LOGGED E Williamson	CHECKED E Gkeli
CLIENT NZ Transport Agency	JOB NO. 5C1750.04

BH101

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

NZGD ID: BH_106075

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BOREHOLE LOG

HOLE NO. **BH101**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751916 E 5432056 N	R.L.: 3 m	SHEET: 2 of 3
LOCATION: Railway Land - Effluent / Disposal Site	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 15.275 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Alluvial Deposits	Clayey GRAVEL with some sand; brown, medium dense, moist to wet, moderate to high plasticity.	8		12	2/2//4/2/3/3					Gradational contact. Gravel is fine to coarse (up to 3 cm), angular to subangular. Sand is fine. Matrix is sticky.		22	SPT			106 mm	3.4 m 6/03		
												81	SC						
Marine Deposits	SAND with some gravel and pockets of clay; dark blue-grey, loose to medium dense, wet. Clay pockets have moderate plasticity.	9		11	2/2//1/4/3/3					High abundance of shells. Sand is coarse.		49	SPT						
		10										100	SC						
	Silty SAND; dark grey-black, medium dense, moist. Pockets of more silty material.									Sand is fine, shell fragments throughout. Recovered as loose material.							2.1 mm 5/03		
Alluvial Deposits	Sandy GRAVEL with some clay; grey-brown, medium dense, moist. Pockets of moderate plasticity.			18	4/3//4/5/4/5					Gradational contact. Gravel is fine to coarse (up to 3 cm), subangular to subrounded.		67	SPT	Sonic Percussive Drilling					
		11										100	SC						
	Clayey, sandy GRAVEL; dense, moist, moderate to high plasticity.									Gravel is fine to coarse (up to 3 cm), subangular to subrounded. Sand is fine.									
		12		37	7/15//10/10/11/6							16	SPT						
	GRAVEL; grey-brown, very dense, dry.	13		50+	13/16//15/16/10/9 = 25mm					Cobbles and pebbles of completely weathered, grey-brown SANDSTONE/SILTSTONE. Sonic rig struggling to drill through.		100	SC			106 mm			
	Gradual transition to bedrock.											80	SPT						
Wellington Greywacke	Residual soil, grey-brown SANDSTONE; extremely weak [Clayey, sandy GRAVEL; dense, moist, moderate to high plasticity].	14				EW	RS			Gravel is fine to 4 cm, fractured.									
	Completely weathered, grey brown SANDSTONE; extremely weak [GRAVEL; grey-brown, very dense, dry].						CW					100	SC						

NOTES

Water Levels during drilling:
5/3/14 pm reading: 2.1 m (BOH - 10.5 m)
6/3/14 am reading: 3.4 m (BOH - 10.5 m)
6/3/14 pm reading: 1.8 m (BOH - 15.275 m)
11/4/14 reading: 3.78 m (BOH - 7.0 m)

STARTED: 5/03/2014		FINISHED: 6/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH101
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES — SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH101**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751916 E 5432056 N	R.L.: 3 m	SHEET: 3 of 3
LOCATION: Railway Land - Effluent / Disposal Site	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 15.275 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
	Completely weathered, grey brown SANDSTONE; extremely weak [GRAVEL; grey-brown, very dense, dry].			50+	22/13//25/ 25 = 50 mm	EW	CW					73	SPT				1.8 mm 6/03		
		16																	
		17																	
		18																	
		19																	
		20																	
		21																	
		22																	

NOTES

Water Levels during drilling:
5/3/14 pm reading: 2.1 m (BOH - 10.5 m)
6/3/14 am reading: 3.4 m (BOH - 10.5 m)
6/3/14 pm reading: 1.8 m (BOH - 15.275 m)
11/4/14 reading: 3.78 m (BOH - 7.0 m)

STARTED: 5/03/2014		FINISHED: 6/03/2014	
DRILLER: Tim Johnson		DRILLING CO.: Griffiths Drilling	
INCLINATION/ AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH101
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

OPUS
Wellington Office
PO Box 12-003
Wellington, NZ
Tel: +64 4 471 7000
Fax: +64 4 471 1291
www.opus.co.nz

BOREHOLE LOG

HOLE NO. **BH104**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751937 E 5432073 N	R.L.: 3 m	SHEET: 1 of 2
LOCATION: Hutt Road South Of Underpass	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 10.35 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Fill	Sandy GRAVEL with minor clay; brown, medium dense, low plasticity.	1		11	1/2//1/4/4/2					Gravel is angular up to 5 cm. Sand is medium.		0	JV	JetVac			-		
												22	SPT						
Greywacke Bedrock	Residual soil, mottled dark and light grey SANDSTONE/SILTSTONE; extremely weak [Gravelly SAND; very dense].	2								Gravel and sand are fine. Sample has been highly disturbed from sonic barrel - potentially rock fragments.		100	SC						
		3		50+	7/11//16/22 /12 = 50mm							100	SPT						
	Residual soil; brown SANDSTONE/SILTSTONE; extremely weak [sandy GRAVEL; very dense].									Gravel is fine. Sand is medium.		100	SC	Sonic Percussive Drilling					
	Residual soil, mottled dark and light grey SANDSTONE/SILTSTONE; extremely weak [gravelly SAND; very dense].	4				EW	RS			Gravel and sand are fine. Sample has been highly disturbed from sonic barrel - potentially rock fragments.									
				50+	14/20//30 /20 = 50 mm					Gravel is fine, angular. Matrix is stickey. Quartz veins and mottled throughout. Potential crush zone.		100	SPT						
	Residaul soil, light brown-greySANDSTONE/SILTSTONE; extremely weak [silty GRAVEL with minor sand; light brown-grey, very dense, dry].	5										100	SC						
	Completely weathered, dark grey SILTSTONE; extremely weak [GRAVEL with some silt; dark grey, very dense, moist]. -	6					CW			Gravel is fine to 1 cm, angular.		63	HQ						
												0	HQ	Rotary Coring					
		7										0	HQ				1.56m 11/04		

NOTES

Water Levels during drilling:
11/4/14 am reading: 1.56 m (BOH - 7.5 m)

STARTED: 10/04/2014	FINISHED: 11/04/2014
DRILLER: Nathan Gardiner	DRILLING CO.: Griffiths Drilling
INCLINATION/ AZIMUTH: -90°	DRILLING RIG: Sonic
LOGGED: E Williamson	CHECKED: E Gkeli
CLIENT: NZ Transport Agency	JOB NO.: 5C1750.04

BH104

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

OPUS
Wellington Office
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Fax: +64 4 471 1291
www.opus.co.nz

BOREHOLE LOG

HOLE NO. **BH104**

PROJECT: Ngauranga Walls Seismic Assessment	CO-ORD.: 1751937 E 5432073 N	R.L.: 3 m	SHEET: 2 of 2
LOCATION: Hutt Road South Of Underpass	REF. GRID: NZTM	DATUM: MSL	HOLE LENGTH: 10.35 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Greywacke Bedrock	-															106 mm			
	Completely weathered, dark grey SILTSTONE; extremely weak [GRAVEL; dark grey, very dense].	8				EW	CW			Gravel is ~1 cm, angular. Quartz veins throughout. Likely to be in-situ rock, fragmented during drilling. Possible crush zone.		40	HQ						
												0	HQ						
		9										0	HQ	Rotary Coring					
												0	HQ						
	Somes zones of silty sand matrix.			50+	6/7//16/25 /9 = 25 mm	EW	CW					100	HQ						
												100	SPT						
	Slightly weathered blue-grey SILTSTONE; weak, joints are very close to closely spaced.	10		50+	3/4//4/7 /17/22 = 65 mm	W	SW	VC				100	HQ						
												100	SPT			106 mm			
		11																	
		12																	
		13																	
		14																	

NOTES

Water Levels during drilling:
11/4/14 am reading: 1.56 m (BOH - 7.5 m)

STARTED: 10/04/2014		FINISHED: 11/04/2014	
DRILLER: Nathan Gardiner		DRILLING CO.: Griffiths Drilling	
INCLINATION/ AZIMUTH: -90°		DRILLING RIG: Sonic	
LOGGED: E Williamson		CHECKED: E Gkeli	BH104
CLIENT: NZ Transport Agency		JOB NO.: 5C1750.04	

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 5C1750.04 NGAURANGA WALLS SEISMIC ASSESSMENT.GPJ OPUS WLG REV080408.GDT 6/6/14

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH1**

PROJECT	CO-ORD.	R.L.	SHEET
Ngauranga 1/C Reinforced Earth Walls	1751972 E 5432111 N	Approx. 4m	1 of 3
LOCATION	**REF. GRID**	**DATUM**	**HOLE LENGTH**
Ngauranga Interchange	NZTM	MSL	19.14 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Fill	Sandy GRAVEL with some clay, brown. Medium dense, moist.	1	1		19	1//4/3/6/6					Fine to coarse, angular to sub-angular gravel clasts. Fine to medium sand.			BULK						
													84	SPT						PSD
														BULK						
	Sandy GRAVEL with some clay, brown. Dense, moist.	2	2		39	9//6/8/12/13					Fine to medium, rounded to sub-angular gravel clasts.		56	SPT						
														BULK						
	GRAVEL with some sand, brown. Dense, moist.		3		46	18//14/10/15/7					Fine to coarse, angular, blue-grey greywacke gravel clasts.		62	SPT						
														BULK						
	As above.	0	4		36	11//7/8/11/10							56	SPT						
	Sandy GRAVEL with some clay, brown. Dense.										Fine to medium, angular, blue-grey gravel.									
														BULK						
	Sandy GRAVEL with some silt, blue-grey. Dense, moist.		5		45	7//9/14/12/10					Fine to coarse, angular greywacke gravel.		40	SPT						
														BULK						
Holocene Marginal Marine Deposits	Gravelly SAND with minor silt, grey-blue. Medium dense, moist.	-2	6		24	16//7/4/6/7					Medium to coarse, angular gravel.		78	SPT						PSD
														BULK						
	Gravelly SAND with minor silt, blue-grey. Medium dense, moist.		7		20	12//3/5/6/6					Medium to coarse sand. Medium angular gravel.		78	SPT						

Rotary percussive (concentrix)

NOTES

1) Drill changed halfway through BH
2) Coordinates taken with handheld GPS, accurate to +/- 8m.
3) PSD = Particle Size Distribution Test

STARTED	FINISHED
5/02/2012	5/08/2012
DRILLER: Nathan	DRILLING CO.: Grifftiths
INCLINATION/ AZIMUTH: -90° / Vertical°	DRILLING RIG: Tracked
LOGGED: E. Gkeli	CHECKED: T. Binczyk
CLIENT: John Wood Consulting Ltd.	JOB NO.: 5-C2261.00

BH1

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 NGAURANGA 1C REINFORCED EARTH WALLS.GPJ OPUS WLG REV080408.GDT 13/6/12

Scale 1:25.0

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www.opus.co.nz

BOREHOLE LOG

HOLE NO. **BH1**

PROJECT	CO-ORD.	R.L.	SHEET
Ngauranga 1/C Reinforced Earth Walls	1751972 E 5432111 N	Approx. 4m	2 of 3
LOCATION	**REF. GRID**	**DATUM**	**HOLE LENGTH**
Ngauranga Interchange	NZTM	MSL	19.14 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Holocene Marginal Marine Deposits	GRAVEL, blue grey.										Medium gravel clasts.			BULK						
														BULK						
	Gravelly SAND with minor silt, blue grey. Medium dense, moist.	-4	8		19	8//6/4/6/3					Fine to medium sand. Medium to coarse angular gravel.		84	SPT						PSD
	Sandy GRAVEL with minor silt.													BULK						
	Gravelly SAND with some silt, brownish grey. Dense, moist.		9		33	6//3/5/12/13					Fine to coarse sand. Fine to medium angular gravel.		84	SPT						PSD
	Gravelly SAND with minor silt.													BULK						
	Gravelly SAND to sandy GRAVEL with minor clay, blue grey. Very dense, dry.	-6	10		50+	10//10/14/16/10 for 10					Medium, angular, greywacke gravel.		100	SPT						
	GRAVEL, blue-grey.										Fine to medium, angular gravel.			BULK						
	Gravelly SAND to sandy GRAVEL, blue-grey. Very dense, dry to moist.		11		50	9//12/11/14/13							100	SPT						
	GRAVEL, blue-grey.										Rounded gravel clasts.			BULK						
	Gravelly SAND with some clay, blue-grey. Dense.	-8	12		43	7//9/9/12/13							89	SPT						
	GRAVEL, blue-grey.										Fine to medium gravel clasts.			BULK						
	No sample recovery.		13		22	10//6/6/5/5					No sample recovery.		0	SPT						
														BULK						
	Greywacke BOULDER, grey.	-10	14		15	4//4/2/5/4							11	SPT						
	GRAVEL, grey.										Medium to coarse gravel clasts.			BULK						

Rotary percussive (concentrix)

Rotary triple tube wireline coring

NOTES

1) Drill changed halfway through BH
2) Coordinates taken with handheld GPS, accurate to +/- 8m.
3) PSD = Particle Size Distribution Test

STARTED	FINISHED
5/02/2012	5/08/2012
DRILLER	**DRILLING CO.**
Nathan	Grifftiths
INCLINATION/ AZIMUTH	**DRILLING RIG**
-90° / Vertical°	Tracked
LOGGED	**CHECKED**
E. Gkeli	T. Binczyk
CLIENT	**JOB NO.**
John Wood Consulting Ltd.	5-C2261.00

BH1

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 NGAURANGA 1C REINFORCED EARTH WALLS.GPJ OPUS WLG REV080408.GDT 13/6/12

Scale 1:25.0

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BOREHOLE LOG

HOLE NO. **BH1**

PROJECT	CO-ORD.	R.L.	SHEET
Ngauranga 1/C Reinforced Earth Walls	1751972 E 5432111 N	Approx. 4m	3 of 3
LOCATION	**REF. GRID**	**DATUM**	**HOLE LENGTH**
Ngauranga Interchange	NZTM	MSL	19.14 m

GEOLOGY/UNIT	MAIN DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	ROCK STRENGTH	ROCK WEATHERING	DEFECT SPACING	DIP (0 degrees 90)	DETAILED DESCRIPTION	CORE: RQD (%)	CORE: TOTAL CORE RECOVERY (%)	CORE: SAMPLE TYPE	DRILLING: METHOD	DRILLING: FLUID LOSS	DRILLING: CASING	BASE OF HOLE & WATER LEVEL	PIEZOMETER DETAILS	LABORATORY TESTING
Holocene Marginal Marine Deposits	Gravelly SAND to sandy GRAVEL with minor silt, grey. Dense, moist.			36	8//8/8/10/10					Fine to medium sand. FIne to medium gravel.		62	SPT	Rotary triple tube wireline coring					
	GRAVEL with some sand, grey.									Fine to medium gravel.			BULK						
	Sandy GRAVEL with minor silt, blue-grey. Very dense, moist.	-12 / 16		50+	38//50 for 55mm							49	SPT						
	Moderately weathered sandstone (greywacke) BOULDERS, light blue.																		
	Clayey SAND with some gravel, brown. Moist.	17								Fine to medium, blue-grey gravel clasts.		100	HQ						
	Very dense.			50+	50 for 140mm							57	SPT						
	No sample recovery.	-14 / 18								No sample recovery.		0	HQ						
	Gravelly SAND, grey. Very dense, moist.	19		50+	50 for 140mm					Coarse sand. Fine to medium gravel.		43	SPT						
	E.O.H. at 19.14m Target Depth Reached	-16 / 20																	
		21																	
		-18 / 22																	

NOTES

1) Drill changed halfway through BH
2) Coordinates taken with handheld GPS, accurate to +/- 8m.
3) PSD = Particle Size Distribution Test

STARTED	FINISHED
5/02/2012	5/08/2012
DRILLER: Nathan	DRILLING CO.: Grifftiths
INCLINATION/ AZIMUTH: -90° / Vertical°	DRILLING RIG: Tracked
LOGGED: E. Gkeli	CHECKED: T. Binczyk
CLIENT: John Wood Consulting Ltd.	JOB NO.: 5-C2261.00

BH1

LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY (2005) GUIDELINES

SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS

BOREHOLE_LOG_A3 NGAURANGA 1C REINFORCED EARTH WALLS.GPJ OPUS WLG REV080408.GDT 13/6/12

Scale 1:25.0

B

Appendix B – Historical Investigations: Hutt Road

B.1 Previous Geotechnical Investigations in Proximity to Hutt Road.

NZGD ID	Consultant	Year	Location	Type	Depth (m)
CPT_112572(01-03)	Pattle Delamore Partners	2018	35 Hutt Road	CPT	5.04
TP_107045	Beca Ltd	2008	Wellington Station Entry	Test Pit	2.00
BH_107038	Beca Ltd	2008	Wellington Station Entry	Machine Borehole	8.75
BH_150985	Tonkin & Taylor Ltd	2020	Thorndon overbridge	Machine Borehole	30.20
BH_150986	Tonkin & Taylor Ltd	2020	Hutt Road, beneath Thorndon overbridge	Machine Borehole	17.10
BH_150987	Tonkin & Taylor Ltd	2020	Hutt road, north Thorndon overbridge	Machine Borehole	5.35
TP_107044	Beca Ltd	2008	90 Hutt Road	Test Pit	1.85
BH_150357	ENGEO Ltd	2019	126 Hutt Road	Machine Borehole	28.75
CPT_150495	ENGEO	2020	126 Hutt Road	CPT	8.20
BH_150358	ENGEO	2019	126 Hutt Road	Machine Borehole	30.50
TP_101991	Tonkin & Taylor Ltd	2008	North of Onslow/Hutt Road intersection	Test Pit	2.20

295 Blenheim Road
Upper Riccarton
Christchurch 8041
www.pdp.co.nz

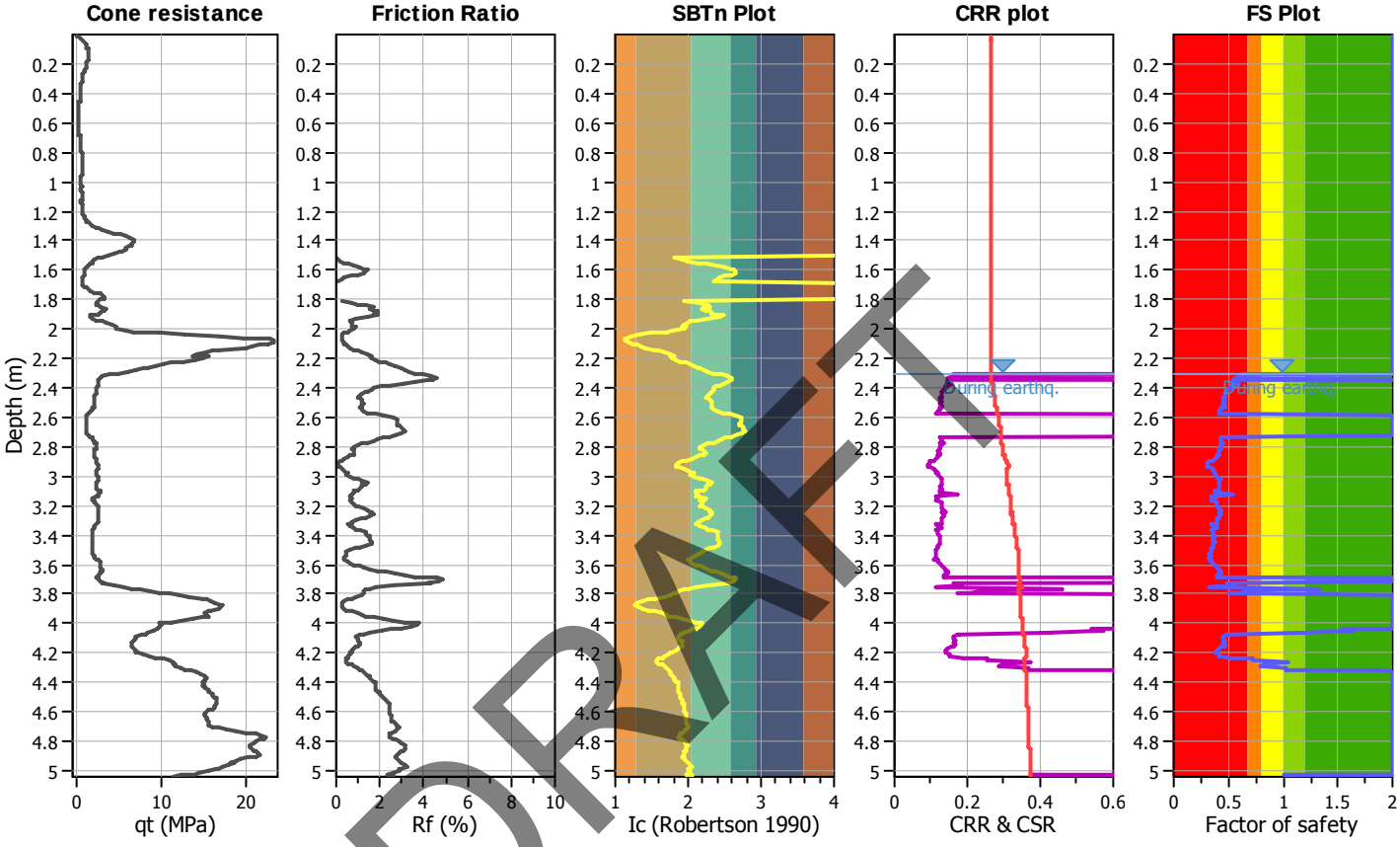
LIQUEFACTION ANALYSIS REPORT

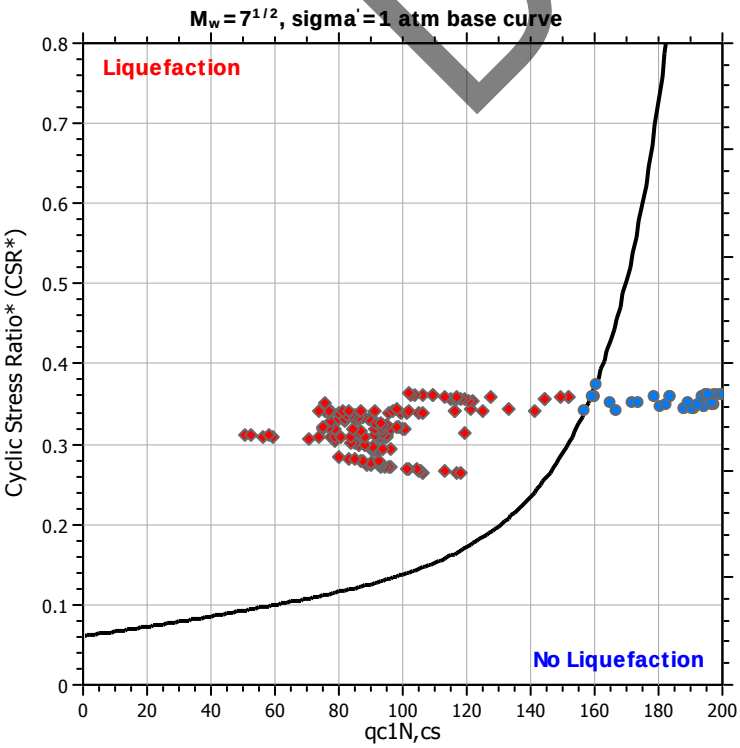
Project title : 24 - 26 Hutt Road **Location : Thorndon, Wellington**

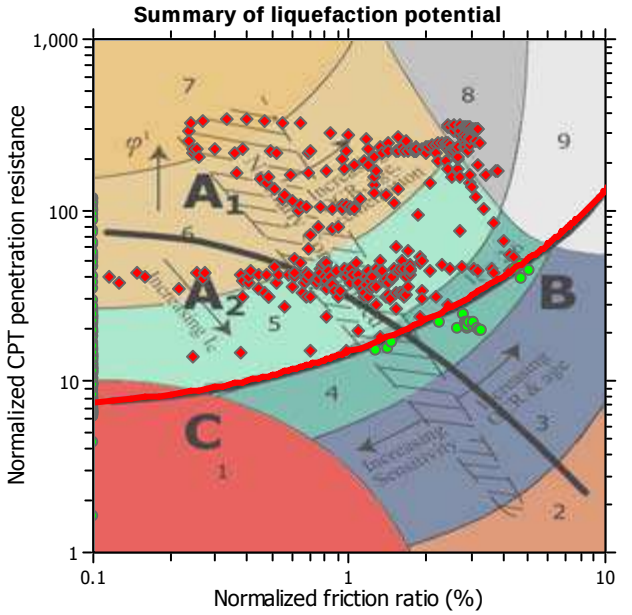
CPT file : CPT_01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.30 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	2.30 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.45	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



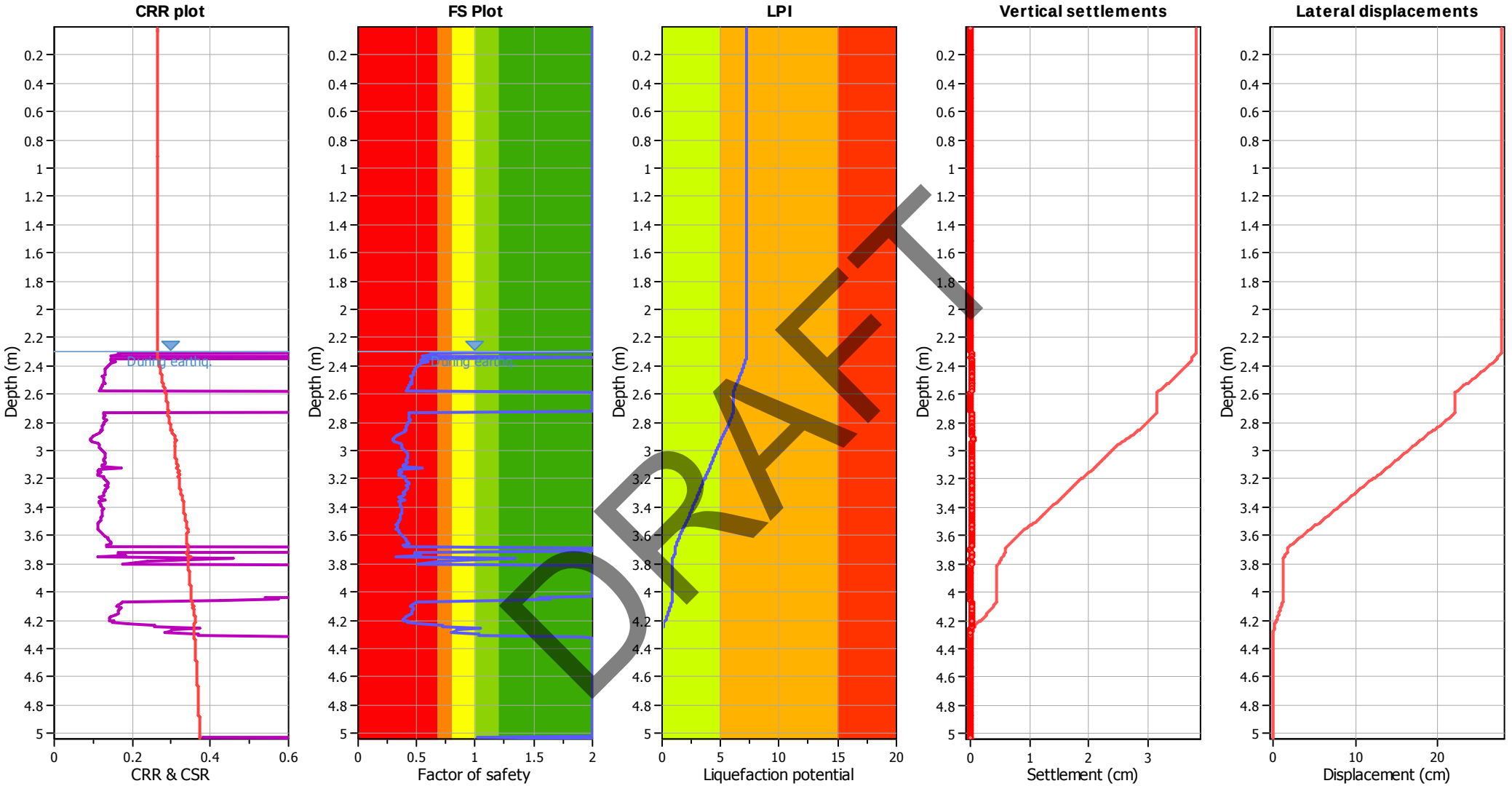




Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

NZGD ID: CPT_112572

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	2.30 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.45	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	2.30 m	Fill height:	N/A	Limit depth:	N/A

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

NZGD ID: CPT_112572

GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

CPT ZERO TEST

Job:	24 Hutt Road, Thorndon

Date:	1/09/2018	**Operator**	Kenton

Hole #		Point Resistance (Qc)	Pore Pressure (u)	Local Friction (fs)	Tilt Angle
1	*Before*	12343	12428	12588	-
		11.0464 Mpa	250.7 Kpa	129.7 Kpa	
	After	12391	12538	12603	-
		11.1104 Mpa	251.1 Kpa	130.6 Kpa	

Time at Start of Test:	8:15am	**S:**	-
Time at End of Test:	8:40am	**E:**	-

Reason for Refusal:	Anchor	Could Not Push	X

Other (Explain): … Friction high. Could not push. Anchors pulled.

……

……

Pre-Drill Depth:	1.50m
Final Test Depth:	5.44m

Hole #		Point Resistance (Qc)	Pore Pressure (u)	Local Friction (fs)	Tilt Angle
2	*Before*	12314	12392	12589	-
		11.0205 Mpa	250 Kpa	129.7 Kpa	
	After	12383	12412	12603	-
		11.071 Mpa	250.7 Kpa	130.4 Kpa	

Time at Start of Test:	9:18am	**S:**	-
Time at End of Test:	9:45am	**E:**	-

Reason for Refusal:	Anchor	Could Not Push	X

Other (Explain): … Friction stopped test.

……

……

Pre-Drill Depth:	1.50m
Final Test Depth:	9.587m

NZGD ID: CPT_112572

Hole #		Point Resistance (Qc)		Pore Pressure (u)		Local Friction (fs)		Tilt Angle
3	*Before*	12253		12400		12671		-
		10.9659	Mpa	250.1	Kpa	130.6	Kpa	
	After	12267		12418		12703		-
		11.0125	Mpa	250.45	Kpa	131.3	Kpa	

Time at Start of Test:	10:45am	**S:**	-
Time at End of Test:	11:05am	**E:**	-

Reason for Refusal:	Anchor		Could Not Push	X

Other (Explain): … Friction stopped test

……

……

Pre-Drill Depth:	1.50m
Final Test Depth:	7.935m

Göteborg:2017-09-14

CALIBRATION CERTIFICATE FOR CPT PROBE 4616

Probe No	4616
Date of Calibration	2017-09-12
Calibrated by	Christoffer Hurtig.....
Run No	523
Test Class:	ISO 1

Point Resistance — Tip Area 10cm²

Maximum Load	100	MPa
Range	100	MPa
Scaling Factor	**852**	
Resolution	0,8955	kPa
Area factor (a)	0,834	

ERRORS

Max. Temperature effect when not loaded 60,856 kPa
Temperature range 5 –40 deg. Celsius.

Local Friction — Sleeve Area 150cm²

Maximum Load	0,5	MPa
Range	0,5	MPa
Scaling Factor	**3700**	
Resolution	0,0103	kPa
Area factor (b)	0	

ERRORS

Max. Temperature effect when not loaded 0,566 kPa
Temperature range 5 –40 deg. Celsius.

Pore Pressure

Maximum Load	2	MPa
Range	2	MPa
Scaling Factor	**3780**	
Resolution	0,0202	kPa

ERRORS

Max. Temperature effect when not loaded 1,069 kPa
Temperature range 5 –40 deg. Celsius.

Tilt Angle. — Scaling Factor: 0,95

Range	0 - 40	Deg.

Backup memory

NZGD ID: CPT_112572

Calibration Certificate. Loading Point Resistance

Göteborg:2017-09-14

Probe No:	**4616**
Date of Calibration:	**2017-09-12**
Calibration Run No:	**523**
Calibrated by:	**Christoffer Hurtig**
Scaling Factor:	**852**
Reference Cell:	75672

Applied Load MPa	PointRes. MPa	Difference MPa	Accuracy %/MV	Friction MPa	PorePress MPa
0,000	0,000	0,000	0,000	0,000	0,000
10,004	10,047	-0,043	-0,429	0,000	0,000
20,047	20,135	-0,088	-0,439	0,000	-0,001
30,033	30,148	-0,115	-0,382	0,001	-0,001
40,009	40,136	-0,127	-0,317	0,002	-0,001
50,041	50,151	-0,110	-0,219	0,002	-0,002
59,993	60,069	-0,076	-0,126	0,003	-0,002
69,969	69,992	-0,023	-0,032	0,004	-0,002
80,004	79,949	0,055	0,068	0,005	-0,002
90,032	89,890	0,142	0,157	0,006	-0,002
100,018	99,763	0,255	0,255	0,007	-0,003
90,029	89,879	0,150	0,166	0,005	-0,001
80,001	79,927	0,074	0,092	0,004	-0,001
69,997	69,990	0,007	0,010	0,003	0,000
60,017	60,060	-0,043	-0,071	0,002	0,000
50,041	50,119	-0,078	-0,155	0,001	0,000
40,031	40,128	-0,097	-0,242	0,001	0,000
30,039	30,142	-0,103	-0,342	0,000	0,000
20,014	20,106	-0,092	-0,459	0,000	0,000
10,025	10,061	-0,036	-0,359	0,000	0,000
0,003	-0,002	0,005	0,000	0,000	0,000

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SE-436 32 ASKIM, Sweden SE556098559901

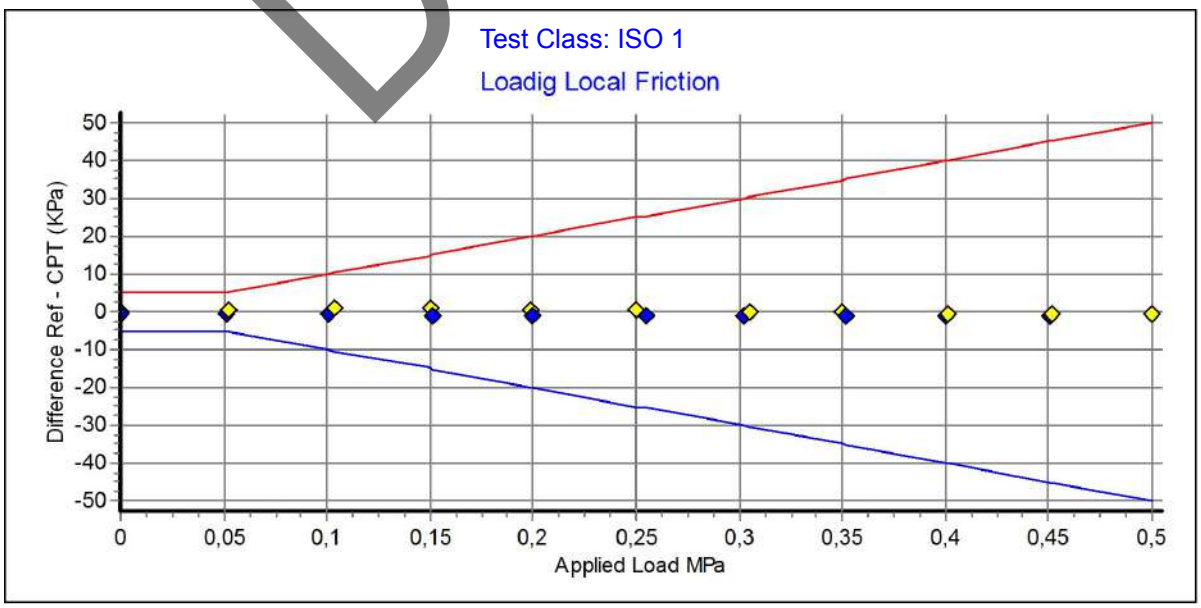
NZGD ID: CPT_112572

Calibration Certificate. Loading Local Friction

Göteborg:2017-09-14

Probe No:	**4616**
Date of Calibration:	**2017-09-12**
Calibration Run No:	**523**
Calibrated by:	**Christoffer Hurtig**
Scaling Factor:	**3700**
Reference Cell:	76360

Ref MPa	Friction MPa	Difference KPa	Accuracy %/MV	PointRes. MPa	PorePress MPa
0,000	0,000	0,000	0,000	0,000	0,000
0,052	0,051	0,653	0,000	0,010	0,000
0,104	0,103	0,792	0,000	0,014	0,000
0,150	0,149	0,846	0,000	0,017	0,000
0,199	0,198	0,674	0,000	0,018	0,000
0,250	0,250	0,397	0,158	0,019	0,000
0,305	0,304	0,218	0,071	0,021	0,000
0,350	0,350	0,066	0,019	0,023	0,000
0,401	0,401	-0,271	-0,067	0,024	0,000
0,452	0,452	-0,403	-0,089	0,025	0,000
0,500	0,501	-0,778	-0,155	0,025	0,000
0,451	0,452	-1,047	-0,231	0,021	0,000
0,400	0,402	-1,212	-0,301	0,018	0,000
0,352	0,354	-1,252	-0,353	0,017	0,000
0,302	0,303	-1,141	-0,375	0,015	0,000
0,255	0,256	-1,104	-0,431	0,011	0,000
0,200	0,201	-0,993	-0,492	0,010	0,000
0,151	0,152	-0,849	0,000	0,008	0,000
0,101	0,102	-0,567	0,000	0,008	0,000
0,051	0,051	-0,300	0,000	0,005	0,000
0,000	0,000	-0,340	0,000	0,000	0,000



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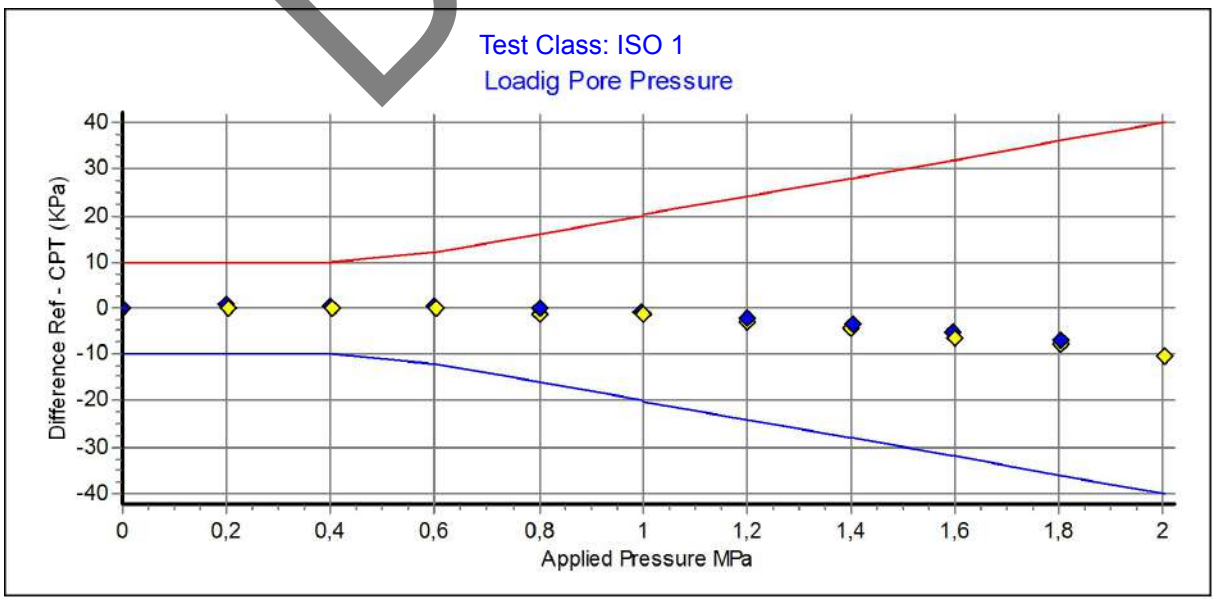
NZGD ID: CPT_112572

Calibration Certificate. Loading Pore Pressure

Göteborg:2017-09-14

Probe No: **4616**
Date of Calibration: **2017-09-12**
Calibration Run No: **523**
Calibrated by: **Christoffer Hurtig**
Scaling Factor: 3780
Reference Cell: 44410026

Appl. Press MPa	PorePress MPa	Difference KPa	Accuracy %/MV	PointRes. MPa	Friction MPa	Area Factor A = PR/PP	Area Factor B = LF/PP
0,000	0,000	0,100	0,000	0,000	0,000		
0,202	0,202	-0,129	-0,064	0,162	0,000	0,802	0,000
0,402	0,402	-0,154	-0,038	0,319	0,000	0,793	0,000
0,603	0,603	-0,177	-0,029	0,490	0,000	0,812	0,000
0,801	0,803	-1,426	-0,177	0,660	0,000	0,821	0,000
1,002	1,003	-1,470	-0,146	0,832	0,000	0,829	0,000
1,202	1,205	-2,805	-0,232	1,005	0,000	0,834	0,000
1,401	1,405	-4,495	-0,319	1,176	0,000	0,837	0,000
1,598	1,604	-6,245	-0,389	1,346	0,000	0,839	0,000
1,802	1,810	-7,907	-0,436	1,523	0,000	0,841	0,000
2,002	2,012	-10,277	-0,510	1,697	0,000	0,843	0,000
1,803	1,809	-6,976	-0,385	1,525	0,000	0,843	0,000
1,597	1,602	-5,181	-0,323	1,350	0,000	0,842	0,000
1,403	1,406	-3,230	-0,229	1,184	0,000	0,842	0,000
1,202	1,204	-2,079	-0,172	1,014	0,000	0,842	0,000
0,998	0,999	-0,709	-0,071	0,842	0,000	0,842	0,000
0,801	0,800	0,183	0,022	0,673	0,000	0,841	0,000
0,600	0,600	0,530	0,088	0,503	0,000	0,838	0,000
0,400	0,399	0,513	0,128	0,333	0,000	0,834	0,000
0,200	0,199	0,702	0,000	0,163	0,000	0,819	0,000
0,000	0,000	0,100	0,000	-0,002	0,000		



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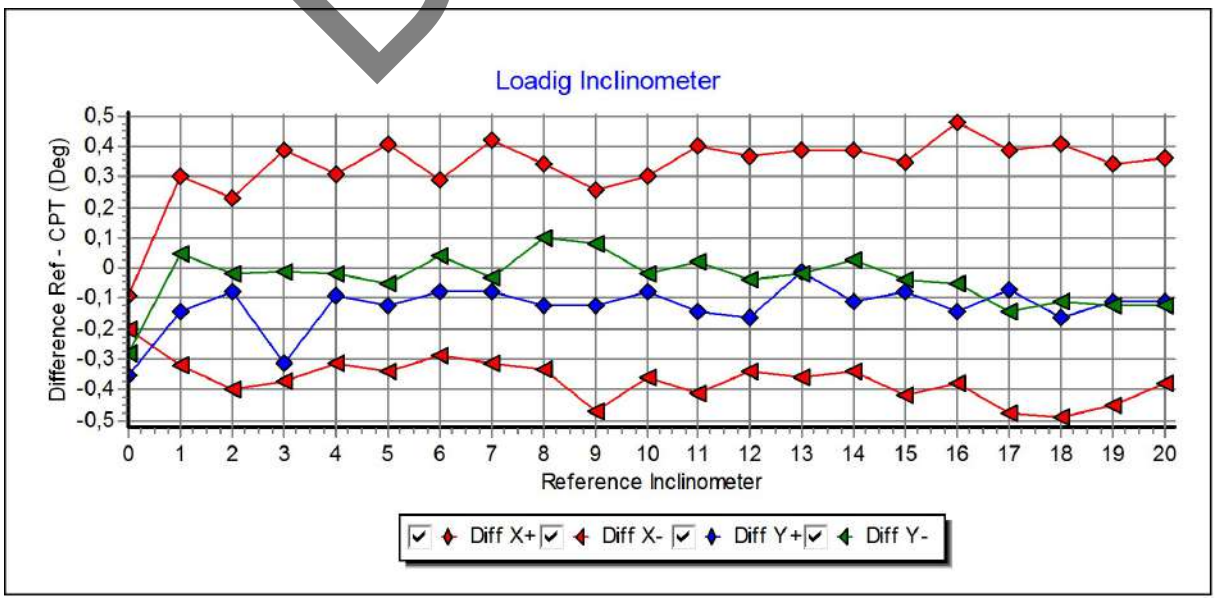
NZGD ID: CPT_112572

Calibration Certificate. Loading Inclinometer

Göteborg:2017-09-14

Probe No:	**4616**
Date of Calibration:	**2017-09-12**
Calibration Run No:	**523**
Calibrated by:	**Christoffer Hurtig**
Scaling Factor:	**0,95**

Appl. Incin. Deg	X+ Deg	X- Deg	Y+ Deg	Y- Deg	Diff X+ Deg	Diff X- Deg	Diff Y+ Deg	Diff Y- Deg
0,00	0,09	0,20	0,35	0,28	-0,09	-0,20	-0,35	-0,28
1,00	0,70	1,32	1,14	0,95	0,30	-0,32	-0,14	0,05
2,00	1,77	2,40	2,08	2,02	0,23	-0,40	-0,08	-0,02
3,00	2,61	3,37	3,31	3,01	0,39	-0,37	-0,31	-0,01
4,00	3,69	4,31	4,09	4,02	0,31	-0,31	-0,09	-0,02
5,00	4,59	5,34	5,12	5,05	0,41	-0,34	-0,12	-0,05
6,00	5,71	6,29	6,08	5,96	0,29	-0,29	-0,08	0,04
7,00	6,58	7,31	7,08	7,03	0,42	-0,31	-0,08	-0,03
8,00	7,66	8,33	8,12	7,90	0,34	-0,33	-0,12	0,10
9,00	8,74	9,47	9,12	8,92	0,26	-0,47	-0,12	0,08
10,00	9,70	10,36	10,08	10,02	0,30	-0,36	-0,08	-0,02
11,00	10,60	11,41	11,14	10,98	0,40	-0,41	-0,14	0,02
12,00	11,63	12,34	12,16	12,04	0,37	-0,34	-0,16	-0,04
13,00	12,61	13,36	13,01	13,02	0,39	-0,36	-0,01	-0,02
14,00	13,61	14,34	14,11	13,97	0,39	-0,34	-0,11	0,03
15,00	14,65	15,42	15,08	15,04	0,35	-0,42	-0,08	-0,04
16,00	15,52	16,38	16,14	16,05	0,48	-0,38	-0,14	-0,05
17,00	16,61	17,48	17,07	17,14	0,39	-0,48	-0,07	-0,14
18,00	17,59	18,49	18,16	18,11	0,41	-0,49	-0,16	-0,11
19,00	18,66	19,45	19,11	19,12	0,34	-0,45	-0,11	-0,12
20,00	19,64	20,38	20,11	20,12	0,36	-0,38	-0,11	-0,12



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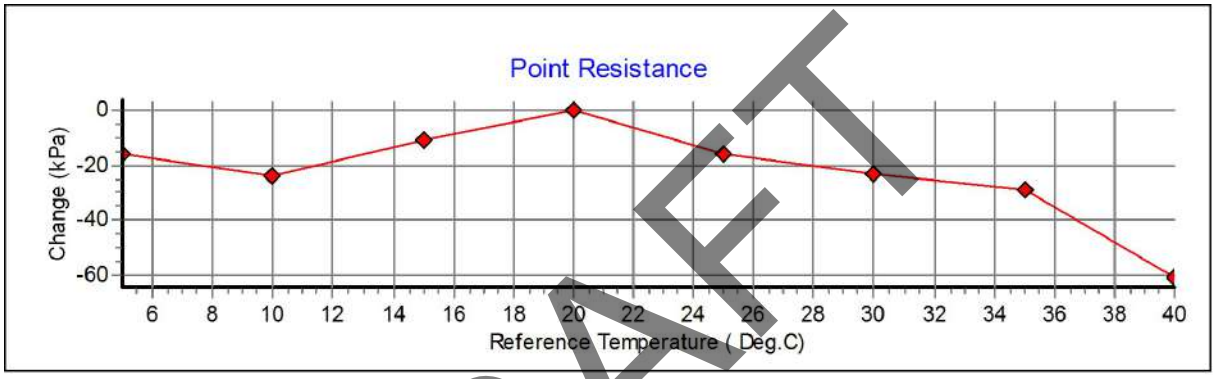
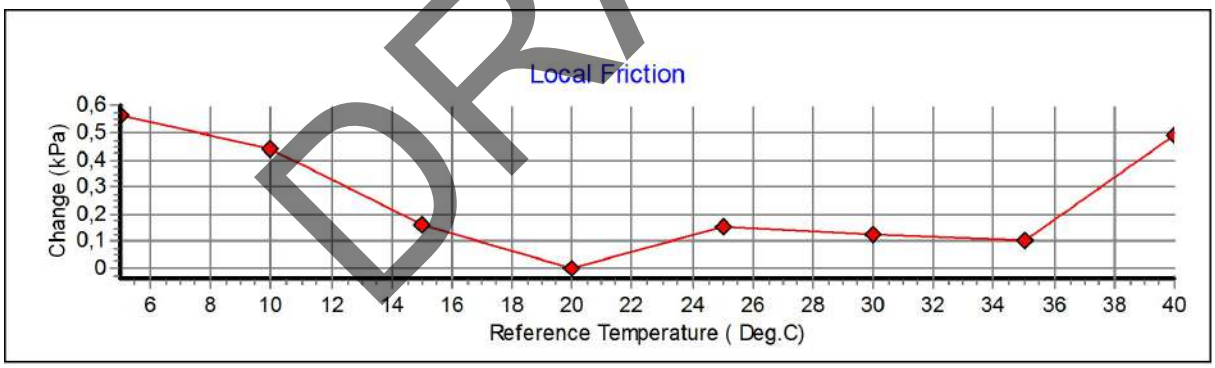
NZGD ID: CPT_112572

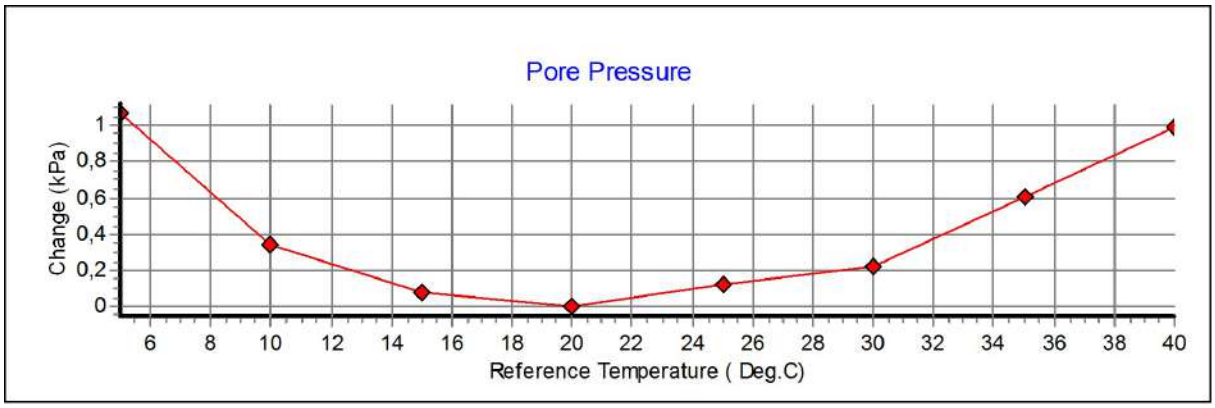
Calibration of temperature effect when not loaded.

Göteborg:2017-09-14

Probe No:	**4616**
Date of Calibration:	**2017-09-12**
Calibration Run No:	**523**
Calibrated by:	**Christoffer Hurtig**







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NZGD ID: CPT_112572

Calibration procedure.

Göteborg: 2017-09-14

We are following the procedure that is described in the European Standard **EN ISO22476-1:**

Point resistance.

The point resistance is calibrated from 0 to maximum range in 10 steps up and down.
Then we adjust the calibration factor to fit the best linearity.

Local friction.

A special adapter unit substitutes the cone and transfers the axial forces to the lower end of the friction sleeve. The friction is calibrated from 0 to maximum range in 10 steps up and down then the sleeve is turned 90 degrees and the calibration repeated.
Then we adjust the calibration factor to fit the best linearity.

Pore pressure & Area ratio a and b.

The completed probe is installed in a special chamber and the pore pressure sensor are calibrated from 0 to maximum range in 10 step up and down.
Then we adjust the calibration factor to fit the best linearity.
At half range the pressure of the point and friction is registered and used for calculation of the area factor.

Tilt inclination.

The tilt sensor is calibrated +/- 20deg. from vertical line in steps of 1 deg.
This will be done in 2 orthogonal directions.

Temperature.

The temperature sensor are calibrated in steps of 5°C from 5 to 40 °C.

Temperature compensation.

The Point, Friction and the Pore pressure sensors in the probe is temperature compensated and tested in the range 5 to 40 °C.

Calibration reference equipment.

Reference	Load cell	HBM C2/100kN FB088 no.N75672
Reference	Load cell	HBM C2/20kN FB088 no.N76360
Reference	Pressure sensor	HBM P3MB 1MPa no.160410072
Reference	Pressure sensor	HBM P3MB 2MPa no.44410026
Reference	Pressure sensor	HBM P3MB 50MPa no.140510158

The reference sensors are connected to the Geotech black box together with the CPT probe. The measuring data from the reference sensors are simultaneously send to the computer and stored in the Geotech calibration software. The completed systems are recalibrated at RISE Research Institutes of Sweden once a year.

Environment.
Air pressure: 990,6 hPa.
Temperature: 25,5 °C.

NZGD ID: CPT_112572

Cptlog Cone data base information

Göteborg: 2017-09-14

Cone name: 4616

Serial number: 4616

Date of purchase: User.

Ranges

Point resistance: 100 (Mpa)

Local friction: 0,5 (Mpa)

Pore pressure: 2 (Mpa)

Tilt sensor: 40 (Deg)

temperature: ©

Elect. Conductivity: (mS/m)

Geometric parameters

Area factor a: 0,834

Area factor b: 0

Tip area: 10 (cm^2)

Sleeve area: 150 (cm^2)

Scaling factors

Point resistance: 852

Local friction: 3700

Pore pressure: 3780

Tilt sensor: 0,95

temperature: 1

Elect. Conductivity A:

Elect. Conductivity B:

Type: NOVA cone

Memory option: With memory

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NZGD ID: CPT_112572

NZGD ID: TP_107045

Beca

TEST PIT LOG

TEST PIT No: **TP E**

SHEET 1 of 1

PROJECT:	Wellington Station Entry Project 602	JOB NUMBER:	3320677/240
SITE LOCATION:	Wellington Station Yard	CLIENT:	ONTRACK

TESTPIT LOCATION: Eastern side of Johnsonville Line embankment

COORDINATES: N 703,816 m, E 300,629 m

R.L: 3.25 m

DATUM: Horizontal: Wellington Geodetic 1949; Vertical: Wellington 1953 (MSL)

GEOLOGICAL UNIT	R.L (m)	DEPTH (m)	WATER LEVEL	GRAPHIC LOG	CLASSIFICATION	MOISTURE	CONSISTENCY	SOIL DESCRIPTION	SAMPLES	Scala (Blows/150mm)	SV (kPa)	τ (kPa)
Fill	3				ML	D	L	Loosely packed, 'loose', dark brown sandy gravelly SILT, trace clay, dry, slightly plastic (when wetted), matrix supported. Gravel: Strong, MW, grey/brown, medium to coarse, poorly graded, rounded to subangular greywacke.				
					GM	M	L	Loosely packed, 'loose', silty sandy GRAVEL, trace clay; moist, slightly plastic (matrix when wetted), gravel supported. Gravel: Strong, MW-SW, grey, stained orange, medium to coarse, minor cobbles, subrounded to subangular greywacke.				
					GM	M	St					
					MH	M	St	Stiff, black/ dark brown, silty GRAVEL, minor clay; moist, moderately plastic (when wetted), matrix supported.				
								Stiff, light brown, gravelly SILT, some sand, some clay; moist, highly plastic (when wetted). Gravel: Strong, MW-SW, grey, stained orange, medium to coarse, minor cobbles, subrounded to subangular greywacke.				
					GP	M	L	Loosely packed, 'loose', grey GRAVEL, trace silt and sand; moist, non plastic, gravel supported. Gravel: Strong, MW-SW, grey, medium to coarse, poorly graded, subangular and angular greywacke.				
	1				ML	M	St	Stiff, light brown gravelly sandy SILT, trace clay; moist, slightly plastic (when wetted). Gravel: Strong, MW-SW, grey, stained brown, medium to coarse gravel, and cobble and boulder sized, well graded, rounded to subangular.	D1			
	2				SP	M	L	Loosely packed, 'loose', dark brown silty gravelly SAND; moist, non plastic. Gravel: MW-SW, grey/brown, fine to medium, some cobbles, poorly graded, subrounded to rounded greywacke. Sand: Medium to coarse.	D2			
		2						End of Test Pit 2 m.				
	1											

DATE DRILLED: 23/2/08

LOGGED BY: JUB

PILCON VANE No:

EXCAVATION METHOD: Hitachi EX60

CONTRACTOR: HRS

COMMENTS:
No seepage encountered.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Test Pit Location (embankment)

Test Pit Photos

TP E

NZGD ID: TP_107045

NZGD ID: BH_107038

Beca

BOREHOLE No: **BH3**

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT: Wellington Station Entry Project 602 — JOB NUMBER: 3320677/400

SITE LOCATION: East of Johnsonville Line Embankment — CLIENT: ONTRACK

CIRCUIT: Wellington Geodetic Datum 1949 — BOREHOLE LOCATION: North end of proposed retaining wall

COORDINATES: N 703,824.00 m, E 300,637.00 m — R L: 1.6 m — DATUM: Wellington 1953 (MSL)

DRILLING: FLUID LOSS	DRILLING: WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: ROD	DRILLING: CASING	IN-SITU TESTS: SV (kPa)	IN-SITU TESTS: τ (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	Vacuum							0				Vacuum excavation for service check - no recovery, logged downhole and from spoil. Tightly packed, clast supported GRAVEL, minor sandy silt matrix, yellowish brown; non plastic (matrix). Gravel: Medium to coarse, subangular to subrounded, greyish brown, stained brown, MW, moderately strong greywacke.		1
		67 %	SPT					1 2 1 N=3		1		ML	M	Soft gravelly sandy SILT, trace clay, yellowish brown; moist, low plasticity. Gravel: Fine to medium, angular, greyish brown, stained brown, MW greywacke.		
		0 %	TT											No recovery.		0
	23/8/08 (10.10am)	13 %	SPT					3 3 3 N=6		2		GP	S	Poor recovery. Loose, clast supported (or matrix lost?) GRAVEL; saturated. Gravel: Fine to medium, angular, grey stained brown, MW moderately strong greywacke.	Reclamation Fill	
		45 %	TT											No recovery.		-1
		0 %	TT							3		GP	S	Poor recovery. Loose, clast supported with trace matrix (washed out) coarse GRAVEL, and COBBLES; saturated. Gravel and cobbles: Subangular, grey stained brown, MW and SW greywacke. Matrix: Dark grey silty sand.		
														No recovery - SPT at 3.0 m obstructed by cobbles, wash drilled until clear - (ash /slag /hyraulic fill?)		-2
										4						
		11 %	SPT					14 4 2 N=6				GP	W	Poor recovery - coarse gravel lodged in end of SPT. Loose GRAVEL, minor shelly sand and fine angular gravel fragments; wet, non plastic. Gravel: Medium to coarse, brown/grey, MW-SW, moderately strong greywacke.	Marine sediments	-3
			TT					2				GM	S	Poor recovery. Loose clast supported (or matrix lost?) shelly sandy GRAVEL; saturated. Gravel: Fine to medium, subrounded, and coarse subangular,		

DATE STARTED: 23/8/08 — DRILLED BY: Griffiths Drilling (NZ) Ltd

DATE FINISHED: 23/8/08 — EQUIPMENT: Longyear H170

LOGGED BY: JUB — DRILL METHOD: TT/OB/CC/SPT

SHEAR VANE No: — DRILL FLUID: Water + mud/compressed air

VANE CALIBRATION: — DIAMETER/INCLINATION: - / 90°

COMMENTS:
Water level inferred from soil saturation. SPT @ 3m obstructed by gravel. Air-cored to 3.0 m. RL estimated from site plan. Coordinates approximate only, +/- 2m, measured on site by tape.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

A4 Scale 1:25

MACHINE_BOREHOLE P:\332133206777\400\TGE\WELLINGTON STATION ENTRY PROJECT 602.GPJ BECA.GDT 26/9/08

NZGD ID: BH_107038

Beca

BOREHOLE No: **BH3**

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: Wellington Station Entry Project 602 — JOB NUMBER: 3320677/400

SITE LOCATION: East of Johnsonville Line Embankment — CLIENT: ONTRACK

CIRCUIT: Wellington Geodetic Datum 1949 — BOREHOLE LOCATION: North end of proposed retaining wall

COORDINATES: N 703,824.00 m — R L: 1.6 m

E 300,637.00 m — DATUM: Wellington 1953 (MSL)

DRILLING: FLUID LOSS	DRILLING: WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: ROD	DRILLING: CASING	IN-SITU TESTS: SV (kPa)	IN-SITU TESTS: T (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		38 %	SPT					3 2 N=5				MH	M	green and grey stained brown and black, MW and SW greywacke. Poor recovery. Firm clayey SILT, trace gravel, greyish green; moist, high plasticity. Gravel: Fine to medium, subangular, CW-HW, extremely weak sandstone, trace fine subangular siltstone.	Marine sediments *(Contd.)*	
		11 %	TT											Poor recovery - logged from SPT overdrill. Stiff, some gravel, blue-grey. Gravel: Fine, subrounded and subangular poorly cemented/ extremely weak sandstone.		-4
		100 %	SPT					2 4 6 N=10		6		MH	M W	Firm sandy gravelly SILT, some clay, blue/green grey; moist, high plasticity. Gravel: Coarse, green/grey, stained orange, extremely weak sandstone. Thin soft lens (drilling disturbed?). Wet.		
		50 %	UT			UTP	UTP					ML	M	Undisturbed tube sample - poor recovery. Described from base of tube: Stiff SILT, some sand, some gravel, trace clay, orange-brown; moist, low plasticity. Gravel: Medium, subangular, brown MW, greywacke.		-5
		100 %	SPT					6 10 9 N=19		7		SM	M	Firm to stiff gravelly sandy SILT, trace clay, orange-brown; moist, low plasticity to non plastic. Gravel: Fine, trace medium, subangular and rounded, brown stained grey, extremely weak sandstone/greywacke.	Pleistocene deposits	
		100 %	TT									SM	W	Soft (drilling disturbed?) sandy SILT, some gravel, minor clay, orange-brown; wet, low plasticity. Gravel: Fine to medium, subangular to subrounded, extremely weak sandstone/greywacke.		-6
												MH	M	Stiff SILT, some clay, minor fine sand, minor gravel, orange/grey mottled dark orange; moist, high plasticity. Gravel: Coarse, angular, greyish brown, MW, very weak greywacke.		
		100 %	SPT					5 8 11 N=19		8		MH MH SM	W M M	Stiff gravelly SILT, some sand, minor clay, orange-brown; wet, high plasticity Gravel: Medium to coarse, angular, brown, MW, extremely to very weak greywacke/sandstone.		
														Stiff SILT, some clay, some sand, some gravel, orange-brown; moist, high plasticity. Gravel: Medium to coarse, angular, MW, very weak greywacke.		
		83 %	TT									ML	M	Medium dense, silty fine SAND, minor gravel, trace clay, greenish grey; moist, low plasticity to non plastic. Gravel: Medium, subangular, greenish grey, HW, extremely weak, sandstone/greywacke.		-7
														Very stiff fine sandy SILT, minor clay, minor gravel, green/grey; moist, low plasticity. Trace clay.		
										9				END OF LOG @ 8.75 m		-8

DATE STARTED: 23/8/08 — DRILLED BY: Griffiths Drilling (NZ) Ltd

DATE FINISHED: 23/8/08 — EQUIPMENT: Longyear H170

LOGGED BY: JUB — DRILL METHOD: TT/OB/CC/SPT

SHEAR VANE No: — DRILL FLUID: Water + mud/compressed air

VANE CALIBRATION: — DIAMETER/INCLINATION: - / 90°

COMMENTS:
Water level inferred from soil saturation. SPT @ 3m obstructed by gravel. Air-cored to 3.0 m. RL estimated from site plan. Coordinates approximate only, +/- 2m, measured on site by tape.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

A4 Scale 1:25

MACHINE_BOREHOLE P:\332\33206777\400\TGE\WELLINGTON STATION ENTRY PROJECT 602.GPJ BECA.GDT 26/9/08

NZGD ID: BH_107038

Borehole Location

Downhole View
(vacuum excavated):

DEPTH: 0 to 1.0m

NZGD ID: BH_107038

BOX: 1 **DEPTH: 1.0 to 8.75m**

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH2

SHEET: 1 OF 7

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: 5430323.40 mN, 1749504.16 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	Air vaccum excavation.			AC	0		2	1.0							09/10/2020			
	Core loss.			SPT	0	1/1 1/2 15 for 75mm N>=50 bouncing	1	1.5										
	Fine to coarse SAND with some gravel; dark brown and black. Very dense, moist. Gravel is fine to medium, subangular, greywacke.							2.0										
	Wellington Water 900 dia. stormwater drain.			SNC	8			2.5										
	Fine to coarse SAND with some gravel, minor silt; dark brown. Very dense, moist. Gravel is fine to medium, subangular, greywacke.			SPT	66	3/12 for 75mm N>=50 bouncing	0	3.0										
	Core loss.																	
	Fine to coarse GRAVEL; dark grey. Very dense, moist. Subangular, well graded, greywacke and concrete material. (Fines flushed)							3.5										
	Gravelly SILT with some sand; orange brown. Firm to stiff, moist. Gravel is fine to coarse, subangular, greywacke. Sand is fine to coarse.			SNC	74													
	Fine to coarse SAND with minor gravel and silt; dark brown. Medium dense, moist. Gravel is fine to medium, subrounded, greywacke.						-1	4.0					*4.00m:* changes to some gravel.					
	SILT with some sand, minor gravel; grey. Medium dense, moist. Sand is fine to coarse. Gravel is fine to coarse, subrounded, greywacke.												*4.15 - 4.20m:* changes to black, hydrocarbon smell.					
	SILT with some clay, minor sand and gravel; grey mottled brownish orange. Firm, moist. Highly plastic. Sand is fine to medium. Gravel is fine, subrounded, greywacke.			SPT	33	6/13 8/6 5/4 N=23		4.5										
	Core loss.																	

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH2

SHEET: 2 OF 7

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: 5430323.40 mN, 1749504.16 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits	Sandy SILT with some clay, minor sand and gravel; grey mottled brownish orange. Firm, moist. Slightly plastic. Sand is fine to medium. Gravel is fine, subrounded, greywacke.			SNC	100	Atterberg @ 5.60m	5.5											
						1/2 2/3 5/4 N=14	3	6.0										
	Core loss.			SPT	44			6.5										
	Sandy SILT with minor clay; grey mottled brownish orange. Medium dense, moist. Slow dilatancy. Sand is fine.																	
	Sandy SILT with some gravel; grey mottled brownish orange. Medium dense, moist. Slow dilatancy. Sand is fine. Gravel is fine to medium, angular, greywacke.												*6.80m:* changes to brownish orange.					
	Gravelly silty fine to coarse SAND; brown mottled grey. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100	PSD @ 7.25m	-4	7.0										
								7.5										
				SPT	55	1/3 4/6 4/6 N=20												
	Core loss.						-5	8.0										
	Fine SAND with some silt, minor gravel; brownish orange. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100	Small bag @ 8.80m		8.5										
							-6	9.0										
	Core loss.			SPT	66	1/4 6/6 7/7 N=26												
	Fine SAND with some silt and gravel; grey. Medium dense, moist. Poorly graded. Gravel is fine to medium, subangular, greywacke.							9.5										
	Fine to medium SAND with minor silt and gravel; orange brown. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.						-7											

Box 1, 0.0-6.6m

Box 2, 6.6-9.6m

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH2

SHEET: 3 OF 7

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: 5430323.40 mN, 1749504.16 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits	Fine SAND with minor silt and gravel; orange brown. Dense, moist. Poorly graded. Gravel is fine to medium, subangular, greywacke.			SNC	100			10.5										
	Fine SAND with minor gravel, trace silt; grey mottled brown. Dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SPT	88	2/4 4/6 7/7 **N=24**	-8	11.0										
	Core loss.																	
	Fine SAND with minor gravel, trace silt; grey mottled brown. Dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100			11.5										
	Gravelly sandy SILT; brown. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular, greywacke.			SPT	100	PSD @ 12.20m 2/3 5/6 **N=16**	-9	12.0										
	Fine SAND with some silt, minor gravel; brownish grey mottled orange brown. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100			12.5										
	Fine SAND wtih some silt, minor gravel; orange brown. Dense, moist. Poorly graded. Gravel is fine to medium, subangular, greywacke.						-10	13.0										
								13.5										
				SPT	100	2/7 7/8 8/10 **N=33**	-11	14.0										
	Fine to medium SAND with some gravel, minor silt; orange brown. Dense, moist. Poorly graded. Gravel is fine to medium, subangular, greywacke.							14.5										
	Fine to medium SAND with some gravel, minor silt;						-12											

Box 3, 9.6-12.7m

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH2

SHEET: 4 OF 7

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: 5430323.40 mN, 1749504.16 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits	Fine to medium SAND with minor silt and gravel; brown. Dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100													
				SPT	100	4/7 8/9 12/12 **N=41**		15.5										Box 4, 12.7-15.7m
	Fine SAND with minor silt and gravel; grey. Medium dense, moist. Poorly graded. Gravel is fine to medium, subangular, greywacke.						-13	16.0										
	Core loss.			SNC	52			16.5										
	Fine SAND with some gravel, minor silt; grey. Medium dense, moist. Subhorizontal bedding. Poorly graded. Gravel is fine to medium, subangular to subrounded, greywacke.			SPT	100	5/5 6/6 6/8 **N=26**	-14	17.0										
				SNC	100			17.5										
	Silty fine SAND with trace gravel; grey mottled brownish orange. Medium dense, moist. Subhorizontal bedding. Poorly graded. Gravel is fine to medium, subangular, greywacke.						-15	18.0										
				SPT	77	2/4 4/6 8/9 **N=27**		18.5					*18.30m:* changes to light grey.					Box 5, 15.7-18.8m
	Core loss.																	
	Gravelly fine to coarse SAND with trace silt; grey. Medium dense, moist. Gravel is fine to medium, angular to subangular, greywacke.						-16	19.0										
	Silty fine SAND with minor gravel; grey. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100			19.5										
	Core loss.					1/2 3/3 4/4 **N=14**	-17											

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

NZGD ID: BH_150985

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH2

SHEET: 5 OF 7

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: (NZTM2000) 5430323.40 mN 1749504.16 mE

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits	SILT with some gravel, minor sand and clay; grey mottled orange brown and brown. Medium dense, moist. Moderately plastic, slow dilatancy. Gravel is fine to coarse, angular, greywacke. Sand is fine.			SPT	0													
				SNC	100		-18	20.5										
								21.0										Box 6, 18.8-21.3m
	Core loss.			SPT	0	1/3 3/3 3/5 **N=14**		21.5										
	Silty fine SAND with some gravel; grey mottled dark grey. Medium dense, moist. Poorly graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	100		-19	22.0										
	Silty fine SAND with some organic material; grey mottled brown and black. Medium dense, moist. Poorly graded. Organic material is fibrous tree material.							22.5										
	Sandy SILT with some gravel; grey. Medium dense, moist. Sand is fine to medium. Gravel is fine to medium, angular, greywacke.			SPT	100	1/3 3/3 4/5 **N=15**	-20	23.0										
	SILT with some sand and gravel; grey mottled brownish orange. Medium dense, moist. Sand is fine to coarse. Gravel is fine to medium, angular to subrounded, greywacke.			SNC	100		-21	23.5					*24.20m:* changes to grey.					
								24.0										Box 7, 21.3-24.3m
	Gravelly SILT with some sand; brownish grey. Dense, moist. Gravel is fine to medium, subangular, greywacke. Sand is fine to coarse.			SPT	100	3/5 7/8 11/12 **N=38**		24.5										
							-22											

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: BH2

SHEET: 6 OF 7

Tonkin+Taylor

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: 5430323.40 mN, 1749504.16 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits	Gravelly fine SAND with minor silt; brownish orange. Dense, moist. Poorly graded. Gravel is fine to medium, subangular, greywacke.			SNC	100		-23	25.5										
	Core loss.			SPT	22	3/2 5/4 6/6 **N=21**		26.0										
	Fine to medium GRAVEL with some sand, minor silt; brownish orange. Medium dense, moist. Poorly graded. Sand is fine to coarse.			SNC	100		-24	26.5										
								27.0										Box 8, 24.3-27.4m
Torlesse Terrane	Moderately weathered, dark grey with orange ironstaining along defects, fine, SANDSTONE. Moderately strong. Defects are closely spaced, steeply inclined to very steeply inclined, ironstained and clay veneer on some defect surfaces.			SPT	100	15/35 for 55mm **N>=50** Solid		27.5										
				RC	100		-25	28.0										
								28.5										
	Core loss due to hole collapsing, core washed away.			SPT	0	21/29 for 50mm **N>=50** Solid	-26	29.0										
				RC	0			29.5										
							-27											

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH2

SHEET: 7 OF 7

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: To the west of Aotea Quay bridge, north of railway lines.

CO-ORDINATES: (NZTM2000) 5430323.40 mN 1749504.16 mE

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 01/10/2020

FINISH DATE: 02/10/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
	Solid cone SPT- no recovery.			SPT	0	18/28 50 for 45mm **N>=50** Solid												Bx:0, 27.4-32.2m
	30.2m: END OF BOREHOLE						-28 -29 -30 -31	30.5 31.0 31.5 32.0 32.5 33.0 33.5 34.0 34.5					*30.20m:* backfilled with grout, one PVC 50mm pipe was installed for shear wave velocity testing.					

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 30.2m

Scale 1:25

Rev.: A

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH2**

Hole Location: To the west of Aotea Quay bridge, north of railway lines.

PROJECT: Aotea Quay	LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: 5430323.40 mN (NZTM2000) 1749504.16 mE R.L.: 3.00m DATUM: NZVD2016	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 01/10/2020 HOLE FINISHED: 02/10/2020 DRILLED BY: ProDrill LOGGED BY: ANPO CHECKED: TH

0.00-6.55m

6.55-9.55m

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH2**

Hole Location: To the west of Aotea Quay bridge, north of railway lines.

PROJECT: Aotea Quay		LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: (NZTM2000)	5430323.40 mN 1749504.16 mE	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 01/10/2020 HOLE FINISHED: 02/10/2020 DRILLED BY: ProDrill
R.L.:	3.00m		
DATUM:	NZVD2016		LOGGED BY: ANPO CHECKED: TH

9.55-12.65m

12.65-15.65m

Tonkin+Taylor

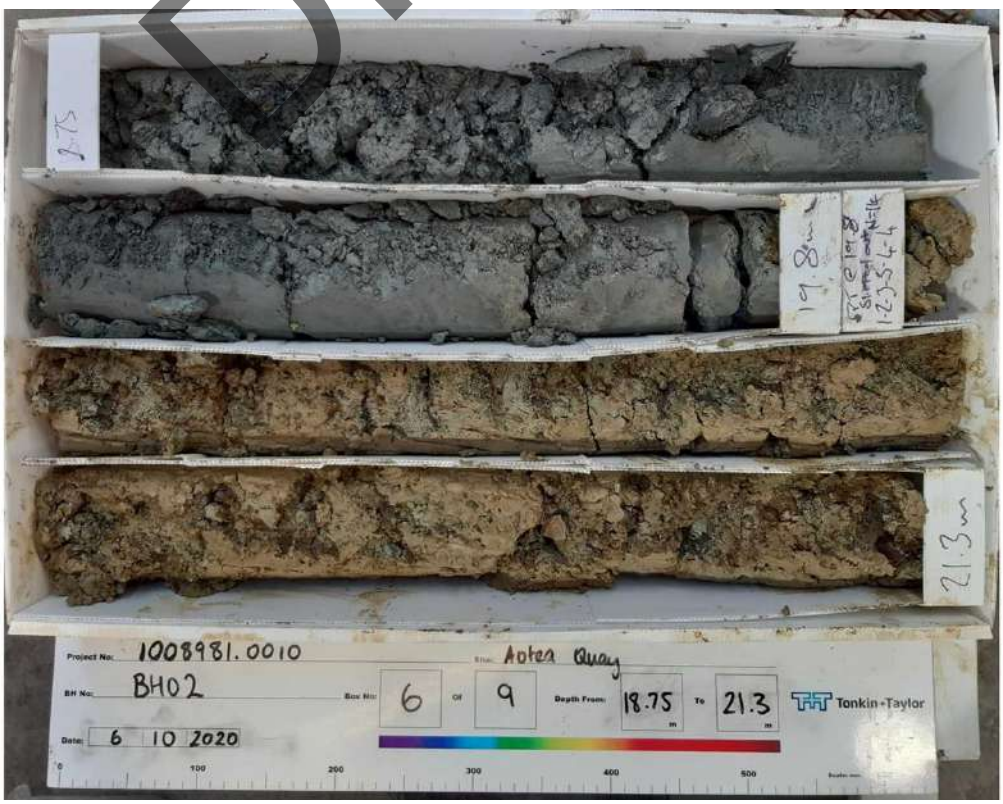
CORE PHOTOS

BOREHOLE No.: **BH2**

Hole Location: To the west of Aotea Quay bridge, north of railway lines.

PROJECT: Aotea Quay	LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: 5430323.40 mN (NZTM2000) 1749504.16 mE R.L.: 3.00m DATUM: NZVD2016	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 01/10/2020 HOLE FINISHED: 02/10/2020 DRILLED BY: ProDrill LOGGED BY: ANPO CHECKED: TH

15.65-18.75m



18.75-21.30m

NZGD ID: BH_150985

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH2**

Hole Location: To the west of Aotea Quay bridge, north of railway lines.

PROJECT: Aotea Quay		LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: (NZTM2000)	5430323.40 mN 1749504.16 mE	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 01/10/2020 HOLE FINISHED: 02/10/2020 DRILLED BY: ProDrill
R.L.:	3.00m		
DATUM:	NZVD2016		LOGGED BY: ANPO CHECKED: TH

21.30-24.30m

24.30-27.40m

NZGD ID: BH_150985

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH2**

Hole Location: To the west of Aotea Quay bridge, north of railway lines.

PROJECT: Aotea Quay	LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: 5430323.40 mN (NZTM2000) 1749504.16 mE R.L.: 3.00m DATUM: NZVD2016	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 01/10/2020 HOLE FINISHED: 02/10/2020 DRILLED BY: ProDrill LOGGED BY: ANPO CHECKED: TH

27.40-30.20m

BOREHOLE LOG

BOREHOLE No.: BH4

SHEET: 1 OF 2

Tonkin+Taylor

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: Beneath the northern end of Aotea Quay bridge off ramp, north of the railway tracks.

CO-ORDINATES: 5430425.00 mN, 1749519.00 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 4.00m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Chris

LOGGED BY: ANPO

CHECKED: TH

START DATE: 21/09/2020

FINISH DATE: 21/09/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	Medium to coarse GRAVEL; dark brown. Dense, moist. Poorly graded, subrounded, greywacke.																	
	Concrete core.							0.5										
Torlesse Terrane	Core loss.			RC	30													
							3	1.0										
				RC	0			1.5										
	Solid cone SPT.			SPT	0	9/15 16/18 16 for 50mm N>=50 Solid	2	2.0										
	Core loss.			RC	8			2.5										
							1	3.0										
	Moderately weathered, dark grey with orange ironstaining along defects, fine, SANDSTONE. Moderately strong. Defects are closely spaced, steeply inclined to very steeply inclined, ironstained and clay veneer on some defect surfaces.																	
	Solid cone SPT.					7/10 13/16 21 for 30mm N>=50 Solid		3.5										
	Moderately weathered, dark grey with orange ironstaining along defects, fine, SANDSTONE. Moderately strong. Defects are closely spaced, steeply inclined to very steeply inclined, ironstained and clay veneer on some defect surfaces.																	
	Core loss.			RC	10		0	4.0										
								4.5										

COMMENTS: 1. Hammer efficiency for the SPT hammer was 82.7%. 2. No casing.

Hole Depth 5.35m

Scale 1:25

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH4

SHEET: 2 OF 2

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: Beneath the northern end of Aotea Quay bridge off ramp, north of the railway tracks.

CO-ORDINATES: 5430425.00 mN, 1749519.00 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 4.00m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Chris

LOGGED BY: ANPO

CHECKED: TH

START DATE: 21/09/2020

FINISH DATE: 21/09/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Torlesse Terrane	Solid cone SPT.			SPT	0	12/17 17/23 10 for 50mm **N>=50**							*5.05m:* backfilled with grout.					Box 1, 0.0-5.4m
	5.35m: END OF BOREHOLE					Solid		5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5										

COMMENTS: 1. Hammer efficiency for the SPT hammer was 82.7%. 2. No casing.

Hole Depth 5.35m

Scale 1:25

Rev.: A

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH4**

Hole Location: Beneath the northern end of Aotea Quay bridge off ramp, north of the railway tracks.

PROJECT: Aotea Quay		LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: (NZTM2000)	5430425.00 mN 1749519.00 mE	DRILL TYPE: Kioti 1 DRILL METHOD: SNC	HOLE STARTED: 21/09/2020 HOLE FINISHED: 21/09/2020 DRILLED BY: ProDrill
R.L.:	4.00m		
DATUM:	NZVD2016		LOGGED BY: ANPO CHECKED: TH

0.00-5.35m

NZGD ID: BH_150987

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH3

SHEET: 1 OF 4

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: Near Hutt Road bus stop to the east of Aotea Quay bridge.

CO-ORDINATES: 5430378.00 mN, 1749514.44 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 28/09/2020

FINISH DATE: 29/09/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Fill	Hydro-excavation.	HVAC	0		2	0.5
						1.0
	Sandy fine to medium GRAVEL with minor silt; orange brown. Very loose, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.	SPT	33	1/0 1/0 1/0 N=2		1.5
	Core loss.					
	Sandy fine to medium GRAVEL with minor silt; orange brown. Very loose, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.	SNC	100		1	2.0
						2.5
Pleistocene Alluvium / Colluvium and Fan Deposits	Gravelly fine to coarse SAND with some silt; brown. Very dense, moist. Well graded. Gravel is fine to medium, angular, greywacke.	SPT	100	7/13 18/14 22 for 20mm N>=50	0	3.0
	Core loss.					
	Gravelly fine to coarse SAND with some silt; brown. Very dense, moist. Well graded. Gravel is fine to medium, angular, greywacke.	SNC	100			3.5
					-1	4.0
		SPT	94	10/11 17/20 13 for 55mm N>=50		4.5
	Core loss.					

ROCK DEFECTS: Defect Log; Fracture Spacing (mm); RQD (%); Description & Additional Observations

Fluid Loss (%); Water Level (29/09/2020); Casing; Installation (Box 1, 0.0-4.8m); Core Box No

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 17.1m

Scale 1:25

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH3

SHEET: 2 OF 4

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: Near Hutt Road bus stop to the east of Aotea Quay bridge.

CO-ORDINATES: 5430378.00 mN, 1749514.44 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 28/09/2020

FINISH DATE: 29/09/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits	Gravelly fine to coarse SAND with some silt; brown. Very dense, moist. Well graded. Gravel is fine to medium, angular, greywacke.																	
	Fine to coarse SAND with some silt and gravel; brown mottled brownish orange. Very dense, moist. Well graded. Gravel is fine to medium, angular to subangular, greywacke.			SNC	56			5.5					*5.30m:* changes to brown mottled light grey.					
	Core loss.																	
	Fine to medium GRAVEL with some sand, minor silt; brown. Very dense, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.			SPT	100	8/17 13/26 13 for 75mm **N>=50**	-3	6.0										
	Core loss.							6.5										
	Fine to medium GRAVEL with some sand, minor silt; brown. Very dense, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.			SNC	84		-4	7.0										
	Core loss.							7.5										
	Fine to medium GRAVEL with some sand, minor silt; brown. Very dense, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.			SPT	100	11/23 16/19 15 for 10mm **N>=50**												Box 2, 4.8-7.9m
	Core loss.						-5	8.0					*7.91m:* fines from core has been washed away leaving gravel clasts.					
	Fine to medium GRAVEL with some sand, minor silt; brown. Very dense, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.			SNC	100			8.5										
	Sandy fine to medium GRAVEL with trace silt; brown mottled light brown. Very dense, dry. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.						-6	9.0										
	Core loss.			SPT	77	10/13 13/8 11/10 **N=42**												
	Sandy fine to medium GRAVEL with trace silt; brown mottled light brown. Very dense, dry. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.							9.5										
	Sandy fine to medium GRAVEL with minor silt; brown. Dense, moist. Poorly graded, angular to						-7											

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 17.1m

Scale 1:25

Rev.: A

BOREHOLE LOG

BOREHOLE No.: BH3

SHEET: 3 OF 4

Tonkin+Taylor

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: Near Hutt Road bus stop to the east of Aotea Quay bridge.

CO-ORDINATES: 5430378.00 mN, 1749514.44 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 28/09/2020

FINISH DATE: 29/09/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Pleistocene Alluvium / Colluvium and Fan Deposits				SNC	100													
				SPT	66	6/9 10/9 7/8 **N=34**		10.5										
	Core loss.						-8	11.0										Box 3, 7.9-11.1m
	Sandy fine to medium GRAVEL with minor silt; brown. Dense, moist. Poorly graded, angular to subangular, greywacke. Sand is fine to coarse.																	
	Fine to medium GRAVEL with some sand, trace silt; orange brown. Very stiff, moist. Poorly graded. Sand is fine to coarse.			SNC	100			11.5										
				SPT	100	11/20 15/10 11/10 **N=46**	-9	12.0										
								12.5										
				SNC	100		-10	13.0										
	Silty fine to coarse GRAVEL with some sand; brown. Very dense, moist. Well graded, angular, greywacke. Sand is fine to coarse.							13.5										
	Fine to coarse GRAVEL with trace silt; brown. Very dense, moist. Well graded, angular, greywacke.			SPT	88	9/13 11/7 6/12 **N=36**	-11	14.0										Box 4, 11.1-14.2m
	Core loss.																	
	Fine to coarse GRAVEL with trace silt; brown. Very dense, moist. Well graded, angular, greywacke.							14.5										
	Silty fine to coarse GRAVEL with minor sand; brown. Very dense, moist. Well graded, angular, greywacke. Sand is fine to coarse.						-12											

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 17.1m

Scale 1:25

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: BH3

SHEET: 4 OF 4

PROJECT: Aotea Quay

JOB No.: 1008981.0010

LOCATION: Near Hutt Road bus stop to the east of Aotea Quay bridge.

CO-ORDINATES: 5430378.00 mN, 1749514.44 mE (NZTM2000)

DIRECTION: 90°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR: 3.30m

DATUM: NZVD2016

SURVEY: GIS\Web map viewer

DRILLED BY: Rodney

LOGGED BY: ANPO

CHECKED: TH

START DATE: 28/09/2020

FINISH DATE: 29/09/2020

CONTRACTOR: ProDrill

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
				SNC	100													Box 5, 14.2-15.5m
Torlesse Terrane	Slighly weathered, grey with orange and white between defects, fine SANDSTONE. Moderately strong. Defects are very closely spaced, steeply inclined to very steeply inclined, ironstained and clay veneer on some defect surfaces.			SPT	100	16/22 27/23 for 40mm **N>=50**	-13	15.5					*15.50 - 15.70m:* core disturbed through drilling process.					
	Unweathered, grey and greyish white, fine SANDSTONE. Moderately strong. Defects are very closely spaced, steeply inclined to very steeply inclined, clay veneer on few defect surfaces.			RC	100			16.0				0	15.75 - 15.80m: B, 20° dip, B 20°, PL, SM, N-VN, CN *15.90 - 16.06m:* core disturbed through drilling process. 16.05 - 16.15m: B, 80° dip, B 80°, ST, SM, N-VN, white clay infill 16.20 - 16.25m: B, 45° dip, B 45°, ST, SM, N-VN, white clay infill. 16.35 - 16.40m: B, 45° dip, B 45°, PL, SM, VN, white clay infill. 16.40 - 16.45m: B, 45° dip, B 45°, PL, SM, VN, white clay infill.					Box 6, 15.5-17.1m
				SPT	0	35/15 for 20mm **N>=50** Solid	-14	17.0					*16.10m:* core disturbed through drilling process.					
	17.1m: END OF BOREHOLE						-15	17.5 18.0 18.5					*17.10m:* backfilled with grout, sand and gravel. One PVC 50 mm pipe with a response zone between 1.5 - 4.7m bgl was installed for groundwater monitoring.					
							-16	19.0 19.5										

COMMENTS: 1. Hammer efficiency for the SPT hammer was 91.1%.

Hole Depth 17.1m

Scale 1:25

Rev.: A

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH3**

Hole Location: Near Hutt Road bus stop to the east of Aotea Quay bridge.

PROJECT: Aotea Quay		LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: (NZTM2000)	5430378.00 mN 1749514.44 mE	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 28/09/2020 HOLE FINISHED: 29/09/2020 DRILLED BY: ProDrill
R.L.:	3.00m		
DATUM:	NZVD2016		LOGGED BY: ANPO CHECKED: TH

0.00-4.84m

4.84-7.91m

NZGD ID: BH_150986

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH3**

Hole Location: Near Hutt Road bus stop to the east of Aotea Quay bridge.

PROJECT: Aotea Quay	LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: 5430378.00 mN (NZTM2000) 1749514.44 mE R.L.: 3.00m DATUM: NZVD2016	DRILL TYPE: Fraste DRILL METHOD: SNC	HOLE STARTED: 28/09/2020 HOLE FINISHED: 29/09/2020 DRILLED BY: ProDrill LOGGED BY: ANPO CHECKED: TH

7.91-11.05m

11.05-14.15m

NZGD ID: BH_150986

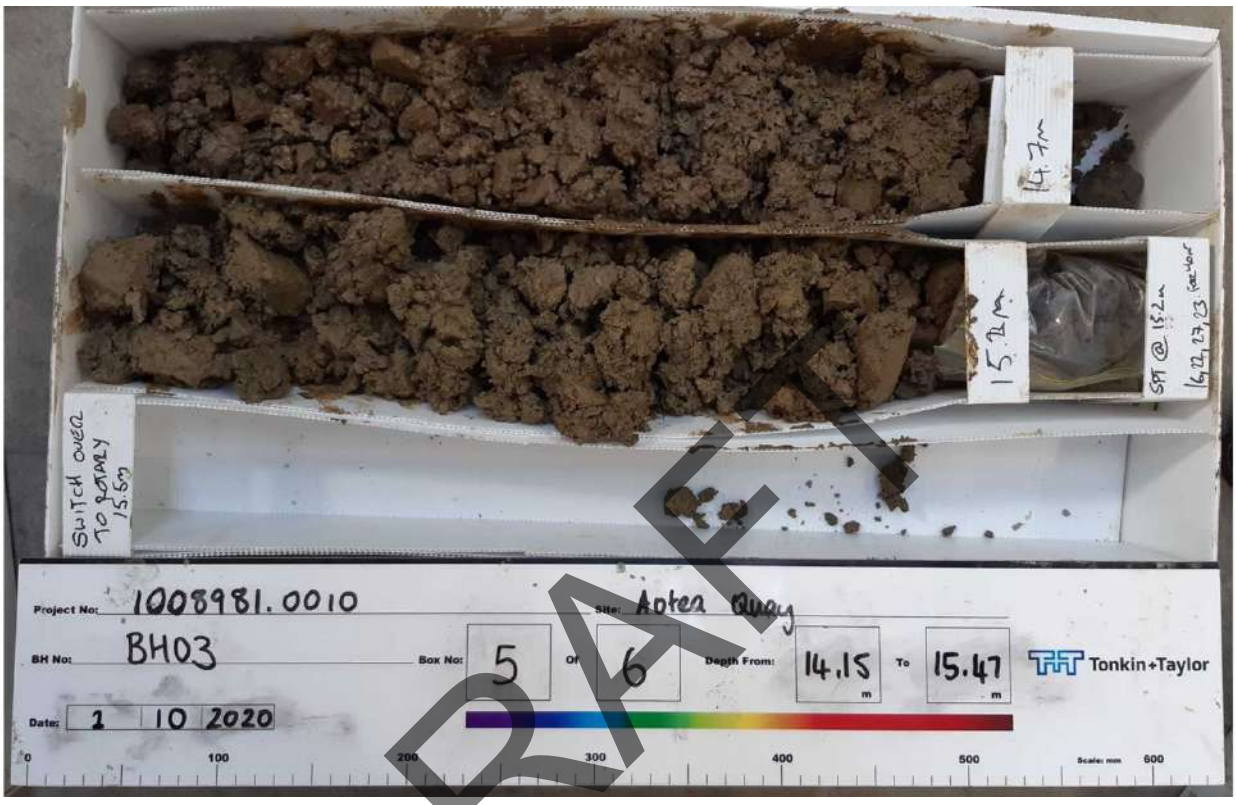
Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **BH3**

Hole Location: Near Hutt Road bus stop to the east of Aotea Quay bridge.

PROJECT: Aotea Quay	LOCATION: Aotea Quay, Wellington	JOB No.: 1008981.0010
CO-ORDINATES: 5430378.00 mN (NZTM2000) 1749514.44 mE	DRILL TYPE: Fraste	HOLE STARTED: 28/09/2020
R.L.: 3.00m	DRILL METHOD: SNC	HOLE FINISHED: 29/09/2020
DATUM: NZVD2016		DRILLED BY: ProDrill
		LOGGED BY: ANPO CHECKED: TH



14.15-15.47m

15.47-17.10m

NZGD ID: BH_150986

NZGD ID: TP_107044

Beca

TEST PIT LOG

TEST PIT No: **TP 2.15**

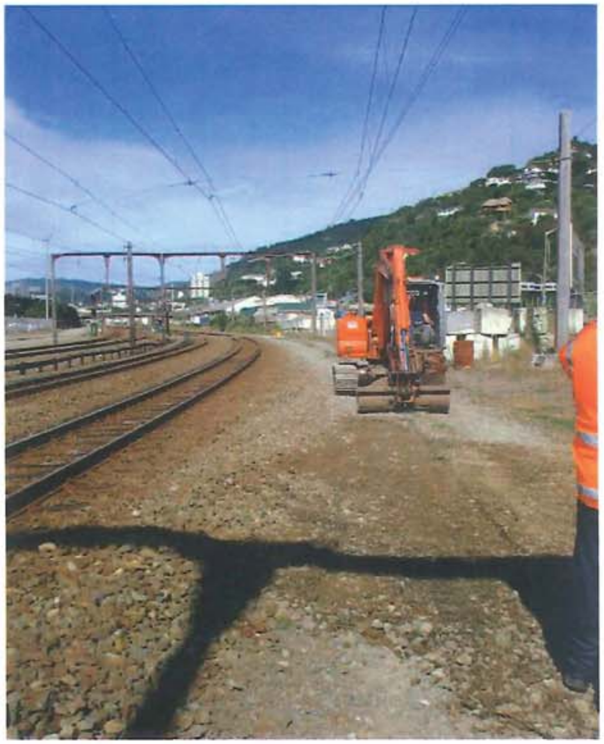
SHEET 1 of 1

PROJECT:	Wellington Station Entry Project 602	JOB NUMBER:	3320677/240
SITE LOCATION:	Wellington Station Yard	CLIENT:	ONTRACK
TESTPIT LOCATION:	Approx. 2.15 km from Wellington Station		
COORDINATES:	N 704,158 m E 300,928 m	R.L:	1.81 m
		DATUM:	Horizontal: Wellington Geodetic 1949; Vertical: Wellington 1953 (MSL)

GEOLOGICAL UNIT	R.L (m)	DEPTH (m)	WATER LEVEL	GRAPHIC LOG	CLASSIFICATION	MOISTURE	CONSISTENCY	SOIL DESCRIPTION	SAMPLES	Scala (Blows/150mm)	SV (kPa)	T (kPa)
Fill					GM	D	L	Loosely packed, 'loose', brown/grey silty sandy GRAVEL; dry, non plastic, gravel supported. Gravel: Moderately strong, MW-SW, grey, stained brown, fine gravel to cobble size, well graded, subangular greywacke.				
						M		Matrix at 0.2 m: Brown SILT, minor clay; moist, moderately plastic.				
					GM	W	L	Loosely packed, 'loose', brownish grey sandy GRAVEL, some silt; wet, non plastic, matrix supported. Gravel: Strong, SW, grey, minor black (coal?), medium to coarse, subrounded and subangular, greywacke. 1x rusted 200 mm bolt.	D1			
					GM	W	F	Firm, yellowish brown, silty sandy GRAVEL - BOULDERS, some clay; moist, highly plastic (matrix), cohesive matrix dominates behaviour. Gravel and boulders: Moderately strong, MW-SW, grey, stained orange, coarse gravel, cobbles, boulders, subangular.	D2			
	1				GM	W	F	Firm, yellowish brown, clayey silty sandy GRAVEL; wet, highly plastic (matrix), cohesive matrix dominates behaviour. Gravel: Moderately strong, MW-SW, grey, stained brown, fine to medium, minor coarse, well graded, subangular greywacke.	D3			
		1						Some cobbles and boulders (max. dia. 300 mm). Strong, MW-SW, grey stained brown, subangular and angular greywacke				
	0		▽ 23/2/08 (10:00 am)					End of Test Pit 1.85 m.				
		2										
	-1											

DATE DRILLED:	23/2/08	EXCAVATION METHOD: Hitachi EX60	COMMENTS: Pit located at 2.25 m offset west of NIMTL up main. Tidal conditions - falling
LOGGED BY:	JUB	CONTRACTOR: HRS	
PILCON VANE No:			

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET



Test Pit Photos

TP 2.15

NZGD ID: TP_107044

ENGEO Expect Excellence

LOG OF BORING BH01

Geotechnical Investigation
126 Hutt Road
Kaiwharawhara, Wellington
15926.000.000

Client : TM Consultants
Date : 11/03/2019
Hole Depth : 28.75 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 83 mm
Hammer Efficiency : 88.9 %
Logged By/Reviewed By : CM / RC
Latitude : -41.260061
Longitude : 174.790204

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	FILL			CONCRETE.									
			SP	Gravelly coarse SAND; dark brown. Poorly graded; gravel is medium to coarse, poorly graded, angular.									
			GP	CONCRETE.									
1.0		NR		Medium to coarse GRAVEL with trace sand; grey mixed brown. Poorly graded, angular to subangular; sand is coarse, poorly graded. Contains glass and cobbles of greywacke sandstone.	NR			-	3/2//1/1/1/1 N=4			25 50 75	
2.0				NO RECOVERY.									
			SW	Fine to coarse SAND with minor silt, minor gravel; brown. Well graded; gravel is fine to medium, poorly graded, angular to subangular.									
			GW	Sandy fine to coarse GRAVEL; brown mixed dark grey. Well graded, angular to rounded; sand is fine to coarse, well graded. Contains red brick and glass.					2/3//4/4/3/4 N=15				
4.0	MARGINAL MARINE DEPOSIT		SW	Gravelly fine to coarse SAND with minor silt; dark grey speckled white. Well graded; gravel is fine to coarse, well graded, angular to subrounded. Contains organics and shell fragments.				Medium Dense	5/6//6/5/5/5 N=21				
5.0			GP	Medium to coarse GRAVEL; dark grey. Poorly graded, angular to subangular.									
			SW	Gravelly fine to coarse SAND with minor silt; dark grey speckled white. Well graded; gravel is fine to coarse, well graded, angular to subrounded. Contains organics and shell fragments.					2/1//2/1/4/3 N=10				
6.5			PT	Fibrous PEAT.									
			SP	Fine to medium SAND with some silt, minor gravel; dark grey mottled brown speckled white. Poorly graded; gravel is fine to medium, poorly graded, subrounded. Contains organics and shell fragments.	NR			-					
7.5	COLLUVIUM		GW	NO RECOVERY.					6/9//5/4/2/3 N=14				
8.0				Fine to coarse GRAVEL with some sand; dark grey mixed grey. Well graded, subangular to rounded; sand is fine to coarse, well graded.				Medium Dense					
				8.50 m - Becomes brown mixed grey in colour.									
9.0									4/8//9/8/7/11 N=35				
9.5								Dense					
10.0													
10.5													

ENGEO Expect Excellence

LOG OF BORING BH01

Geotechnical Investigation
126 Hutt Road
Kaiwharawhara, Wellington
15926.000.000

Client : TM Consultants
Date : 11/03/2019
Hole Depth : 28.75 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 83 mm
Hammer Efficiency : 88.9 %
Logged By/Reviewed By : CM / RC
Latitude : -41.260061
Longitude : 174.790204

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
11.0	COLLUVIUM		GW	Fine to coarse GRAVEL with some sand; dark grey mixed grey. Well graded, subangular to rounded; sand is fine to coarse, well graded. 10.95 m - Becomes with trace sand.					4/9//11/7/7/8 N=33				
11.5				11.40 m - Becomes brown mixed dark grey in colour.				Dense					
12.0				12.00 m - Becomes with some sand.					5/9//10/5/8/8 N=31				
12.5			SW	Gravelly fine to coarse SAND with minor silt; grey. Well graded; gravel is fine to coarse, well graded, subangular to rounded.									
13.0				13.20 m - Becomes dark grey.									
13.5								Medium Dense	5/7//7/6/2/2 N=17				
14.0													
14.5			GP	Medium to coarse GRAVEL; dark grey. Well graded, angular to subrounded.									
			GW	Sandy fine to coarse GRAVEL with minor silt; grey. Well graded, subangular to rounded; sand is fine to coarse, well graded.									
15.0									9/10//50 for 50 mm N=50+				
15.5			GP	Fine to coarse GRAVEL; dark grey. Well graded, angular to subrounded.									
			GW	Sandy fine to coarse GRAVEL; grey mixed brown. Well graded, angular to rounded. Contains cobbles.									
16.0													
16.5									6/10//50 for 35 mm N=50+				
17.0								Very Dense					
17.5													
18.0									8/12//13/37 for 70 mm N=50+				
18.5													
19.0				18.70 m - Becomes brown mixed dark grey.									
19.5									5/10//11/10/9/8 N=38				
20.0			SW	Gravelly fine to coarse SAND with minor silt; brown mixed dark grey. Well graded; gravel is fine to medium, poorly graded, subangular to rounded. Contains cobbles.				Dense					
20.5													
21.0													

NZGD ID: BH_150357

ENGEO Expect Excellence

LOG OF BORING BH01

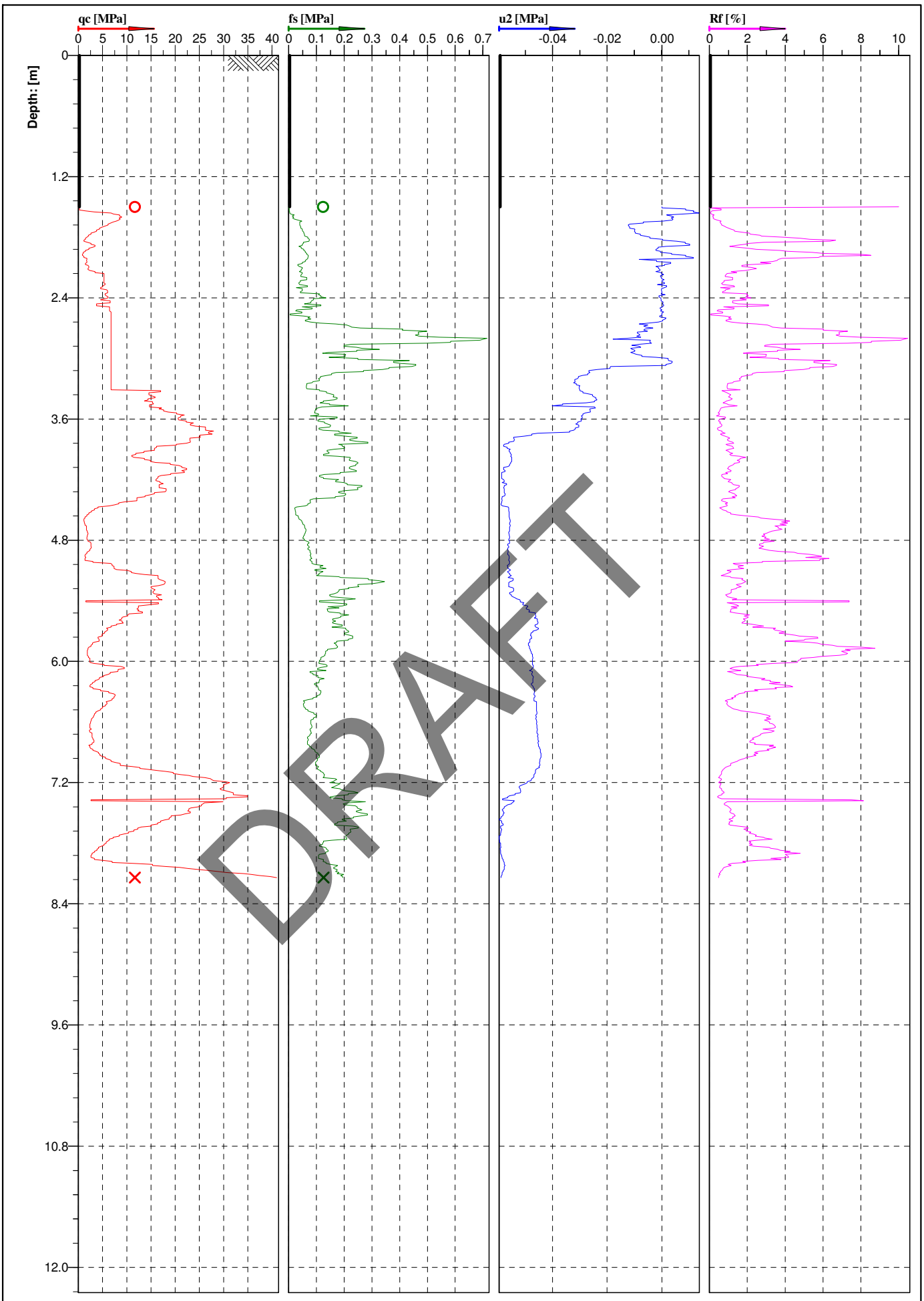
Geotechnical Investigation
126 Hutt Road
Kaiwharawhara, Wellington
15926.000.000

Client : TM Consultants
Date : 11/03/2019
Hole Depth : 28.75 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 83 mm
Hammer Efficiency : 88.9 %
Logged By/Reviewed By : CM / RC
Latitude : -41.260061
Longitude : 174.790204

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
21.5	COLLUVIUM		GP	Medium to coarse GRAVEL with trace sand; brown mixed grey. Poorly graded, angular to subrounded.				Medium Dense	4/6//6/5/4/2 N=17			25 50 75	
22.0			GW	Sandy fine to coarse GRAVEL with trace silt; brown mixed dark grey. Well graded, angular to subrounded; sand is fine to coarse, well graded.				Very Dense					
22.5									6/6//4/6/40 for 10 mm N=50+				
23.0	GREYWACKE SANDSTONE		GW	Completely weathered Greywacke SANDSTONE recovered as sandy fine to coarse GRAVEL; brown mixed grey. Well graded, subangular to rounded; sand is coarse, poorly graded.									
23.5				Highly weathered, weak, reddish brown Greywacke SANDSTONE. Highly fractured joints are very closely spaced, planar and rough.									
24.0									50 for 5 mm N=50+				
24.5													
25.0													
25.5													
26.0								-					
26.5				Moderately weathered, weak, grey SANDSTONE. Fractured joints are moderately spaced, planar and rough.									
27.0													
27.5													
28.0													
28.5													

End of Hole Depth: 28.75 m
Termination: Target depth



Location: Inside Building	Position: -, -	Ground level: 0.00	Test No.: TEST2
Project ID: 2	Client:	Date: 22/03/2019	Scale: 1 : 50
Project: 126 Hutt Rd		Page: 1/1	Fig.:
		File: cpt1 spotlight round 2.cpt	

GRIFFITHS DRILLING

u2

Cone No: 5336
Tip area [cm2]: 10
Sleeve area [cm2]: 150

ENGEO Expect Excellence

LOG OF BORING BH02

Geotechnical Investigation
126 Hutt Road
Kaiwharawhara, Wellington
15926.000.000

Client : TM Consultants
Date : 13/03/2019
Hole Depth : 30.5 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 83 mm
Hammer Efficiency : 88.9 %
Logged By/Reviewed By : CM / RC
Latitude : -41.260019
Longitude : 174.791046

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	-	NR		JET VACUUM.				-					
1.5	FILL		SW	Gravelly fine to coarse SAND with some silt; brown. Well graded; gravel is fine to medium, poorly graded, angular to subangular.					2/1//2/1/1/1 N=5				
2.5				2.40 m - Becomes light brown in colour.				Loose					
3.0			GW	Sandy fine to coarse GRAVEL; light brown mixed grey. Well graded, angular to subrounded; sand is fine to coarse, well graded.					4/2/2/2/1/1 N=6				
3.5	MARGINAL MARINE DEPOSIT		GW	Fine to coarse GRAVEL with some sand; dark grey. Well graded, angular to rounded; sand is medium to coarse, poorly graded.									
5.0			GW	Sandy fine to coarse GRAVEL; light brown mixed grey. Well graded, angular to subrounded; sand is fine to coarse, well graded.				Medium Dense	6/3//4/3/4/2 N=13				
6.5			PT	Fibrous PEAT.				-	4/2//1/3/3/3 N=10				
			SW	Fine to coarse SAND with some gravel, some silt; dark grey speckled white. Well graded; gravel is fine to medium, poorly graded, subangular to rounded. Contains shell fragments and organics.									
7.5				7.50 m - Becomes minor gravel.				Loose	3/1//1/1/2/2 N=6				
8.0			PT	Fibrous PEAT.				-					
8.5			SW	Fine to coarse SAND with some silt, minor gravel; dark grey speckled white. Well graded; gravel is fine to medium, poorly graded, subangular to rounded. Contains shell fragments and organics.									
9.0								Medium Dense	2/2//2/3/3/5 N=13				
10.5													

GEOSCIENCE MACHINE BORING 15926 - BH LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/26/19

ENGEO Expect Excellence

LOG OF BORING BH02

Geotechnical Investigation
126 Hutt Road
Kaiwharawhara, Wellington
15926.000.000

Client : TM Consultants
Date : 13/03/2019
Hole Depth : 30.5 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 83 mm
Hammer Efficiency : 88.9 %
Logged By/Reviewed By : CM / RC
Latitude : -41.260019
Longitude : 174.791046

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
11.0	COLLUVIUM		GW	Sandy fine to coarse GRAVEL; dark grey mixed grey. Well graded; angular to subrounded; sand is fine to coarse, well graded.					5/4//3/3/5/7 N=18				
11.5				10.95 m - Becomes some sand and contains cobbles.									
12.0								Medium Dense	4/4//5/5/8/8 N=26				
12.5													
13.0													
13.5									3/4//7/7/9/14 N=37				
14.0								Dense					
14.5													
15.0									6/3//2/6/5/5 N=18				
15.5								Medium Dense					
16.0													
16.5									9/9//14/17/19 for 50 mm N=50+				
17.0								Very Dense					
17.5				17.50 m - Becomes grey mixed brown.									
18.0									7/8//9/9/10/13 N=41				
18.5													
19.0													
19.5								Dense	7/12//10/11/10/12 N=43				
20.0													
20.5													
21.0													

GEOSCIENCE MACHINE BORING 15926 - BH LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/26/19

ENGEO Expect Excellence

LOG OF BORING BH02

Geotechnical Investigation
126 Hutt Road
Kaiwharawhara, Wellington
15926.000.000

Client : TM Consultants
Date : 13/03/2019
Hole Depth : 30.5 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 83 mm
Hammer Efficiency : 88.9 %
Logged By/Reviewed By : CM / RC
Latitude : -41.260019
Longitude : 174.791046

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
21.5	COLLUVIUM		GW						5/9//9/7/7/8 N=31				
			GP	Medium to coarse GRAVEL; dark grey. Poorly graded, angular to subrounded.				Dense					
			GW	Sandy fine to coarse GRAVEL; dark grey mixed grey. Well graded; angular to subrounded; sand is fine to coarse, well graded.									
22.0				NO RECOVERY.	NR			-					
22.5			SM	Silty fine to medium SAND; light grey. Poorly graded.				Medium Dense	2/2//2/3/3/3 N=11				
23.0													
23.5													
24.0			GW	Sandy fine to coarse GRAVEL; brown. Well graded, angular to subrounded; sand is fine to coarse, well graded.				Very Dense	16/19//24/25/1 for 5 mm N=50+				
24.5													
25.0	GREYWACKE SANDSTONE		SW	Completely weathered SANDSTONE recovered as gravelly fine to coarse SAND; dark grey. Well graded; gravel is fine to medium, poorly graded, subangular to subrounded.									
25.5				Moderately weathered, weak, dark grey SANDSTONE. Fractured joints are moderately spaced, planar and rough.					50 for 70 mm N=50+				
26.0													
26.5			GW	Completely weathered SANDSTONE recovered as sandy fine to coarse GRAVEL; dark grey. Well graded, angular to subangular; sand is fine to coarse, well graded.									
27.0													
27.5								-					
28.0													
28.5													
29.0			GW	Moderately weathered, weak, dark grey SANDSTONE. Fractured joints are moderately spaced, planar and rough.									
29.5				Completely weathered SANDSTONE recovered as sandy fine to coarse GRAVEL; dark grey. Well graded, angular to subangular; sand is fine to coarse, well graded.									
30.0													
30.5				End of Hole Depth: 30.5 m Termination: Target depth									

GEOSCIENCE MACHINE BORING 15926 - BH LOGS.GPJ NZ DATA TEMPLATE 2.GDT 3/26/19

NZGD ID: BH_150358

TONKIN & TAYLOR LTD.

EXCAVATION LOG

EXCAVATION NO: TP1

SHEET 1 OF 1

PROJECT: ONTRACK SUBSTATIONS | LOCATION: KAIWHARAWHARA | JOB NO: 84616

CO-ORDINATES: See Fig. 2.2 | EXPOSURE TYPE: TEST PIT | HOLE STARTED: 27-8-08

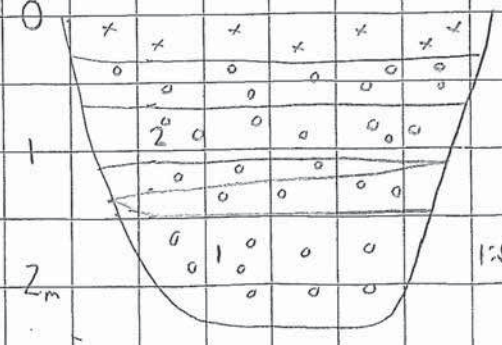
EQUIPMENT: 8t | HOLE FINISHED: 27-8-08

OPERATOR: HRS | LOGGED BY: GRH

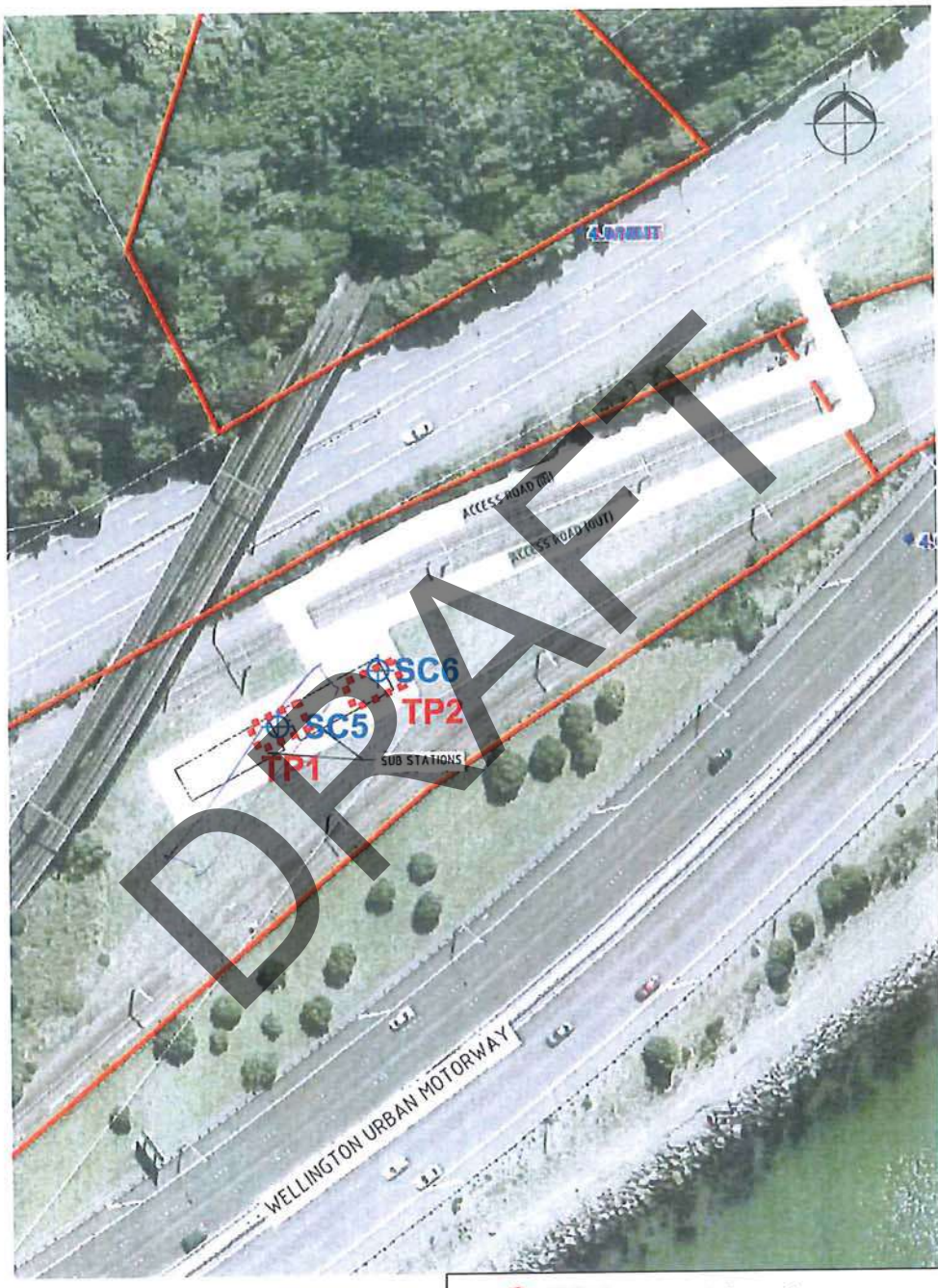
RL: | DATUM: | EXCAVATION DIMENSIONS: 2.2md, 4mL, 2mW | CHECKED BY: NP

EXCAVATION AND TESTS				ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	RL (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa (10 25 100 200)	ORIGIN TYPE, MINERAL COMPOSITION, DETECTS, STRUCTURE	UNIT
	N/A	▽	SC S.	0.3		—	SILT. Brown. Top soil	M	—		FILL. (Reclaimation) ?	1
				0.6		GP	GRAVEL. Dark brown. Medium. Metal.	D	MD			2
				1		GW	GRAVEL. Grey. Medium to coarse angular greywacke.	D	MD/D			
				1.2		GW	GRAVEL. Light orange-brown. Medium angular greywacke.	M	MD/D			
				1.4		GW	GRAVEL. Grey. Medium to coarse angular greywacke.	M	MD/D			
				2		GW	GRAVEL, Minor silt. Orange brown. Medium to coarse angular greywacke.	W	MD.		FILL ?	3
							EOTP @ 2.2m - Refusal					

SKETCH



NZGD ID: TP_101991



TP1 Test pit locations

SC1 Scala penetrometer Test

Not to scale

Tonkin & Taylor Environmental & Engineering Consultants Hamilton Wellington Dunedin Nelson Christchurch Auckland Tauranga	DRAWN	GEH	05/12
	DRAFTING CHECKED	MJP	09/12
	APPROVED		
	CADFILE: Figures.ppt		
	SCALES (AT A4 SIZE) As shown		
	PROJECT No. 84616	FIG. No. Figure 2.2 – Kaiwharawhara Site	REV. 0

ONTRACK SUBSTATIONS

Geotechnical Investigations

NZGD ID: TP_101991

C

Appendix C – Historical Investigations: Thorndon Quay

C.1 Previous Geotechnical Investigations in Proximity to Thorndon Quay.

NZGD ID	Consultant	Year	Location	Type	Depth (m)
BH_88550	Tonkin & Taylor Ltd	2013	33 Lambton Quay	Machine Borehole	25.50
BH_88552	Aurecon	2014	33 Lambton Quay	Machine Borehole	10.67
BH_88788	Tonkin & Taylor Ltd	2013	33 Lambton Quay	Machine Borehole	25.45
BH_72662	Connell Wagner Ltd	1996	Wellington Railway Station	Machine Borehole	18.00
BH_131204	Beca Ltd	1986	Thorndon Quay and Featherston St Intersection	Machine borehole	28.30
BH_72654	ENGEO Ltd	2015	Wellington Railway Station	Machine Borehole	24.42
CPT_130607	Beca Ltd	1997	Westpac Trust Stadium	CPT	4.80
BH_131205	Beca Ltd	1986	Wellington Railway Station	Machine Borehole	23.00
CPT_156073	McMillian Drilling	2020	81 Thorndon Quay	CPT	5.39
BH_136415	ENGEO Ltd	2018	121 Thorndon Quay	Machine Borehole	20.00
HA01-02	ENGEO	2018	121 Thorndon Quay	Hand Auger	0.45
BH_107036	Beca Ltd	2008	Wellington Station Entry	Borehole	8.45
TP_107039	Beca Ltd	2008	Wellington Station Entry	Test Pit	2.00
TP_107040	Beca Ltd	2008	Wellington Station Entry	Test Pit	1.80
HA_106180	Tonkin & Taylor Ltd	2000	2 Tinakori Road	Hand Auger	1.35

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: To the south od Rutherford House
SHEET 1 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990433 mN, 2659017 mE
R.L.: approx. 3.0m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 31/8/13
HOLE FINISHED: 1/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: EBB CHECKED: NCP

GEOLOGICAL									ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
PAVEMENT																Asphalt
RECLAMATION FILL		1/9	0	Jet Vac							M	N/A				GRAVEL with some sand; brown. Moist, poorly graded. Gravel is medium to coarse grained with some cobbles.
			67	SPT		N=4										Silty, sandy GRAVEL; brown. Loose, moist, well graded. Gravel is fine to coarse grained, angular to sub-angular. Sand is fine to medium grained.
			57	HFC												Core loss.
MARINE DEPOSITS			73	SPT		N=12					M	MD				SAND with some shell fragments and thin layers of brown organic silt; dark grey. Medium dense, wet. Sand is fine to medium. grained
											M					Organic SILT; dark brown and light grey. Moist. Low plasticity. Wood/fibrous. PI=12, LL=45, WC=32.3%, FC=92.36%
			67	SPT		N=11					M	MD				GRAVEL; dark to light brown. Medium dense, poorly graded. Gravel is fine to medium grained.
PLEISTOCENE ALLUVIUM											M	MD				SAND with some shell fragments and thin layers of brown organic silt; dark grey. Medium dense, wet. Sand is fine to medium. grained
			89	SPT		N>50					M	S				Clayey organic SILT with traces of wood/fibrous; dark brown matrix.
											M	VD				Gravelly SAND; blue. Very dense, moist, poorly graded. Sand is fine to coarse

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BOREHOLE 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: To the south od Rutherford House
SHEET 2 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990433 mN 2659017 mE
R.L.: approx. 3.0m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 31/8/13
HOLE FINISHED: 1/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: EBB CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	WEATHERING / MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM			78	SPT		N=49			5.5			M	D				grained, angular. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
			84	SPT		N=39						M					Silty GRAVEL with some sand. Dense, moist, poorly graded. Sand is fine to coarse grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke. Sand is fine to coarse.
												M	D				SILT with some wood fibers; grey.
			100	HFC					6.0			M					Gravelly SAND. Sand is fine to coarse grained. Dense. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
									6.5								SILT; grey. Medium to high plasticity.
												M	VS				PEAT; dark brown.
			100	SPT		N=14			7.0			M	St				SILT becoming sandier with depth; grey. Sand is fine grained. PI=7, LL=35, WC=30.4%, FC=95.5%
			100	HFC					7.5								
									8.0								
			73	SPT		N=23			8.5			M	VSt				Gravelly SILT with minor sand. Very stiff, moist. Sand is fine to coarse grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
												M					SILT; grey.
			100	HFC					9.0								
												M					Silty GRAVEL with minor sand; grey. Moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
									9.5								
									10								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: To the south od Rutherford House
SHEET 3 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990433 mN 2659017 mE
R.L.: approx. 3.0m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 31/8/13
HOLE FINISHED: 1/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: EBB CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING / STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM			67	SPT		N>50			10.5								Silty GRAVEL with minor sand; grey. Moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
			100	HFC					11.0								10.5
												M					11.0 GRAVEL; bluish grey. Gravel is medium to coarse grained.
			89	SPT		N>50			11.5			M	VD				11.5 Silty GRAVEL with minor sand; grey. Very dense, moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke. Thin beds (100mm thick) of silt throughout.
			100	HFC					12.0								12.0
												M					SILT with minor sand and traces of wood fibres. Sand is fine to medium grained. Low plasticity.
									12.5								12.5
												M	VD				Silty GRAVEL with minor sand; grey. Very dense, moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
			89	SPT		N>50			13.0								13.0
												M					SILT with some gravels and traces of wood fibres; grey. Gravel is fine to medium grained. Low plasticity.
			100	HFC					13.5			M	S				13.5 PEAT; dark brown.
												M					SILT with trace shell fragments; grey.
									14.0								14.0
			93	SPT		N>50			14.5			M	VSt				14.5 SILT with minor sand becoming gravelly with depth; grey. Very Stiff. Sand is fine to medium grained.
									15								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: To the south od Rutherford House
SHEET 4 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990433 mN, 2659017 mE
R.L.: approx. 3.0m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 31/8/13
HOLE FINISHED: 1/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: EBB CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	WEATHERING: MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM			100	HFC					15.5			M	VD				Silty GRAVEL with minor sand; grey. Very dense, moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
			89	SPT		N>50			16.0			M	VD				SAND; grey. Very dense, moist.
												M	VD				Silty GRAVEL with minor sand; grey. Very dense becoming medium desne, moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke. Becoming medium dense with depth.
			100	HFC					16.5								
									17.0								
			67	SPT		N=23			17.5								
			100	HFC					18.0			M					SILT; bluish grey. Low plasticity.
									18.5								- becoming mottled greenish bluish grey.
												M					SILT with minor gravel; bluish dark grey. Gravel is fine grained.
			67	SPT		N=39			19.0								- becoming very dense; greenish grey. Gravel is fine grained.
																	- bluish dark grey. Well graded gravels.
												M					Sandy SILT; greenish grey. Low plasticity. Sand is fine grained.
												M					
			100	HFC					19.5								Silty GRAVEL with minor sand; grey. Moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
									20								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: To the south od Rutherford House
SHEET 5 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990433 mN, 2659017 mE
R.L.: approx. 3.0m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 31/8/13
HOLE FINISHED: 1/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: EBB CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM									20.5			M					Clayey SILT; bluish grey. Sand is fine to coarse grained. High plasticity.
			78	SPT		N=23						M	VSt				- becoming dark grey with some gravels. Soft. Gravel is fine to medium grained.
									21.0								SILT; greenish grey. Very stiff, moist. Low plasticity.
			100	HFC					21.5			M					Sandy SILT; brown. Sand is fine grained. Medium plasticity.
												M	VD				Sandy, silty GRAVEL with minor sand; grey. Very dense, moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
			53	SPT		N>50			22.0								
									22.5			M	VD				GRAVEL with minor silt and sand; bluish grey. Very dense.
																	- becoming grey. Gravel is angular, cemented.
									23.0								
			93	SPT		N>50			23.5			M	St				SILT with minor sand; grey. Hard, moist.
												M					PEAT, brown. Stiff, moist. Wood fibres.
												M	H				SILT with minor sand; grey. Stiff, moist. Low plasticity.
									24.0								
			100	HFC					24.5			M					Silty GRAVEL with minor sand; grey. Moist, well graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
									25								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: To the south od Rutherford House
SHEET 6 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990433 mN, 2659017 mE
R.L.: approx. 3.0m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 31/8/13
HOLE FINISHED: 1/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: EBB CHECKED: NCP

GEOLOGICAL									ENGINEERING DESCRIPTION								
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
PLEISTOCENE ALLUVIUM			44	SPT		N>50										Refusal.
								25.5								End of borehole (target depth reached 25.5m). Standpipe installed.
								26.0								
								26.5								
								27.0								
								27.5								
								28.0								
								28.5								
								29.0								
								29.5								
								30								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

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New Zealand
Tel: +64 4 472 9589
www.aurecongroup.com

Client: **Victoria University of Wellington**
Project: **Rutherford House**
Location: **23 Lambton Quay, Wellington**
Project Reference: **240174**

BH14I-01

Sheet **1** of **3**

BOREHOLE INFORMATION
Drilling Method: Triple tube
Diameter Core: HQ (63.5mm)
Contractor: Webster Drilling Limited

CO-ORDINATES: N/A
Easting: 1748996.8m
Northing: 5428751.5m
Ground Level: -.7m

Date Started: 22/04/2014
Date Completed: 23/04/2014
Inclination: Vertical, 90°
Orientation: N/A°

Logged by: AGM & AP
Input by: A. Putra
Checked by: D. Molnar
Verified by: D. Molnar

Method/Date	R.L. (m)	Length (m)	Sample	Graphic Log	Layer Code	Material Description	Weathering/USC	In Situ Testing	MC (%)	TCR (%)	SCR (%)	RQD (%)	Fracture Spacing (VWS, WS, MWS, CS, VCS, ECS)	Stratigraphy / Defect Description (Dip recorded as maximum inclination of feature from horizontal.)	Installation
CC	-1					**0m:** CONCRETE. Approximately 3cm of dark brown concrete layer at the bottom (Water proofing layer?).	.			100				0m: FILL?	
SPT		1	W			**0.5m:** Fine to coarse GRAVEL; brown. Medium dense, dry to moist; subangular. Fines washed away during drilling? Minor plastic fragments.	GW	5// 6/ 7/ 4/ 4 N = 21		47					
							.			0					
SPT	-2		W			**1m:** Fine to coarse GRAVEL; brown. Medium dense, moist; subangular. Fines washed away during drilling?	GW	14// 15/ 6/ 4/ 2 N = 27		84					
							.			0					
SPT		2	W			**1.5m:** Sandy fine to coarse GRAVEL with minor silt; bluish grey. Dense, moist; subangular to angular; sand, fine to coarse; intermixed with rare wood fragments.	GW	8// 5/ 10/ 10/ 19 N = 44		75				1.5m: ALLUVIUM	
							.			0					
PUSH	-3					**2m:** PUSH TUBE (2m to 2.35m). Description: Silty fine to coarse GRAVEL; bluish grey. Dense, wet; subrounded to subangular. **2.15m:** SILT with some sand; bluish grey. Very stiff, moist; low plasticity; sand, fine.	GW ML	105/82.5 kPa		100					
W							.			0					
SPT		3				**2.5m:** Sandy fine to medium GRAVEL with minor silt; dark grey. Very dense, moist; subrounded to angular; sand, fine to coarse; intermixed with rare wood fragments.	GW	36// 26/ 24 for 25mm N = 50+		96					
W							.			0					
SPT	-4		W			**3m:** SILT with some sand and gravel; grey. 'Very stiff', moist; non-plastic; gravel, fine to medium, subrounded to angular; sand, fine to medium; intermixed with trace of organics. **Atterberg Limits:** LL = 19, PI = 'Non-plastic' **WC:** 22.6% **FC:** 44%	ML	22// 8/ 6/ 5/ 5 N = 24	23	71				3m: ATTERBERG LIMITS, MOISTURE CONTENT, FINES CONTENT SAMPLE	
							.			0					
PUSH		4				**3.5m:** PUSH TUBE. Description from lab technician: SILT with minor to some clay and some sand, minor organics, very stiff, grey mixed with dark brown, high plasticity. **TRIAXIAL TEST** **Atterberg Limits:** (3.5m-3.58m) LL = 68, PI = 30 **WC:** 48.9% **FC:** 86%	MH			100				3.5m: TRIAXIAL TEST, ATTERBERG LIMITS, MOISTURE CONTENT, FINES CONTENT SAMPLE	
W							.			0					
SPT	-5		W			**4m:** SILT; grey. 'Very stiff', moist; low plasticity.	ML	7// 7/ 4/ 7/ 8 N = 26		2					
							.			0					
SPT		5	W			**4.5m:** SILT; brownish grey. 'Hard', moist; low to moderate plasticity. **WC:** 20.0% **4.67m:** Grades to: Silty fine to medium SAND with some gravel; brownish grey. Very dense, moist; gravel, fine to medium, subrounded to subangular; intermixed with trace of organics. (Logged after MC test, top and bottom are unknown)	ML SW	4// 14/ 26/ 10 for 30mm N = 50+	20	100				4.5m: MOISTURE CONTENT SAMPLE	
							.			0					

REMARKS:
1. Refer to site location plan for borehole locations.
2. Coordinates are approximated from Google Earth converted into NZTM Projection, RL is taken from architect's drawing 'P0.50B-A, exact RL: -0.706m.
3. Logged in general accordance to NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength/consistency description in "inverted commas" are inferred from SPT blow count and logging diagnostics.
5. Dashed line shows inferred boundary.
6. Method legend: CC (Concrete Core), SPT (Standard Penetration Test), W (Wash Drilling), PUSH (Push Tube Sample).
7. Lab Tests Legend: LL=Liquid Limit, PI=Plasticity Index, WC=Water Content, FC=Fines Content passing 0.075mm test sieve.

Water Level Readings mbgl
(1) 23/04/2014 at 3.40m (AM)
(2) 24/04/2014 at 2.20m (PM)

Log Scale 1:25

Database File: 240174 BH LOGS_VER2.GPJ **Library file:** AURECON LIBRARY 2011-06-03(1).GLB **Template File:** AURECON DH LOG V3.0 **Date Generated:** 4/06/2014

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Client: **Victoria University of Wellington**
Project: **Rutherford House**
Location: **23 Lambton Quay, Wellington**
Project Reference: **240174**

BH14I-01

Sheet **2** of **3**

BOREHOLE INFORMATION
Drilling Method: Triple tube
Diameter Core: HQ (63.5mm)
Contractor: Webster Drilling Limited

CO-ORDINATES: N/A
Easting: 1748996.8m
Northing: 5428751.5m
Ground Level: -.7m

Date Started: 22/04/2014
Date Completed: 23/04/2014
Inclination: Vertical, 90°
Orientation: N/A°

Logged by: AGM & AP
Input by: A. Putra
Checked by: D. Molnar
Verified by: D. Molnar

Method/Date	R.L. (m)	Length (m)	Sample	Graphic Log	Layer Code	Material Description	Weathering/USC	In Situ Testing	MC (%)	TCR (%)	SCR (%)	RQD (%)	Fracture Spacing (VWS WS MWS CS VCS EOS)	Stratigraphy / Defect Description (Dip recorded as maximum inclination of feature from horizontal.)	Installation
SPT	-6					**5m:** Silty fine to medium SAND with some gravel; brownish grey. Very dense, moist; gravel, fine to coarse, subangular to angular; intermixed with trace of organics. **WC:** 19.2%	SP	21// 9/ 11/ 20 for 65mm N = 50+	19	82				5m: ALLUVIUM MOISTURE CONTENT SAMPLE	
W							.			0					
SPT		6				**5.75m:** Sandy SILT; grey. 'Hard', moist; non-plastic; sand, fine; interbedded with rare, sub-horizontal organic SILT layers (<30mm, dark brown). **5.83m:** Grades to: fine to medium SAND with some silt; grey. Very dense, moist. **5.91m:** Grades to: SILT; greyish brown. 'Hard', moist; low to moderate plasticity. **5.96m:** Grades to: Sandy fine to medium GRAVEL; bluish grey. Very dense, moist; subrounded to subangular; sand, fine to coarse.	ML SP ML GW	7// 6/ 23/ 21 for 30mm N = 50+		100					
W	-7									0					
SPT						**6.5m:** Sandy fine to coarse GRAVEL; grey. Very dense, moist; subrounded to subangular; sand, fine to coarse.	GW	50 for 145mm N = 50+		100					
W		7					.			0					
SPT	-8					**7.25m:** Gravelly fine SAND; grey. Dense, moist; gravel, fine to coarse, subrounded to subangular; intermixed with rare organics. **WC:** 22.5% **7.45m:** Grades to: Fine SAND with some silt; grey. Dense, moist; Intermixed with trace of organics. (Logged after MC test, top and bottom are unknown)	SP SM	5// 10/ 8/ 9/ 11 N = 38	23	84				7.25m: MOISTURE CONTENT SAMPLE	
W		8					.			0					
SPT	-9					**8m:** Silty fine SAND; grey. Medium dense, moist. **WC:** 28.7% **8.25m:** Grades to SILT; grey. 'Very stiff', moist; low to moderate plasticity. (Logged after MC test, top and bottom are unknown)	SM ML	9// 6/ 6/ 7/ 10 N = 29	29	89				8m: MOISTURE CONTENT SAMPLE	
W							.			0					
SPT	-10					**8.75m:** Fine to coarse GRAVEL with some sand; grey. Very dense, moist; subangular to angular; sand, fine to medium.	GW	50 for 140mm N = 50+		100					
W		9					.			0					
SPT						**9.5m:** Fine to coarse GRAVEL with some sand; grey. Very dense, moist; subangular to angular; sand, fine to medium. **9.62m:** Grades to: Sandy SILT; grey. 'Hard', moist; non-plastic; sand, fine; intermixed with rare organics.	GW ML	6// 5/ 10/ 31 for 15mm N = 50+		89					
W		10					.			0					

REMARKS:
1. Refer to site location plan for borehole locations.
2. Coordinates are approximated from Google Earth converted into NZTM Projection, RL is taken from architect's drawing 'P0.50B-A, exact RL: -0.706m.
3. Logged in general accordance to NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength/consistency description in "inverted commas" are inferred from SPT blow count and logging diagnostics.
5. Dashed line shows inferred boundary.
6. Method legend: CC (Concrete Core), SPT (Standard Penetration Test), W (Wash Drilling), PUSH (Push Tube Sample).
7. Lab Tests Legend: LL=Liquid Limit, PI=Plasticity Index, WC=Water Content, FC=Fines Content passing 0.075mm test sieve.

Water Level Readings mbgl
(1) 23/04/2014 at 3.40m (AM)
(2) 24/04/2014 at 2.20m (PM)

Log Scale 1:25

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Client: **Victoria University of Wellington**
Project: **Rutherford House**
Location: **23 Lambton Quay, Wellington**
Project Reference: **240174**

BH14I-01

Sheet **3** of **3**

BOREHOLE INFORMATION
Drilling Method: Triple tube
Diameter Core: HQ (63.5mm)
Contractor: Webster Drilling Limited

CO-ORDINATES: N/A
Easting: 1748996.8m
Northing: 5428751.5m
Ground Level: -.7m

Date Started: 22/04/2014
Date Completed: 23/04/2014
Inclination: Vertical, 90°
Orientation: N/A°

Logged by: AGM & AP
Input by: A. Putra
Checked by: D. Molnar
Verified by: D. Molnar

Method/Date	R.L. (m)	Length (m)	Sample	Graphic Log	Layer Code	Material Description	Weathering/USC	In Situ Testing	MC (%)	TCR (%)	SCR (%)	RQD (%)	Fracture Spacing (VWS WS MWS CS VCS EGS)	Stratigraphy / Defect Description (Dip recorded as maximum inclination of feature from horizontal.)	Installation
W							.			0				10m: ALLUVIUM	
SPT	-11					**10.25m:** SILT; bluish grey. 'Hard', moist; low to moderate plasticity; intermixed with rare organics.	ML	7// 6/ 6/ 18/ 20 for 45mm N = 50+		88					
						10.5m: Grades to: Sandy SILT; grey. 'Hard', moist; non-plastic; sand, fine.	ML								
						10.57m: Grades to: Sandy fine to medium GRAVEL with some silt; grey. Very dense, moist; subrounded to subangular; sand, fine to medium.	GW								
						End of Borehole at 10.67m (Target Depth)									

REMARKS:
1. Refer to site location plan for borehole locations.
2. Coordinates are approximated from Google Earth converted into NZTM Projection, RL is taken from architect's drawing 'P0.50B-A, exact RL: -0.706m.
3. Logged in general accordance to NZGS Guidelines for Field Description of Soil and Rock (2005).
4. Soil strength/consistency description in "inverted commas" are inferred from SPT blow count and logging diagnostics.
5. Dashed line shows inferred boundary.
6. Method legend: CC (Concrete Core), SPT (Standard Penetration Test), W (Wash Drilling), PUSH (Push Tube Sample).
7. Lab Tests Legend: LL=Liquid Limit, PI=Plasticity Index, WC=Water Content, FC=Fines Content passing 0.075mm test sieve.

Water Level Readings mbgl
(1) 23/04/2014 at 3.40m (AM)
(2) 24/04/2014 at 2.20m (PM)

Log Scale 1:25

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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Carpark adjacent to eastern side of Rutherford House
SHEET 1 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS		LOCATION: 33 LAMBTON QUAY	JOB No: 85725
CO-ORDINATES:	5990484 mN 2659045 mE	DRILL TYPE: WD-SD100 HELIPORT	HOLE STARTED: 21/9/13 HOLE FINISHED: 21/9/13
R.L.:	approx. 3.6m	DRILL METHOD: Sonic	DRILLED BY: WEBSTER DRILLING
DATUM:	NZMG, MSL	DRILL FLUID: N/A	LOGGED BY: DTG CHECKED: NCP

GEOLOGICAL									ENGINEERING DESCRIPTION							
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (mm) 50 250 1000 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
RECLAMATION FILL			0	JET VAC					0			M-W	MD				ASPHALT Sandy, silty FILL with concrete and steel.
									0.5								0.5
																	CONCRETE
									1.0								1.0
																	Sandy, silty fine to coarse GRAVEL with trace brick; brown. Loose to medium dense, moist to wet, poorly graded. Sand is fine to medium grained. Gravel is slightly to moderately weathered, sub-angular greywacke.
									1.5								1.5
			78	SPT		N=44			2.0								Layer of dense GRAVEL 2.0
			100	SONIC					2.5								2.5
									3.0								3.0
			56	SPT		N=6			3.5								3.5
						N=12			4.0								4.0
			0	SPT													
						N=16			4.5								4.5
PLEISTOCENE ALLUVIUM			67	SPT								W	MD				
									5								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Carpark adjacent to eastern side of Rutherford House
SHEET 2 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990484 mN, 2659045 mE
R.L.: approx. 3.6m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 21/9/13
HOLE FINISHED: 21/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: DTG CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM		22/9	100	SPT		N=18			5.5								Silty fine to coarse GRAVEL with minor sand; light bluish grey. Medium dense to dense, wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
			56	SPT		N=16											
			78	SPT		N=47			6.0								
			89	SPT		N=50+			6.5			W	VD				Sandy, silty fine to coarse GRAVEL; light bluish grey. Very dense, wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke. Becoming medium dense with depth.
			89	SPT		N=25			7.0								
			100	SONIC					7.5			W	St				Organic SILT; brownish grey. Stiff, wet, medium plasticity. Organic material is wood/fibrous.
												W	St				SILT with minor organics and trace sand; light brownish grey. Stiff, wet, low plasticity. Sand is fine grained.
									8.0								
			100	SPT		N=14			8.5			W	St				Organic SILT; light brownish grey. Stiff, wet, medium plasticity.
												W	L				Fine to medium SAND with some silt; light bluish grey. Loose, wet, poorly graded.
			100	SONIC					9.0			W	St				SILT with minor organics; brownish grey. Stiff, wet, medium plasticity. Organic SILT between 9.2 - 9.3 m.
									9.5								
									10								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Carpark adjacent to eastern side of Rutherford House
SHEET 3 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990484 mN, 2659045 mE
R.L.: approx. 3.6m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 21/9/13
HOLE FINISHED: 21/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: DTG CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	DEPTH (m)	R.L. (m)	SAMPLES	TESTS	CASING	METHOD	CORE RECOVERY (%)	WATER	FLUID LOSS	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM	10.5			N=22		SPT	67					W	VSt				Sandy SILT with trace gravel; light bluish grey. Very stiff, wet, low plasticity. Sand is fine medium grained. Beds of silty SAND.
	11.0					SONIC	100										
	11.5			N=30		SPT	89					W	MD				Silty fine to medium SAND; light bluish grey. Medium dense, wet, poorly graded. Beds of sandy SILT. Organic SILT between 11.3 - 11.5 m.
												W	MD				Silty fine to medium SAND with minor gravel; light bluish grey. Medium dense, wet, poorly graded. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
	12.0					SONIC	100					W	St				Sandy SILT; light bluish grey. Stiff, wet, low plasticity. Sand is fine grained. SILT with some organics between 12.6 -12.7 m.
	12.5																
												W					Sandy fine to coarse GRAVEL with some silt; light bluish grey. Wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
	13.0			N=34		SPT	84					W	St				SILT with trace organics; brownish grey. Stiff, wet, low plasticity.
												W	D				Silty fine to coarse GRAVEL with some sand; light bluish grey. Dense, wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
	13.5					SONIC	100										
	14.0																
	14.5			N=20		SPT	82					W	VSt				SILT with minor organics and trace clay; light brownish grey. Very stiff, wet, medium plasticity.
	15																

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Carpark adjacent to eastern side of Rutherford House
SHEET 4 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990484 mN, 2659045 mE
R.L.: approx. 3.6m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 21/9/13
HOLE FINISHED: 21/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: DTG CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM			100	SONIC					15.5			W					SILT with minor organics and trace clay; light brownish grey. Very stiff, wet, medium plasticity.
												W					Organic SILT; light greyish brown.Wet, low plasticity. 15.5
			33	SPT		N=7 (350mm under hammer weight)			16.0			W	F				SILT with trace organics, clay and shell fragments; light bluish grey. Wet, high plasticity. 16.0
			100	SONIC					16.5			W					16.5 Silty fine SAND; light bluish grey. Wet, poorly graded. 17.0
			38	SPT		N=8 (350mm under hammer weight)			17.5			W	VD				17.5 Silty fine to coarse GRAVEL with some sand; light bluish grey. Very dense, wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke. Thin layers (100mm thick) layers of SILT. SPT sank 350mm in cuttings at base of hole, recorded N value likely to be under-measured. 18.0
			100	SONIC					18.5								18.5 19.0
			76	SPT		N=50+			19.5								19.5
			100	SONIC					20								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Carpark adjacent to eastern side of Rutherford House
SHEET 5 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990484 mN, 2659045 mE
R.L.: approx. 3.6m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 21/9/13
HOLE FINISHED: 21/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: DTG CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
PLEISTOCENE ALLUVIUM			78	SPT		N=50+			20.5								Silty fine to coarse GRAVEL with some sand; light bluish grey. Very dense, wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke. Thin layers (100mm thick) layers of SILT. SPT sank 350mm in cuttings at base of hole, recorded N value likely to be under-measured. Layer of SILT between 20 - 20.5m.
			100	SONIC					21.0								
									21.5								
			33	SPT		N=31 (bouncing)			22.0								
			100	SONIC					22.5			W	VSt				SILT with some sand; grey. Wet, medium plasticity. Sand is fine grained.
									23.0								Layer of completely weathered, extremely weak, silty GRAVEL between 23 - 23.4m.
			100	SPT		N=25			23.5								
			100	SONIC					24.0			W					Sandy, silty fine to coarse GRAVEL; light bluish grey. Very dense, wet, poorly graded. Sand is fine to medium grained. Gravel is completely to moderately weathered, weak to extremely weak, angular to sub-angular greywacke.
									24.5								
									25								

T+T DATATEMPLATE.GDT ebb

Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Carpark adjacent to eastern side of Rutherford House
SHEET 6 OF 6

PROJECT: 33 LAMBTON QUAY GROUND INVESTIGATIONS | LOCATION: 33 LAMBTON QUAY | JOB No: 85725

CO-ORDINATES: 5990484 mN, 2659045 mE
R.L.: approx. 3.6m
DATUM: NZMG, MSL

DRILL TYPE: WD-SD100 HELIPORT
DRILL METHOD: Sonic
DRILL FLUID: N/A

HOLE STARTED: 21/9/13
HOLE FINISHED: 21/9/13
DRILLED BY: WEBSTER DRILLING
LOGGED BY: DTG CHECKED: NCP

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (mm) 50 250 1000 2000	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
PLEISTOCENE ALLUVIUM			87	SPT		N=50+											
									25.5								End of borehole (target depth reached 25.5m). Borehole backfilled with imported gravel and capped with cold mix asphaltic concrete.
									26.0								
									26.5								
									27.0								
									27.5								
									28.0								
									28.5								
									29.0								
									29.5								
									30								

T+T DATATEMPLATE.GDT ebb

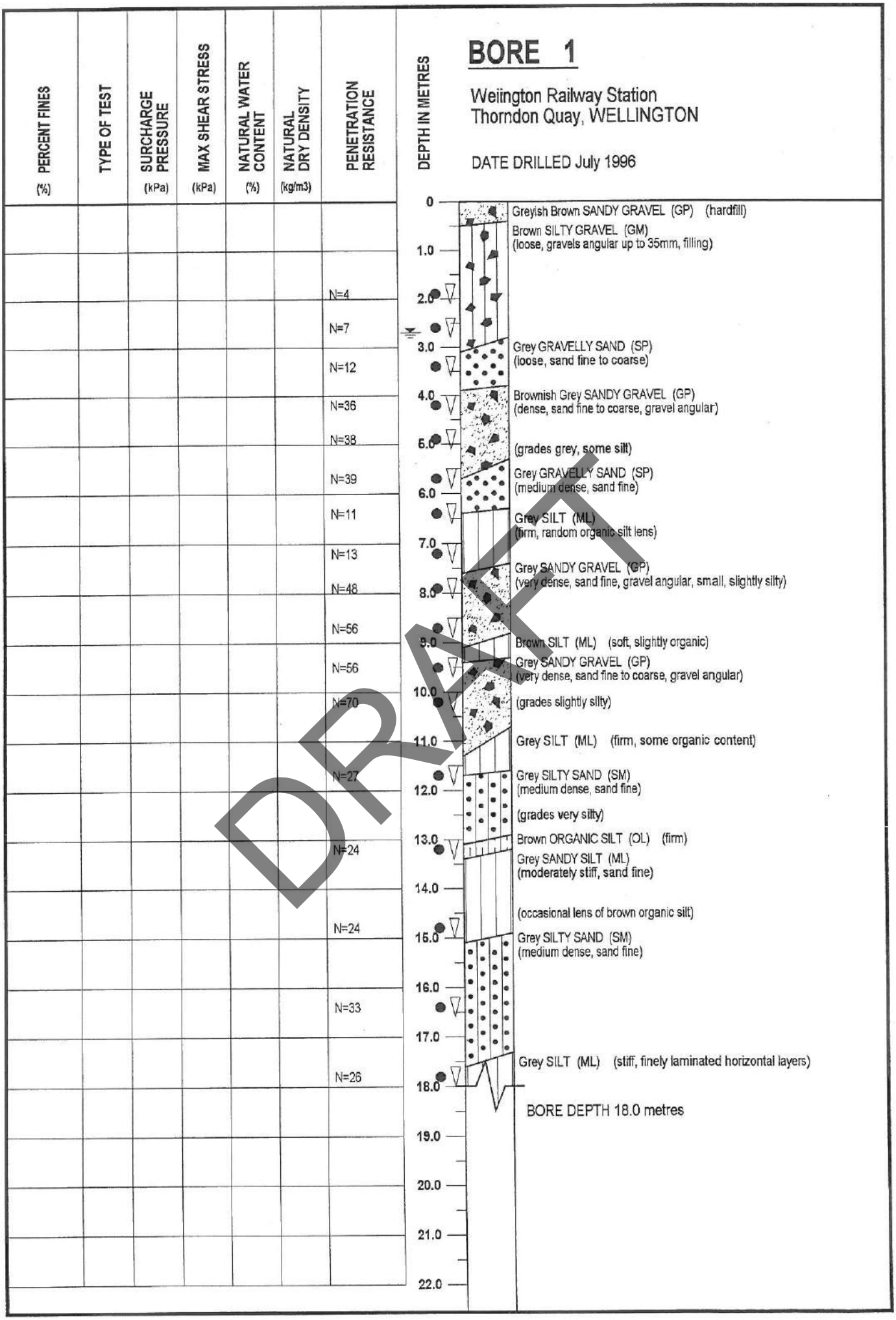
Log Scale 1:25

BORELOG 85725_BH1-BH3.GPJ 16-Dec-2013

BORE 1

Weiington Railway Station
Thorndon Quay, WELLINGTON

DATE DRILLED July 1996



Job No 2305.00 CC Logged by AGM Drawn by RJM Date 12/7/96

Connell Wagner Limited

Plate 2a

BECA CARTER HOLLINGS & FERNER LTD
CONSULTING ENGINEERS AND SURVEYORS

RECORD OF BOREHOLE No. B1

SHEET 1 OF 3

JOB NAME: GATEWAY
CLIENT: MAINZEAL
JOB No.: 266970
LOCATION: WELLINGTON
CO-ORDINATES:
ELEVATION: DATUM:

DRILLING METHOD	RECOVERY %	R.Q.D. %	DEPTH (m)	LEGEND	SYMBOL	STRATA DESCRIPTION	GROUND WATER	SAMPLES DEPTH (m)	SAMPLE TYPE	FIELD TESTS S.P.T. (N Value)	SHEAR VANE	OTHERS	LAB TESTS
			0.1			Black bituminous asphaltic concrete.					DR		
inch ger	100%		0.7			Firm to stiff, light brown, sandy gravelly SILT, dry (FILL) - subgrade. hard concrete obstacle, fragments of brick and concrete.		1.0					
T	50%		1.5			Becoming orange/brown and damp.		1.5	1	2 2 4 N=6			
5 inch ger	100%		2.0		ML		2/11/86 low tide	2.0					
	100%		3.0			Approximate change 3.0 - 3.6m		3.0	2				
SPT	100%		3.8		SW	Compact, dark grey, slightly silty, medium to coarse SAND, minor gravel. Composed of subangular fresh (BEACH DEPOSITS).		3.6	3	4 8 15 N=23			
WB	cuttings		4.0		GM	Compact orange/brown silty sandy GRAVELS (weathered alluvial greywacke gravels).		4.05					
T	100		4.5			Becoming blue-grey.		4.5	4	8 16 22 N=38			
	cuttings		5.0					5.0					
T	100		6.0			Becoming dense to very dense.		6.0	5	12 29 21/100mm N=50+			
	cuttings		7.0		ML	Stiff green fine sandy SILT, moist, non-plastic with trace organics.		7.0	6				
	60%		7.2		SW	Dense green gravelly fine to medium SAND. Rare gravels - fresh - grey, green, and weathered orange brown.		7.5	7	15 16 13 N=29			
WR	cuttings		7.8					8.0					
	100%		8.0		ML	Very stiff green fine sandy SILT, moist with rare fine organics, non-plastic.							
			8.4		GW	100mm: blue-grey fine gravels.							
WB	cuttings				ML								
			9.0		ML	(Cuttings indicate) grey-brown SILT with woody fibres and pieces.		9.0					
	- 100		9.5		SM	Very dense light bluish grey silty gravelly SAND, moist.		9.5	8	16 31 19/70mm N=50+			

DATE STARTED: 28/10/86
DATE FINISHED: 31/10/86
CONTRACTOR: Lemon Piling & Drilling
DRILLING RIG: Ingersoll-Rand
LOGGED BY: A. SMITHSON

DRILLING METHOD

- Wash Bore
- Open Barrel
- TT - Triple Tube
- TR - Tricone Rockbit
- Push Tube Sample
- Standard Penetration Test

LABORATORY TESTS

- WC - Water Content
- DD - Dry Density
- UCS - Unconfined Comp. Strength
- CON - Consolidation - Oedometer
- PI - Atterberg Limits

Triaxial Compression Tests

- UU - Unconsolidated Undrained
- CD - Consolidated Drained
- CU - Consolidated Undrained with p.w.p. measurement

SAMPLES

- Small disturbed sample
- Large disturbed sample
- Undisturbed 100mm ϕ tube sample
- Undisturbed core sample
- Standard Penetration Test (SPT)
- Other samples specified

FIELD TESTS

- N - SPT blows/300mm
- K - Permeability (cm/sec)
- PP - Pocket penetrometer (kPa)

Shear Vane

- C - Undrained cohesion (kPa) direct dial reading
- CC - as C but corrected reading
- CR - remoulded C

BECA CARTER HOLLINGS & FERNER LTD
CONSULTING ENGINEERS AND SURVEYORS

RECORD OF BOREHOLE N°. B1

SHEET 2 OF 3

JOB NAME: GATEWAY
CLIENT: MAINZEAL
JOB N°: 266970
LOCATION: WELLINGTON
CO-ORDINATES:
ELEVATION: DATUM:

DRILLING			STRATA				GROUND WATER	SAMPLES		FIELD TESTS			LAB TESTS
METHOD	RECOVERY %	R.Q.D. %	DEPTH (m)	LEGEND	SYMBOL	DESCRIPTION		DEPTH (m)	SAMPLE TYPE	S.P.T. (N Value)	SHEAR VANE OR	OTHERS	
					SW	Very dense greenish-grey fine to medium sandy GRAVELS (2-30mm diameter) with lenses of silty fine SAND containing minor black and brown decomposed wood.			9			
UT	56cm / 75cm							10.75		15			
SPT	100%		11.0			Becoming gravelly SAND, minor silt with woody fibres in cuttings.		11.0	10	24 / 26/100mm			
										N=50+			
UT	cuttings				SW								
			12.0			Becoming lensed with grey-brown clayey SILT from cuttings.		12.0					
			12.5			Becoming lensed with dark brown clayey SILT, organic, minor gravels.		12.5		18			
SPT	100%								11	27			
						APPROXIMATE CHANGE 12.0 - 13.0m				20			
			13.0			Very stiff greenish grey clayey SILT, moist, low plasticity contains flecks of brown organics.		13.0		N=47			
	cuttings				ML								
			14.0					14.0					
								14.5		7			
T	100%								12	10			
			14.9			30mm dark brown, moderately organic clayey SILT.				15			
UT	100%		15.0					15.0		N=25			
			15.3			Becoming slightly clayey SILT, trace fine sand.			13				
			15.7		ML	Becoming light green, pale brown and dark brown layered with brown and black fibres.		15.5					
TT	1.22cm / 1.50		16.0					16.0					
e lost 16.	-16.4m		16.1		ML	Stiff, greenish-grey slightly clayey sandy SILT and silty SAND.							
			16.6			Becomes greenish-grey slightly clayey SILT, low plasticity slightly dilatant.							
			17.0					17.0		5			
SPT	100%								14	10			
					ML					11			
	cuttings									N=21			
			18.0					18.0	15a				
	1.25cm							18.34					
	1.25cm							18.64	15b				
	100%							19.0	15c				
			18.9			Stiff, greenish-grey speckled white, clayey SILT, moist, high plasticity. White specks turn blue when weathered overnight			15d				
SPT	100		19.0		MH			19.25		9			
									16	11			
	cuttings		19.6			Becoming reddish grey with green-grey lenses.		19.7		13			
										N=24			

DATE STARTED: 28/10/86
DATE FINISHED: 31/10/86
CONTRACTOR Lennon Piling & Drilling
DRILLING RIG: Ingersoll Rand
LOGGED BY: A. SMITHSON

DRILLING METHOD

- Wash Bore
- Open Barrel
- Triple Tube
- TR = Tricone Rockbit
- UT = Push Tube Sample
- ST = Standard Penetration Test

LABORATORY TESTS

- WC = Water Content
- DD = Dry Density
- UCS = Unconfined Comp. Strength
- CON = Consolidation-Oedometer
- PI = Atterberg Limits

Triaxial Compression Tests

- UU = Unconsolidated Undrained
- CD = Consolidated Drained
- CU = Consolidated Undrained with p.w.p. measurement

SAMPLES

- Small disturbed sample
- Large disturbed sample
- Undisturbed 100mm ϕ tube sample
- Undisturbed core sample
- Standard Penetration Test (SPT)
- Other samples specified

FIELD TESTS

- N = SPT blows/300mm
- K = Permeability (cm/sec)
- PP = Pocket penetrometer (kPa)

Shear Vane

- C = Undrained cohesion (kPa) direct dial reading
- CC = as C but corrected reading
- CR = remoulded C

BECA CARTER HOLLINGS & FERNER LTD
CONSULTING ENGINEERS AND SURVEYORS

RECORD OF BOREHOLE No. B1

SHEET 3 OF 3

JOB NAME: GATEWAY
CLIENT: MAINZEAL
JOB No: 266970
LOCATION: WELLINGTON
CO-ORDINATES:
ELEVATION: DATUM:

DRILLING				STRATA				GROUND WATER	SAMPLES		FIELD TESTS			LAB TESTS
HOD	RECOVERY %	R.Q.D. %	DEPTH (m)	LEGEND	SYMBOL	DESCRIPTION			DEPTH (m)	SAMPLE TYPE	S.P.T. (N Value)	SHEAR VANE	OTHERS	
												DR		
T	1.50/1.50 100%		20.6		ML	Hard dark greenish grey clayey SILT, moist, moderately plastic.			20.3	17a				
			20.7			300-500mm: pockets of fine shells, soft green greywacke gravels.			20.6	17b				
			20.9			100mm intervals oysters and cockle shells.				17c				
			21.0		ML	Becoming sandy clayey SILT, minor gravel.			20.9	17d				
			21.3		GM	Very dense green silty sandy GRAVEL, moist, gravels 2mm-15mm.			21.2	17e				
			21.5		ML	21.6m Becoming gravelly sand SILT.			21.5		13			
SPT	100		21.7			Hard, green, fine sandy SILT, moist non-plastic.				18	26			
			22.0		SW	Very dense green SAND and fine GRAVEL.			22.0		37 N=63			
			22.3			Horizontal joint, orange-brown staining 250mm core loss.			22.3	19				
			22.4						22.4					
T	1.26/1.50		22.65		ML	Hard, brown clayey SILT, minor gravels, moist, low-moderately plastic.			22.7	20				
			23.0			Becoming green with orange stained horizontal layers.			23.0					
			23.2		GM	Very dense green slightly silty sandy GRAVEL, moist.			23.1	21				
SPT	100		23.5		SW	Very dense silty coarse SAND and fine GRAVEL.			23.5	22	21 29/130mm N=50+			
B														
		core fell out of barrel	24.0						24.0					
T	0% cutting													
B			25.0		ML	Cuttings and drilling indicate clayey SILT.			25.0					
B	cutting		25.35		SW	Very dense greenish grey silty SAND and GRAVEL, moist.			25.5	23	23 27/120mm N=50+			
			26.0			26-27m cuttings indicate sands and gravels.			25.8					
									26.0					
			27.0			27.0-28.0m cutting indicate interlayered sandy gravels and silts.			27.0					
			28.0		ML	Hard, brown clayey SILT, moist, moderately plastic, moderately organic, becoming greenish-grey at 28.1m.			28.0	24	17 50/120mm N=50+			
			28.15		GW	Very dense greenish grey sandy GRAVELS, moist.								
			28.3			END OF HOLE 28.3m			28.3					
			29.0						29.0					

DATE STARTED: 28/10/86
DATE FINISHED: 31/10/86
CONTRACTOR: LEMMON PILE DRILLING CO.
DRILLING RIG: Ingersoll-Rand
LOGGED BY: A. SMITHSON

DRILLING METHOD

- . Wash Bore
- . Open Barrel
- . Triple Tube
- TR . Tricone Rockbit
- . Push Tube Sample
- ST . Standard Penetration Test

LABORATORY TESTS

- WC . Water Content
- DD . Dry Density
- UCS . Unconfined Comp. Strength
- CON . Consolidation - Oedometer
- PI . Atterberg Limits

Triaxial Compression Tests

- UU . Unconsolidated Undrained
- CD . Consolidated Drained
- CU . Consolidated Undrained with p.w.p. measurement

SAMPLES

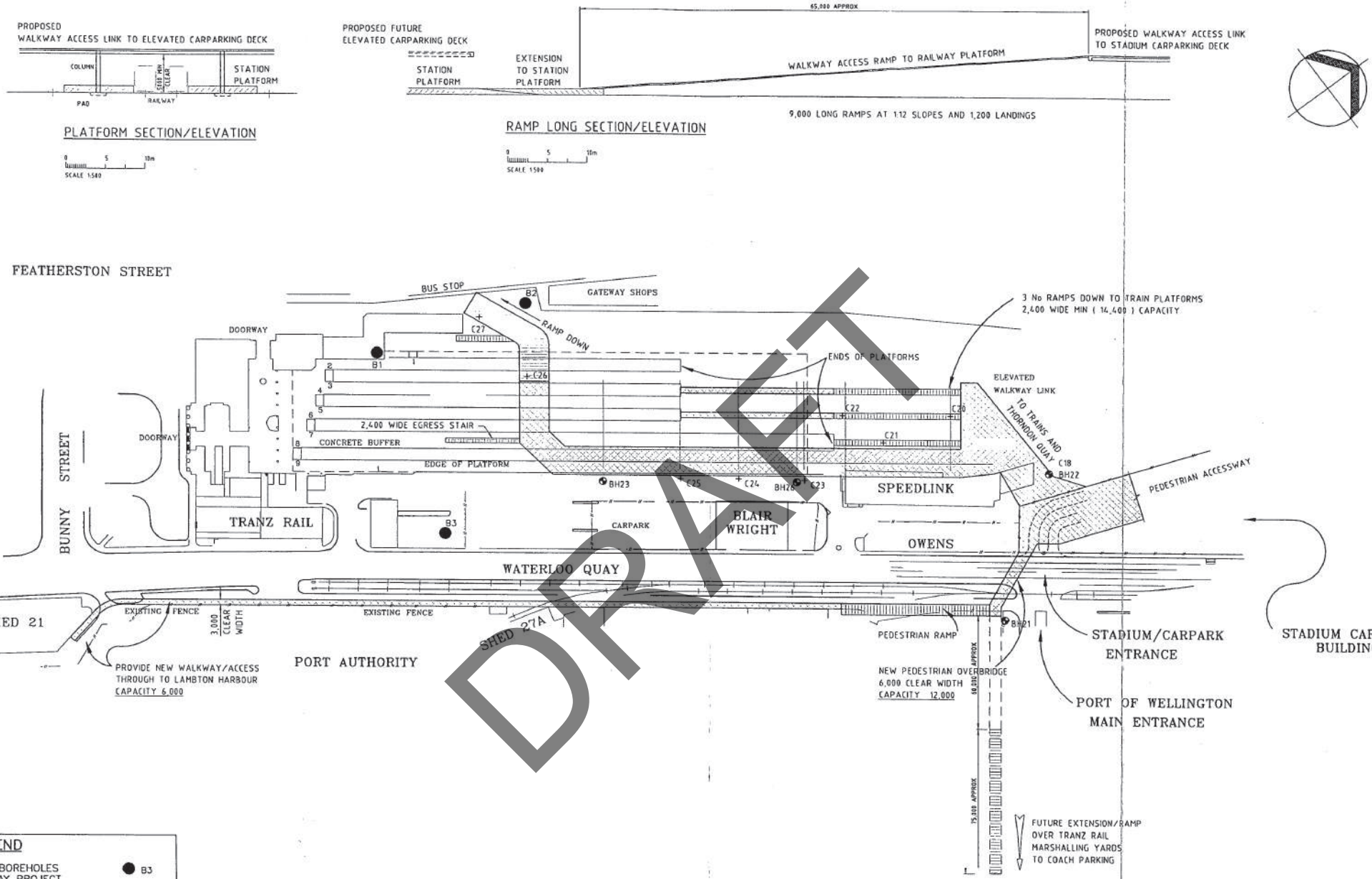
- Small disturbed sample
- Large disturbed sample
- Undisturbed 100mm ϕ tube sample
- Undisturbed core sample
- Standard Penetration Test (SPT)
- Other samples specified

FIELD TESTS

- N . SPT blows/300mm
- K . Permeability (cm/sec)
- PP . Pocket penetrometer (kPa)

Shear Vane

- C . Undrained cohesion (kPa) direct dial reading
- CC . as C but corrected reading
- CR . remoulded C



INVESTIGATION LOCATION PLAN
ELEVATED WALKWAYS
FIGURE 3

BECA
14.11.97
3401154/F003
SCALE 1:2000

ENGEO Expect Excellence

LOG OF BORING BH7

Wellington Railway Station
Pipitea
Wellington 6011
12638

Client : KiwiRail
Date : 19/11/15
Hole Depth : 24.42 m
Drilling Method : Mud Rotary
Drilling Contractor : Griffiths Drilling

Core Diameter : 60 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 5428848.2
Longitude : 1749113.3

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0				Asphalt.									
			GW	Sandy fine to coarse GRAVEL; grey. Subbase.									
			GW	Concrete fragments. Jet vacuumed. [FILL]									
				Sandy fine to coarse GRAVEL with minor silt; brown. Gravel is angular. Brick fragments. Jet vacuumed. [FILL]									
0.5			GW	Sandy fine to coarse GRAVEL with minor cobbles; grey. Gravel is predominantly angular with some subrounded to rounded gravel. Jet vacuumed. [FILL]				LP					
		NR											
1.0													
1.5	FILL		GM	Silty fine to coarse GRAVEL with some sand; orange brown. Gravel is subangular to subrounded. Sand is fine to coarse. [FILL]					1/2//1/0/1/1 N=3				
2.0								VL					
2.5													
		NR		Lost core.	NR	▼		NR					
3.0				Silty fine to coarse GRAVEL with some sand; orange brown. Gravel is subangular to subrounded. Sand is fine to coarse. [FILL]			M		1/0//1/0/3/3 N=7				
3.5			GW	Fine to coarse GRAVEL with minor sand and minor silt; orange brown. Gravel is angular to subangular. Sand is fine to coarse. [FILL]				L					
			GM										
			GM	Silty fine to coarse GRAVEL with some sand; orange brown. Gravel is subangular to subrounded. Sand is fine to coarse. [FILL]									
4.0		NR		Silty fine to coarse GRAVEL with some sand; grey. Gravel is angular to subrounded. Sand is fine to medium.	NR			NR					
				Lost core.									
4.5			ML	Gravelly SILT with some sand; grey. Low plasticity. Gravel is angular to subangular. Sand is fine to medium.				VSt	5/7//8/6/8/9 N=31				
5.0													

NR - no recovery
Standpipe installed

Bedrock was not encountered.

GEOSCIENCE MACHINE BORING 12638_BOREHOLE LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/12/15

ENGEO Expect Excellence

LOG OF BORING BH7

Wellington Railway Station
Pipitea
Wellington 6011
12638

Client : KiwiRail
Date : 19/11/15
Hole Depth : 24.42 m
Drilling Method : Mud Rotary
Drilling Contractor : Griffiths Drilling

Core Diameter : 60 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 5428848.2
Longitude : 1749113.3

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
			ML										
			ML	SILT with minor sand; grey with brown laminations. Low plasticity. Sand is fine. 5.4 m to 5.5 m some fine to coarse gravel, subrounded to rounded. From 5.5 m some fine sand.				VSt				
5.5													
			SP	Fine to medium SAND with some silt; grey.				D					
6.0			ML	Sandy SILT with minor gravel; grey. Low plasticity. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded. From 6.45 m trace fine gravel, subrounded. From 6.6 m minor fine sand, no gravel. From 6.77 m to 6.9 m some fine sand.				H	5/11//12/12/11/7 N=42			
6.5													
7.0			ML	SILT with minor sand; greyish brown. Low plasticity. Sand is fine. From 7.05 m some fine to medium sand. Wood fragments.									
			SM	Silty fine SAND; grey.				D					
7.5	INTERBEDDED MARGINAL MARINE/OUTWASH FAN DEPOSITS		ML	SILT with minor sand; greyish brown. Low plasticity. Sand is fine. From 7.4 m some sand and trace gravel. Sand is fine to medium. Gravel is fine, subangular to subrounded.			M	VSt	5/9//7/4/6/8 N=25				
8.0			ML	Sandy SILT; greyish brown. Low plasticity. Sand is fine to medium.									
			SM	Silty fine to coarse SAND with trace gravel; bluish grey. Gravel is fine, subangular to subrounded.				MD					
8.5			ML	SILT with trace sand; greyish brown. Low plasticity. Sand is fine. From 8.55 m minor fine to medium sand; grey. From 8.7 m some sand.				VSt					
		NR		Lost core.	NR			NR					
9.0			ML	Sandy SILT; bluish grey. Low plasticity. Sand is fine.				VSt	3/3//5/6/7/8 N=26				
9.5			SM	Silty fine SAND; grey.				MD					
			ML	SILT with trace sand; grey. Low plasticity. Sand is fine.				VSt					
		NR		Lost core.	NR			NR					
10.0													

NR - no recovery
Standpipe installed

Bedrock was not encountered.

ENGEO Expect Excellence

LOG OF BORING BH7

Wellington Railway Station
Pipitea
Wellington 6011
12638

Client : KiwiRail
Date : 19/11/15
Hole Depth : 24.42 m
Drilling Method : Mud Rotary
Drilling Contractor : Griffiths Drilling

Core Diameter : 60 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 5428848.2
Longitude : 1749113.3

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
10.5	INTERBEDDED MARGINAL MARINE/OUTWASH FAN DEPOSITS	NR		Lost core.	NR			NR				25 50 75	
			SM	Silty fine SAND; grey.				MD	3/4//6/8/7/8 N=29				
11.0				Lost core. Steel bar lost in the hole at 12.0 m depth. Unable to retrieve. Unable to perform SPT at 12.0 m.									
11.5		NR			NR			NR					
12.0													
12.5			SM	Silty fine SAND; grey.			M	MD					
			ML	SILT; greyish brown. Low plasticity. From 12.7 m grey. From 12.87 m to 13.0 m contains organic matter.									
13.0													
13.5				From 13.45 m to 13.55 m dark brown with light brown laminations. From 13.55 m to 13.65 m brown with light brown mottles.				St	2/2//2/3/3/5 N=13				
14.0				From 13.95 m to 14.0 m brown. From 14.0 m to 14.05 m some fine sand.									
14.5				From 14.43 m to 14.58 m minor fine sand. From 14.65 m greyish brown. From 14.75 m grey with blue mottles.									
15.0													

NR - no recovery
Standpipe installed

Bedrock was not encountered.

GEOSCIENCE MACHINE BORING 12638_BOREHOLE LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/12/15

ENGEO Expect Excellence

LOG OF BORING BH7

Wellington Railway Station
Pipitea
Wellington 6011
12638

Client : KiwiRail
Date : 19/11/15
Hole Depth : 24.42 m
Drilling Method : Mud Rotary
Drilling Contractor : Griffiths Drilling

Core Diameter : 60 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 5428848.2
Longitude : 1749113.3

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
15.5	INTERBEDDED MARGINAL MARINE/OUTWASH FAN DEPOSITS		ML	SILT; greyish brown. Low plasticity. From 15.15 m to 15.6 m brown with 1 mm thin layers of organic matter.					2/3//3/4/5/5 N=17				
16.0				From 15.6 m to 15.9 m cointains organic matter. From 15.95 m minor fine sand; bluish grey.									
16.5				From 16.2 m no sand; grey. From 16.4 m to 17.15 m trace fine sand; bluish grey.					4/4//6/7/6/10 N=29				
17.0				From 17.15 m bluish grey.									
17.5				From 17.45 m grey.			M	VSt					
18.0				From 17.65 m bluish grey.					3/3//5/5/6/7 N=23				
18.5													
19.0				From 18.87 m 1 mm thin layers of organic matter. From 18.9 m to 19.15 m trace gravel and trace sand. Gravel is fine, subangular to subrounded; light yellow. Sand is fine to medium; yellow. From 19.15 m bluish grey.									
19.5				From 19.5 m to 19.95 m blue and yellow mottles.					3/3//5/7/8/11 N=31				
20.0													

NR - no recovery
Standpipe installed

Bedrock was not encountered.

ENGEO Expect Excellence

LOG OF BORING BH7

Wellington Railway Station
Pipitea
Wellington 6011
12638

Client : KiwiRail
Date : 19/11/15
Hole Depth : 24.42 m
Drilling Method : Mud Rotary
Drilling Contractor : Griffiths Drilling

Core Diameter : 60 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 5428848.2
Longitude : 1749113.3

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
20.5	INTERBEDDED MARGINAL MARINE/OUTWASH FAN DEPOSITS		ML	From 19.95 m grey. SILT; greyish brown. Low plasticity. From 20.25 m to 20.45 m shell fragments. From 20.45 m bluish grey. From 20.45 m to 20.6 m moderately plastic, soft. From 20.6 m grey. From 20.6 m to 20.9 m white and blue mottles. From 21.0 m to 21.15 m shell fragments.				VSt				
21.0			ML	Sandy SILT with some gravel; grey. Low plasticity. Sand is fine to coarse. Gravel is fine to medium, angular to subangular. Shell fragments. From 21.45 m some sand. From 21.6 m to 21.65 m gravel is fine to coarse. At 21.63 m cobble.				H	2/5//5/6/10/14 N=35			
21.5			SM	Silty fine to coarse SAND with some gravel; greyish blue. Gravel is fine to coarse, angular to subrounded.			M	D				
22.0		NR		Lost core.	NR			NR				
22.5			SM	Silty fine to coarse SAND with minor gravel; greyish blue. Gravel is fine to medium, angular to subrounded.				D	8/9//10/10/14/16 N=50			
23.0			SM	Silty fine to coarse SAND with some gravel; greyish blue. Gravel is fine to coarse, angular to subrounded.								
23.5			ML	Sandy SILT; greyish blue. Low plasticity. Sand is fine to coarse.				H				
		NR		Lost core.	NR			NR				
24.0			ML	Sandy SILT with minor gravel; greyish blue. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.				H	3/10//18/20/12 N=50+			
				End of Hole Depth: 24.42 m Termination: Target depth								

NR - no recovery
Standpipe installed

Bedrock was not encountered.

GEOSCIENCE MACHINE BORING 12638_BOREHOLE LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/12/15

GEOTECH DRILLING
CONE PENETROMETER

CLIENT: BECA CARTER

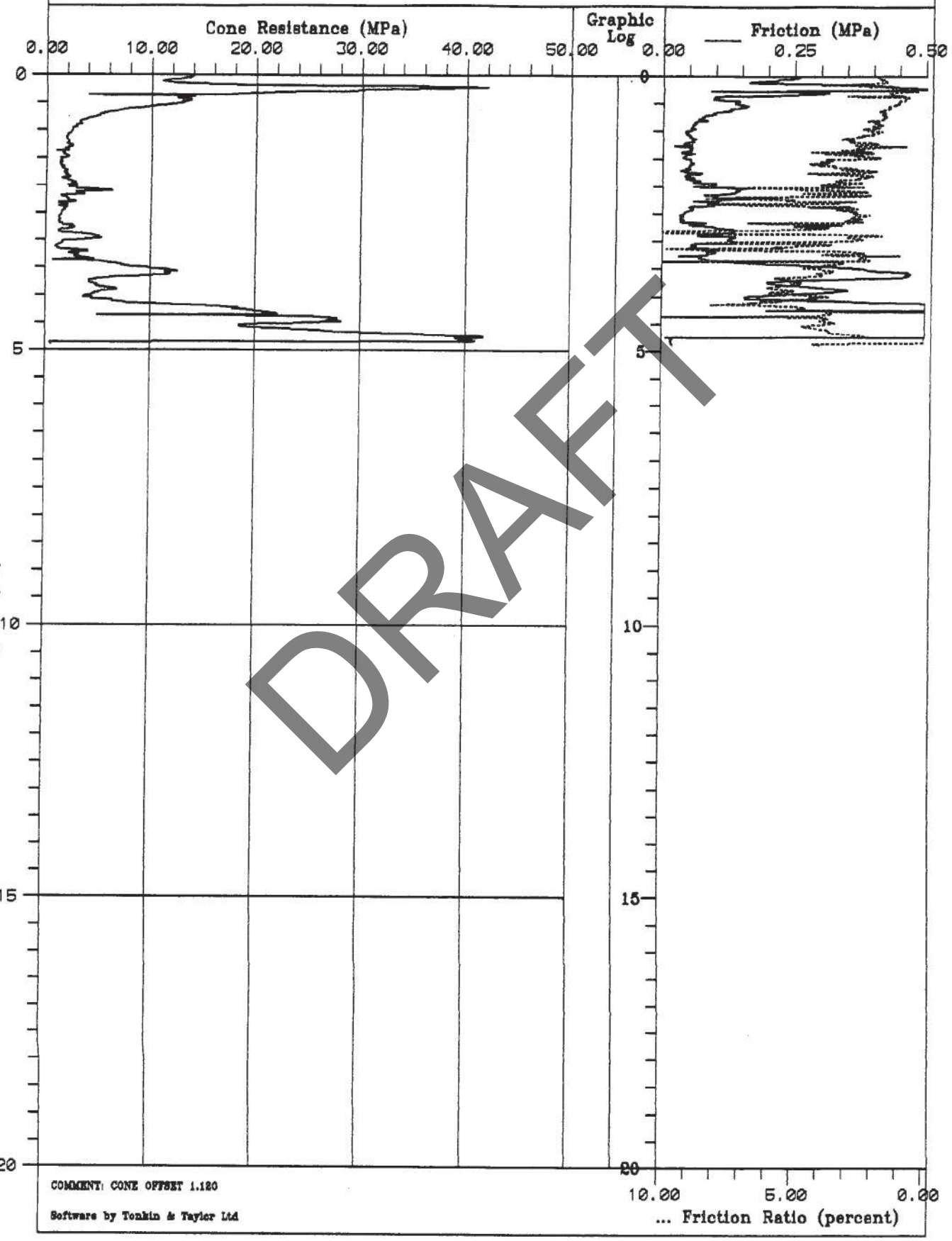
CPT No: 27
of

PROJECT: STADIUM | LOCATION: RAILYARD | JOBNO:

Date: 7 Nov 1997
R.L.:
Datum:

Cone Range:
Operator: S PURVIS
Grid Ref:

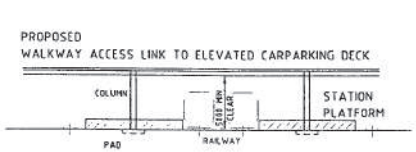
Client Ref:
East:
North:



COMMENT: CONE OFFSET 1.120

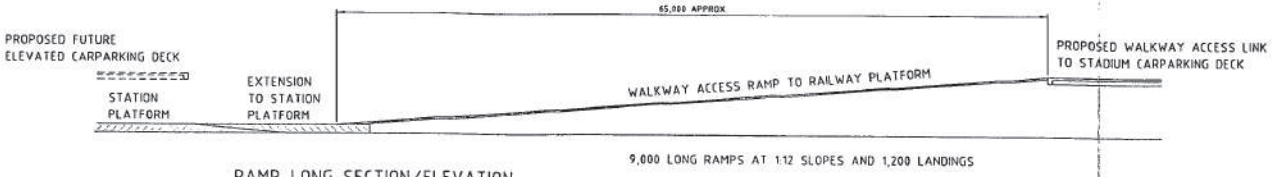
Software by Tonkin & Taylor Ltd

NZGD ID: CPT_130607



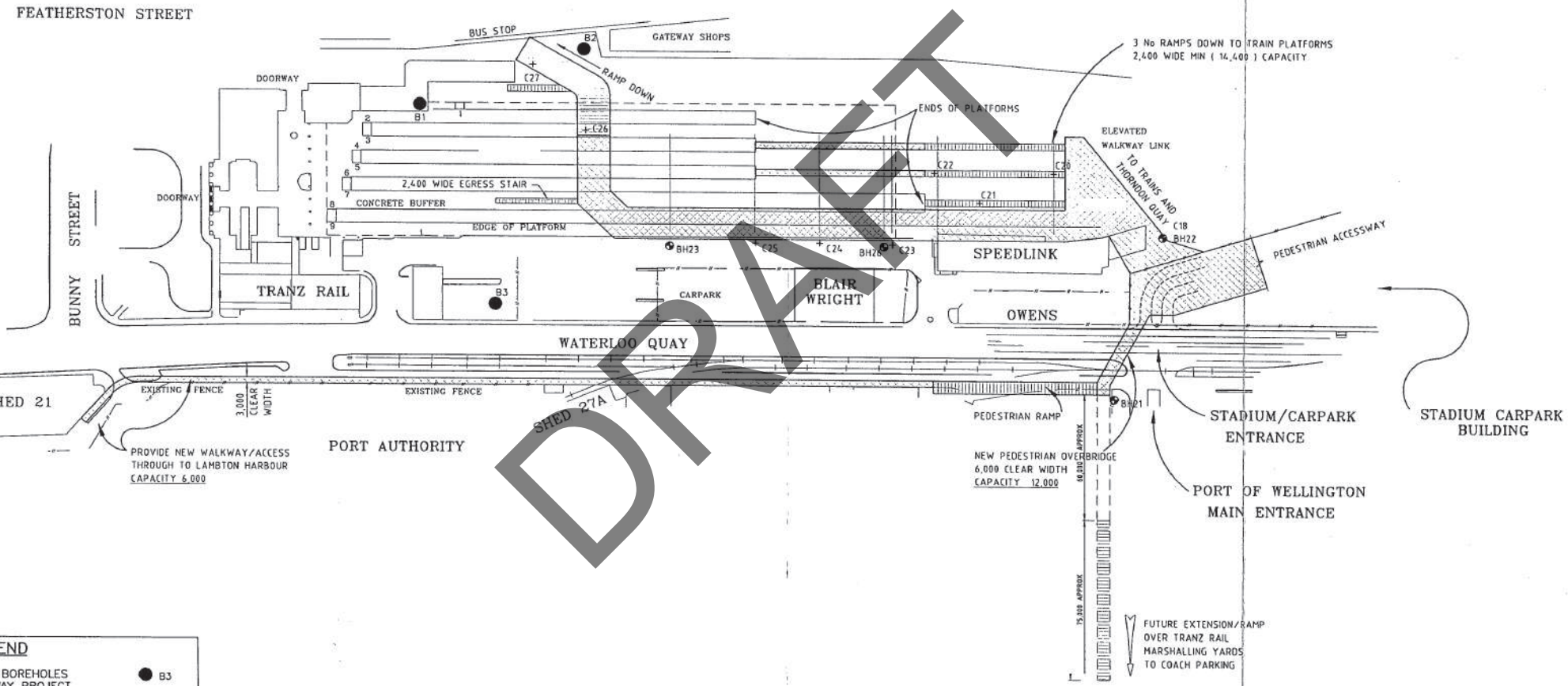
PLATFORM SECTION/ELEVATION

SCALE 1:500



RAMP LONG SECTION/ELEVATION

SCALE 1:500



LEGEND

1986 BOREHOLES GATEWAY PROJECT	B3
BOREHOLE	BH17
CONE PENETROMETER TEST	+ C14

INVESTIGATION LOCATION PLAN

ELEVATED WALKWAYS

FIGURE 3

BECA

14.11.97

3401154/F003

SCALE 1:2000

BECA CARTER HOLLINGS & FERNER LTD
CONSULTING ENGINEERS AND SURVEYORS

RECORD OF BOREHOLE No. B2

SHEET 1 OF 3

JOB NAME: GATEWAY
CLIENT: MAINZEAL
JOB No. 266970
LOCATION: WELLINGTON
CO-ORDINATES:
ELEVATION: DATUM:

DRILLING METHOD	RECOVERY %	R.Q.D. %	DEPTH (m)	LEGEND	SYMBOL	DESCRIPTION	GROUND WATER	SAMPLES DEPTH (m)	SAMPLES SAMPLE TYPE	FIELD TESTS S.P.T. (N Value)	FIELD TESTS SHEAR VANE	FIELD TESTS OTHERS	LAB TESTS
											DR		
5 inch auger	100%		0.1			Black asphaltic concrete.							
			1.0			Firm to stiff, orange-brown gravelly sandy SILT, damp, low plasticity (FILL).		0.7	1				
SPT	60%				ML			1.5		2			
SPT	100%		2.0			Becoming moist to wet.		2.0		3			
UT	100%						▽ 2/11/86	2.5	2	2 N=5			
AUGER	100		3.0					3.0					
UT	100		3.3		SP	Compact blue-green silty gravelly SAND, moist. (Old beach and near-shore deposits).		3.5	3				
PT	100		3.8			Very stiff blue-green gravelly sandy SILT (gravels highly weathered greywacke).		3.8		7			
AUGER	100		4.0		ML	At 4.1 for 40mm; horizontal limonite stained zone (seepage joint).		4.0	4	13			
WB	cuttings							4.25		20 N=33			
			5.0					5.0					
T	100%		6.0		ML	Very stiff blue-green slightly fine sandy SILT, moist, non-plastic.		6.0	5				
PT	100%		6.6			Very dense blue-green silty gravelly SAND, moist.		6.5		13	c=120+		
WB	cuttings		7.0		SP			6.85	6	40 N=50+			
			7.5			Approximate change 7.5m from cuttings.		7.0					
T	100%				ML	Very stiff blue-green slightly clayey sandy SILT, moist, low to moderately plastic with fine layers of brown clayey SILT, moderately plastic.							
			8.0			Becoming sandy SILT non-plastic.		8.0	7				
			8.5		ML			8.5			c=120+		
SPT	100%		8.7		SP	Very dense silty gravelly SAND, moist.		8.75	8	50/240mm			
WB	cuttings		9.0			Hard, blue-green-grey fine sandy SILT, moist, non-plastic.		9.0		N=50+			
TT	50%	9.5-10 lost from barrel			ML				9				
			9.5			100mm brown layered fine organics. 20mm gravelly SILT.							
			10.0					10.0					

DATE STARTED: 31/10/86
DATE FINISHED: 1/11/86
CONTRACTOR: LEMMON PILING & DRILLING
DRILLING RIG: Ingersoll-Rand
LOGGED BY: A. SMITHSON

DRILLING METHOD
- Wash Bore
- Open Barrel
- Triple Tube
- TR = Tricone Rockbit
- PT = Push Tube Sample
- ST = Standard Penetration Test

LABORATORY TESTS
- WC = Water Content
- DD = Dry Density
- UCS = Unconfined Comp. Strength
- CON = Consolidation-Oedometer
- PI = Atterberg Limits

Triaxial Compression Tests
- UU = Unconsolidated Undrained
- CD = Consolidated Drained
- CU = Consolidated Undrained with p.w.p. measurement

SAMPLES
- Small disturbed sample
- Large disturbed sample
- Undisturbed 100mm ϕ tube sample
- Undisturbed core sample
- Standard Penetration Test (SPT)
- Other samples specified

FIELD TESTS
- N = SPT blows/300mm
- K = Permeability (cm/sec)
- PP = Pocket penetrometer (kPa)

Shear Vane
- C = Undrained cohesion (kPa) direct dial reading
- CC = as C but corrected reading
- CR = remoulded C

BECA CARTER HOLLINGS & FERNER LTD
CONSULTING ENGINEERS AND SURVEYORS

RECORD OF BOREHOLE No. B2

SHEET 2 OF 3

JOB NAME: GATEWAY
CLIENT: MAINZEAL
JOB No: 266970

LOCATION: WELLINGTON
CO-ORDINATES:
ELEVATION: DATUM:

DRILLING METHOD	RECOVERY %	R.Q.D. %	DEPTH (m)	LEGEND	SYMBOL	DESCRIPTION	GROUND WATER	SAMPLES DEPTH (m)	SAMPLE TYPE	FIELD TESTS S.P.T. (N Value)	SHEAR VANE	OTHERS	LAB TESTS
											DR		
SPT	100				ML	Hard, green-grey fine sandy SILT, moist, non-plastic with rare brown layers.		10.45	10	7 23 32 N=55			
WB	cuttings		11.0					11.0					
					ML	Very stiff green-grey clayey SILT with 5 - 10mm layers of brown clayey SILT, and fine black and brown organics.		12.0	11	8 14 16 N=30			
SPT	100		12.0						12				
T	100		13.0			Grey-brown clayey SILT with brown and black layers.		13.0	13	6 11 12 N=23			
PT	100				ML			13.5					
			13.8			50mm: thin sandy gravelly layer.							
B	cuttings		14.0			From 14.0 - contains less brown and organic layers mostly blue-green clayey SILT.		14.0					
			15.0			Blue-grey slightly clayey SILT, non-plastic, low plasticity sensitive.		15.0	14	7 14 17 N=31			
SPT	100%												
T	100%		16.0		ML	Very finely laminated (blue grey and brownish grey) horizontally.		16.0					
								16.3	15				
			17.0			Becoming just blue-grey finely laminated.		16.7					
SPT	100							17.0	16	7 13 16 N=29			
WB	cuttings		18.0					18.0					
			18.6			Contains fine layers of sand and gravel.							
			19.0					19.0					
			19.3			Becoming sandy SILT.							
SPT	100%		19.5		ML			19.5	17	10 35 15/60mm N=50+			
					SP	Very dense greenish grey silty gravelly SAND, moist.							

DRAFT

DATE STARTED: 31/10/86
DATE FINISHED: 1/11/86
CONTRACTOR: Lennon Piling & Drilling Co
DRILLING RIG: Ingersoll-Rand
LOGGED BY: A. SMITHSON

DRILLING METHOD

- Wash Bore
- Open Barrel
- TT - Triple Tube
- TR - Tricone Rockbit
- Push Tube Sample
- Standard Penetration Test

LABORATORY TESTS

- WC - Water Content
- Dry Density
- UCS - Unconfined Comp. Strength
- CON - Consolidation - Oedometer
- PI - Atterberg Limits

Triaxial Compression Tests

- UU - Unconsolidated Undrained
- CD - Consolidated Drained
- CU - Consolidated Undrained with p.w.p. measurement

SAMPLES

- Small disturbed sample
- Large disturbed sample
- Undisturbed 100mm ϕ tube sample
- Undisturbed core sample
- Standard Penetration Test (SPT)
- Other samples specified

FIELD TESTS

- N - SPT blows/300mm
- K - Permeability (cm/sec)
- PP - Pocket penetrometer (kPa)

Shear Vane

- C - Undrained cohesion (kPa) direct dial reading
- CC - as C but corrected reading
- CR - remoulded C

BECA CARTER HOLLINGS & FERNER LTD
CONSULTING ENGINEERS AND SURVEYORS

RECORD OF BOREHOLE No. B2

SHEET 3 OF 3

JOB NAME: GATEWAY
CLIENT: MAINZEAL
JOB No. 266970

LOCATION: WELLINGTON
CO-ORDINATES:
ELEVATION: DATUM:

DRILLING			STRATA				GROUND WATER	SAMPLES		FIELD TESTS			LAB TESTS
HOD	RECOVERY %	R.Q.D. %	DEPTH (m)	LEGEND	SYMBOL	DESCRIPTION		DEPTH (m)	SAMPLE TYPE	S.P.T. (N.Value)	SHEAR VANE	OTHERS	
											DR		
T	0.86m 1.00m		20.2 20.3 20.4			Very stiff, green-grey, slightly clayey SILT, non-plastic. 20.3m: Brown with black flecked organics. 20.4m: Slightly gravelly (weathered green-grey greywacke).		20.25		18 19 20			
PT	100		20.6 20.8 21.0			Interbedded layers of very dense, silty gravelly SAND, moist and very dense silty sandy GRAVEL; moist.		20.5 20.8 21.0 21.1		21	14 44 N=50+		
B	cuttings		22.0					22.0					
PT	100%		23.0			END OF HOLE 23.0m		23.0		22	23 27/100mm N=50+		

DATE STARTED: 31/10/86
DATE FINISHED: 3/11/86
CONTRACTOR: Lemon Pile & Drilling Co
DRILLING RIG: Ingersoll-Rand
LOGGED BY: A. SMITHSON

DRILLING METHOD

- Wash Bore
- Open Barrel
- Triple Tube
- TR - Tricone Rockbit
- Push Tube Sample
- Standard Penetration Test

LABORATORY TESTS

- WC - Water Content
- DD - Dry Density
- UCS - Unconfined Comp. Strength
- CON - Consolidation - Oedometer
- PI - Atterberg Limits

Triaxial Compression Tests

- UU - Unconsolidated Undrained
- CD - Consolidated Drained
- CU - Consolidated Undrained with p.w.p. measurement

SAMPLES

- Small disturbed sample
- Large disturbed sample
- Undisturbed 100mm ϕ tube sample
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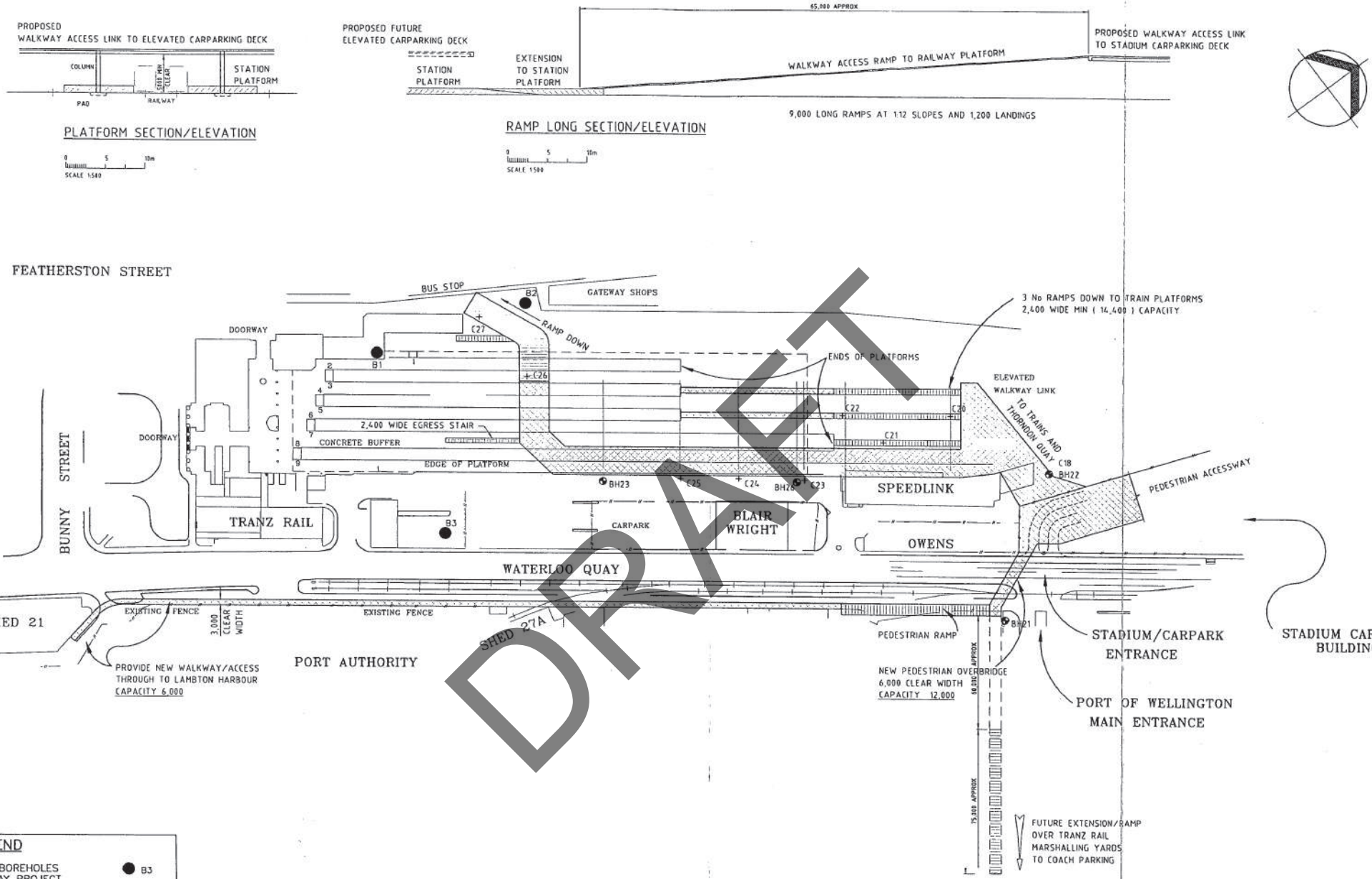
- Standard Penetration Test (SPT)
- Other samples specified

FIELD TESTS

- N - SPT blows/300mm
- K - Permeability (cm/sec)
- PP - Pocket penetrometer (kPa)

Shear Vane

- C - Undrained cohesion (kPa) direct dial reading
- CC - as C but corrected reading
- CR - remoulded C



INVESTIGATION LOCATION PLAN
ELEVATED WALKWAYS
FIGURE 3

BECA
14.11.97
3401154/F003
SCALE 1:2000

NZGD ID: BH_131205

CONE PENETRATION TEST (CPT) REPORT

McMILLAN Drilling

Client: University of Canterbury

Location: CentrePort Wellington
Various locations, Wellington

Printed: 19/08/2020

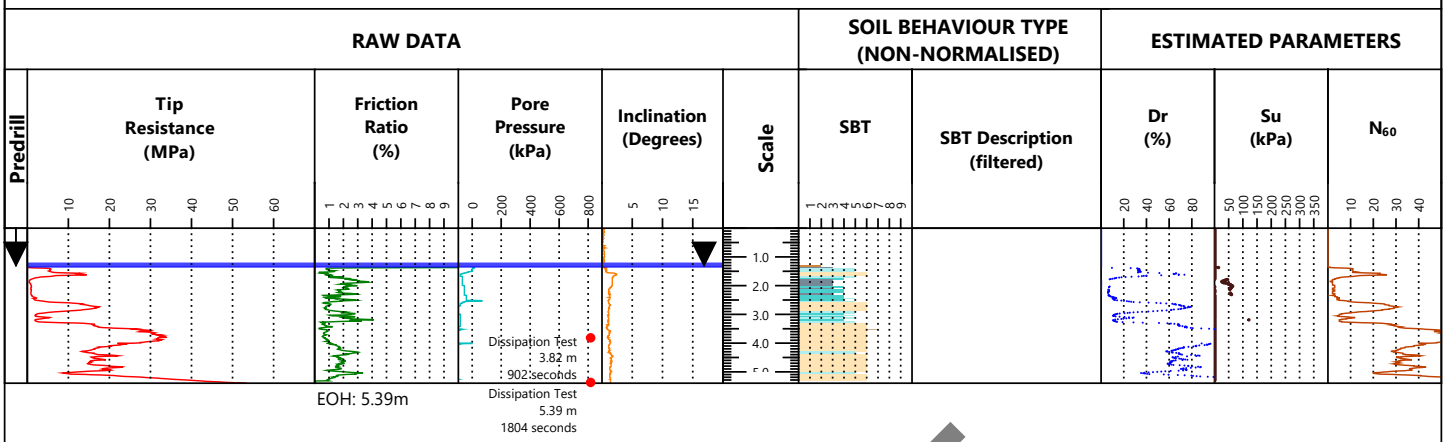
McMILLAN Drilling

Client: University of Canterbury	**Bore No.:** sCPTu1017
Project: CentrePort Wellington	**Job No.:** 18563

Site Location: Various locations, Wellington **Date:** 11/7/2020

Grid Reference: 1749286.2m E, 5429121.34m N (NZTM) - Map or aerial photograph **Rig Operator:** R. Wyllie

Elevation: 0.00m **Datum:** Ground **Equipment:** Geomil Panther 100



Cone Type: I-CFXYP100-10 - Compression
Cone Reference: 140912
Cone Area Ratio: 0.75
Standards: ISO 22476-1:2012

Predrill: 1.3m
Water Level: 1.3m
Collapse: 2.8m

Zero load outputs (MPa)	Before test	After test
Tip Resistance	-0.2003	-0.1382
Local Friction	0.0008	0.0002
Pore Pressure	-0.0094	-0.1097

Termination

Target Depth: ☐

Effective Refusal

Tip: ☑
Gauge: ☐
Inclinometer: ☐

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

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

Notes & Limitations

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

Remarks

NZGD ID: CPT_156073

TEST DETAIL

PointID: sCPTu1017
Sounding: 7

Operator: R. Wyllie
Cone Type: I-CFXYP100-10 - Compression
Cone Reference: 140912
Cone Area Ratio: 0.75

Date: 11/7/2020
Predrill: 1.3m
Water Level: 1.3m
Collapse: 2.8m

Termination

Target Depth: ☐

Effective Refusal
Tip: ☑
Gauge: ☐
Inclinometer: ☐

Zero load outputs (MPa)	Before test	After test
Tip Resistance	-0.2003	-0.1382
Local Friction	0.0008	0.0002
Pore Pressure	-0.0094	-0.1097

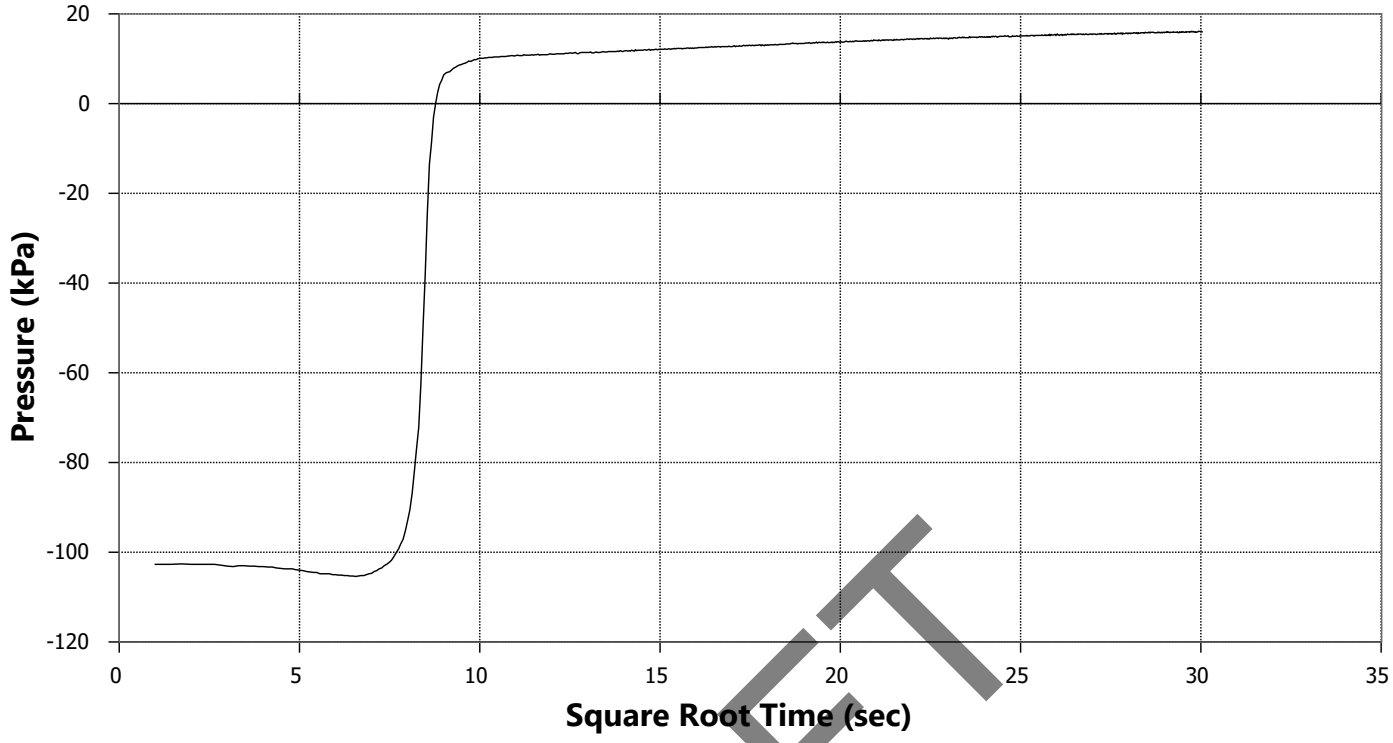
McMILLAN Drilling

NZGD ID: CPT_156073

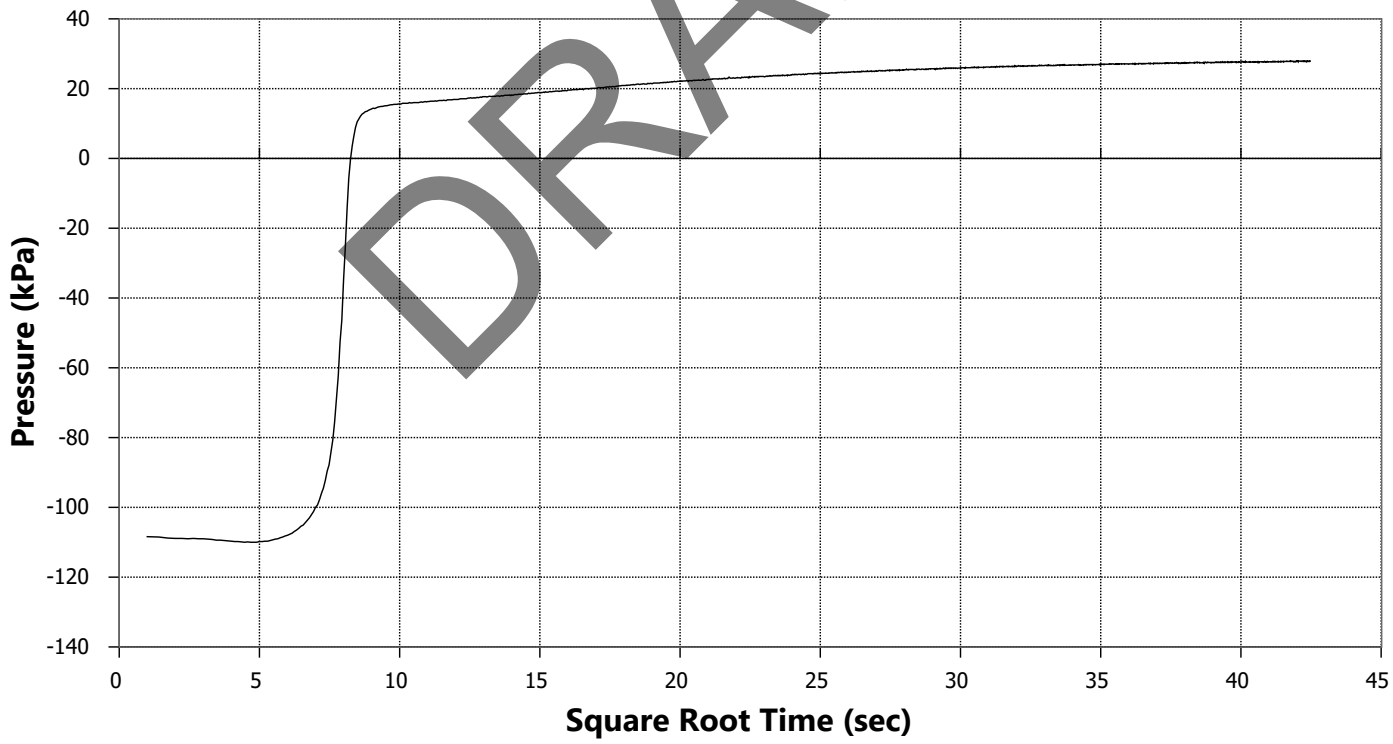
DISSIPATION TESTS

PointID: sCPTu1017

Test Depth: 3.82 **Duration:** 902 seconds



Test Depth: 5.39 **Duration:** 1804 seconds

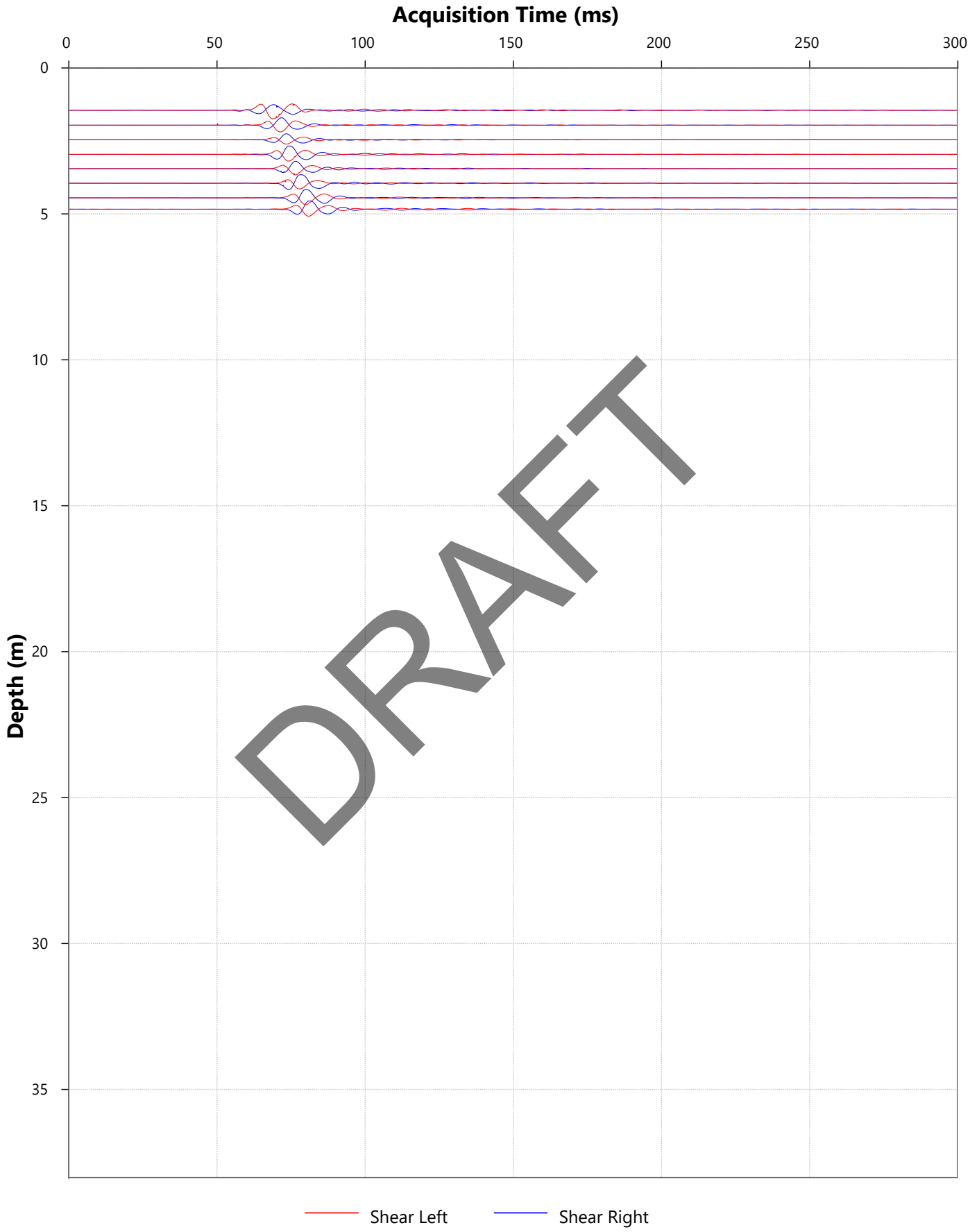


McMILLAN Drilling

SEISMIC TESTS

PointID: sCPTu1017

Horizontal source offset: 1.65m



McMILLAN Drilling

CPT CALIBRATION AND TECHNICAL NOTES

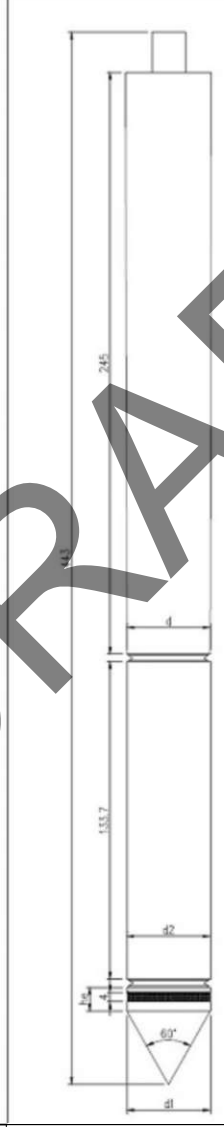
These notes describe the technical specifications and associated calibration references pertaining to the following cone types:

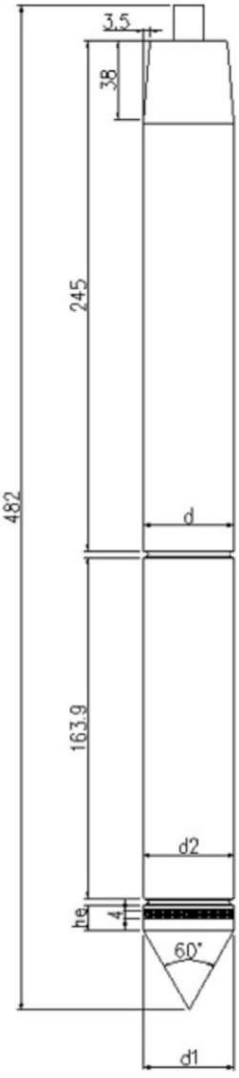
- I-CFXY-10 measuring cone resistance, sleeve friction and inclination (standard cone, 10cm²);
- I-CFXY-15 measuring cone resistance, sleeve friction and inclination (standard cone, 15cm²);
- I-CFXYP20-10 / I-CFXYP100-10 measuring cone resistance, sleeve friction, inclination and pore pressure (piezocone,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

Dimensions

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

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

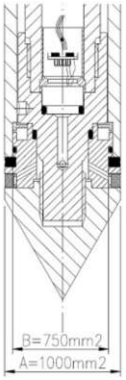




Tip and Local Friction sensor displacement

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

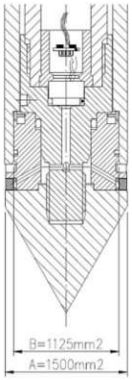
- 10cm² cones: 80mm
- 15cm² cones: 100mm



Cone area ratio

α = B / A = 0.75

β = 1 - B / A = 0.25



McMILLAN Drilling

NZGD ID: CPT_156073

CPT CALIBRATION AND TECHNICAL NOTES

Calibration

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

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

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

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

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

McMILLAN Drilling

Calibration Certificate

a.p. van den berg

1.1 General

Cone number:	140912
Cone type:	I-CFXYP100-10
Description:	Tip 75 MPa Sleeve 1.00 MPa Inclinometer 20° Pore 10MPa
Part number:	01002788
Certificate number:	140912-6
Client:	Mc Millan Drilling

1.2 Calibration equipment

	calibrated
Autolog 3000	
Autolog 3000	August 2017 (Peekel: SN# 2628009)
Autolog 3000	August 2017 (Peekel: SN# 2628009)
Autolog 3000	August 2017 (Peekel: SN# 2628009)
Reference Loadcell 100kN 93280	Sept 2017 (HBM: 64804 2017-09)
Reference Loadcell 20kN H22789	Sept 2017 (HBM: 64867 2017-09)
Reference Sensor 200 Bar 1149206	April 2018 (Trescal: 1803-17622)
Reference ACS-080-SC00-HP2-PM 08/11 470431	March 2015 (Trescal: 1503-02689)
Reference ACS-080-SC00-HP2-PM 08/11 470431	March 2015 (Trescal: 1503-02689)

1.3 Standard
EN ISO 22476-1 2012 Class 2

1.4 Result
The sensor complies to the above standard

Calibrated by:	C.J. Ouwejan
Date:	19/09/2018
Signature:	
QA Manager:	N.R.E. de Jong
Date:	19/09/2018
Signature:	

Calibration Certificate

a.p. van den berg

Zero Value	Cone	-0.015 [MPa]	**Max. Deviation from Zero Value**	Cone	3.75 [MPa]
	Sleeve	0.004 [MPa]		Sleeve	0.05 [MPa]
	Pore(u2)	-3.1 [kPa]		Pore(u2)	500.0 [kPa]

Ref [MPa]	Cone [MPa]	Cone-Ref [kPa]
-0.018	-0.013	5
1.000	1.015	15
2.104	2.095	-9
4.022	4.023	1
8.491	8.494	3
12.349	12.331	-18
20.978	20.975	-3
30.487	30.531	44
41.759	41.798	39
49.899	49.955	56
61.619	61.687	68
75.456	75.470	14

Ref [MPa]	Sleeve [MPa]	Sleeve-Ref [kPa]
0.000	0.000	0
0.036	0.036	0
0.067	0.067	0
0.104	0.105	1
0.130	0.131	1
0.198	0.200	2
0.296	0.299	3
0.421	0.424	3
0.568	0.571	3
0.675	0.678	3
0.752	0.755	3
1.023	1.023	0

Ref [MPa]	Pore(u2) [MPa]	Pore(u2)-Ref [kPa]
0.001	-0.002	-3
0.211	0.209	-2
0.402	0.400	-2
0.740	0.739	-1
1.202	1.203	1
2.013	2.020	7
2.652	2.659	7
3.972	3.979	7
4.813	4.827	14
5.762	5.787	25
7.858	7.867	9
9.819	9.810	-9

NZGD ID: CPT_156073

CONE CERTIFICATES

ENGEO Expect Excellence

LOG OF BORING BH01

Silvester Clark Consulting Engineers
121 Thorndon Quay
Thorndon, Wellington
15394.000.000
-

Client : Silvester Clark Consulting
Date : 11/09/2018
Hole Depth : 20.38 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling
Core Diameter : 83 mm
Hammer Efficiency : 89.2 %
Logged By/Reviewed By : CM / KJ
Latitude : -41.274451
Longitude : 174.783359

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	NO RECOVERY	NR		JET VAC	NR	▽ ▼		-					
1.5	MARGINAL MARINE		GP	Sandy fine to medium GRAVEL with trace silt; brownish orange mottled grey. Poorly graded, angular to subrounded; sand is fine to coarse, well graded.				MD	3/4//6/5/4/4 N=19				
2.0			GP ML	Sandy fine GRAVEL with some silt; grey. Poorly graded, subangular; sand is fine to coarse, well graded.				VS		0			
2.5			ML	SILT with trace gravel; grey. Moderate plasticity; gravel is fine, poorly graded, subangular.						0			
3.0			ML	Gravelly SILT with minor sand; brownish grey. Moderate plasticity; gravel is fine to medium, poorly graded, angular to subangular; sand is fine to coarse, well graded.				S	2/2//1/1/0/1 N=3				
3.5			ML	SILT with minor gravel; brownish grey. Low to moderate plasticity; gravel is fine to medium, poorly graded, angular to subangular.					2/3//5/3/3/3 N=14				
4.0				3.85 m - Additional minor fine to coarse sand, well graded.				St	1/2//2/2/3/4 N=11	100			
4.5			GP SP	Sandy fine GRAVEL; bluish grey. Poorly graded, angular to subangular; sand is fine, poorly graded.				-					
5.0				Fine SAND with minor gravel, minor silt; bluish grey. Poorly graded; gravel is fine, poorly graded, angular to subangular.					4/5//5/5/7/6 N=23				
5.5			SP	Gravelly fine to medium SAND with trace silt; bluish grey. Poorly graded; gravel is fine to medium, poorly graded, angular to subangular.				MD					
6.0			SP SP	Fine SAND with minor gravel, minor silt; bluish grey. Poorly graded; gravel is fine, poorly graded, angular to subangular.					2/4//8/5/6/6 N=25				
6.5			GP	Gravelly fine to medium SAND with trace silt; bluish grey. Poorly graded; gravel is fine to medium, poorly graded, angular to subangular.									
7.0				Sandy fine to medium GRAVEL; bluish grey. Poorly graded, subangular to subrounded; sand is fine, poorly graded.									

VS = Very Soft, S = Soft, St = Stiff, VSt = Very Stiff, H = Hard
MD = Medium Dense, D = Dense, VD = Very Dense
Water level recorded at 0.2 m after 20.0m had been drilled on 14/09/18. Water level recorded at 0.56 m on 19/09/18.

GEOSCIENCE MACHINE BORING 15394 121 THORNDON QUAY BOREHOLE LOGS.GPJ NZ DATA TEMPLATE 2.GDT 10/4/18

ENGEO Expect Excellence

LOG OF BORING BH01

Silvester Clark Consulting Engineers
121 Thorndon Quay
Thorndon, Wellington
15394.000.000
-

Client : Silvester Clark Consulting
Date : 11/09/2018
Hole Depth : 20.38 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling
Core Diameter : 83 mm
Hammer Efficiency : 89.2 %
Logged By/Reviewed By : CM / KJ
Latitude : -41.274451
Longitude : 174.783359

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	MARGINAL MARINE		ML	SILT with some clay, minor gravel; brownish orange. Low to moderate plasticity; gravel is fine to medium, poorly graded, subangular to subrounded.				VSt	4/5//5/3/8/8 N=24				
				CORE LOSS	NR			-					
8.0			ML	SILT with some clay, minor gravel; brownish orange. Low to moderate plasticity; gravel is fine to medium, poorly graded, subangular to subrounded.				H	4/15//17/13/15/5 for 25mm N=50+				
			GP	Sandy fine to medium GRAVEL; bluish grey. Poorly graded, subangular to subrounded; sand is fine, poorly graded.				-					
8.5			ML	Gravelly SILT with some clay, minor sand; brownish orange mottled grey. Low plasticity; gravel is fine to medium, angular to subangular; sand is fine, poorly graded.						250			
9.0			GP	Fine to medium GRAVEL; brownish grey. Poorly graded, subangular to subrounded.				VSt	2/4//6/7/6/8 N=27				
9.5			SP	SILT with some clay, minor gravel; brownish orange. Low to moderate plasticity; gravel is fine to medium, poorly graded, subangular to subrounded.									
10.0				Fine to medium SAND with some gravel; bluish grey. Poorly graded; gravel is fine to coarse, well graded, angular to subangular.				VD	4/9//10/20/20 for 50mm N=50+				
10.5													
11.0			SM	Silty fine to coarse SAND with some gravel; grey. Well graded; gravel is fine to coarse, angular to subangular, poorly graded.				D	3/15//20/6/8/7 N=41				
11.5			GW	Sandy fine to coarse GRAVEL with minor silt; bluish grey. Well graded, angular to subangular; sand is fine to coarse, well graded.				-					
12.0			ML	SILT with minor sand; bluish grey mottled brown. Low plasticity; sand is fine to medium, poorly graded.				H	5/8//13/11/17/9 for 25mm N=50+				
12.5			SW	Gravelly fine to coarse SAND with minor silt; bluish grey. Well graded; gravel is fine to coarse, well graded, angular to subangular.				D					
13.0									5/6//9/10/17/11 N=47				
13.5			SM	Silty fine to coarse SAND with minor gravel; bluish grey. Well graded; gravel is fine to medium, poorly graded, angular to subangular.				VD					
14.0													

VS = Very Soft, S = Soft, St = Stiff, VSt = Very Stiff, H = Hard
MD = Medium Dense, D = Dense, VD = Very Dense
Water level recorded at 0.2 m after 20.0m had been drilled on 14/09/18. Water level recorded at 0.56 m on 19/09/18.

GEOSCIENCE MACHINE BORING 15394 121 THORNDON QUAY BOREHOLE LOGS.GPJ NZ DATA TEMPLATE 2.GDT 10/4/18

ENGEO Expect Excellence

LOG OF BORING BH01

Silvester Clark Consulting Engineers
121 Thorndon Quay
Thorndon, Wellington
15394.000.000
-

Client : Silvester Clark Consulting
Date : 11/09/2018
Hole Depth : 20.38 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling
Core Diameter : 83 mm
Hammer Efficiency : 89.2 %
Logged By/Reviewed By : CM / KJ
Latitude : -41.274451
Longitude : 174.783359

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	MARGINAL MARINE		SM	Silty fine to coarse SAND with minor gravel; bluish grey. Well graded; gravel is fine to medium, poorly graded, angular to subangular. 14.0 m - Becomes some fine to coarse gravel, well graded, angular to subangular.					9/13//30/20 for 50mm N=50+				
15.0								VD	10/16//26/24 for 70mm N=50+				
15.5													
16.0			GW	Fine to coarse GRAVEL with some sand; grey. Well graded, subangular to subrounded; sand is fine to coarse, well graded.					5/15//16/12/6/10 N=44				
16.5			SM	Sandy SILT with minor gravel; grey mottled brown. Low plasticity; sand is fine to medium, poorly graded; gravel is fine to medium, poorly graded, angular to subangular.									
17.0			SP	Fine to medium SAND with some silt; grey mottled brown. Poorly graded.				D	5/6//7/8/9/11 N=35				
17.5				17.45 m - Contains blackened carbon rich organics. 17.60 m - Sand becomes fine.									
18.0									3/6//7/7/8/9 N=31				
18.5				Silty, plastic PEAT.				-					
19.0			SP	Fine SAND with some silt; grey mottled brown. Poorly graded.									
19.5			SM	Silty fine SAND; grey mottled brown. Poorly graded.				D	3/3//4/5/6/7 N=22				
20.0			SP	Fine SAND with some silt; grey mottled brown. Poorly graded.				VD	6/9//13/17/17/3 for 5mm N=50+				

End of Hole Depth: 20.38 m
Termination: Target depth

VS = Very Soft, S = Soft, St = Stiff, VSt = Very Stiff, H = Hard
MD = Medium Dense, D = Dense, VD = Very Dense
Water level recorded at 0.2 m after 20.0m had been drilled on 14/09/18. Water level recorded at 0.56 m on 19/09/18.

GEOSCIENCE MACHINE BORING 15394 121 THORNDON QUAY BOREHOLE LOGS.GPJ NZ DATA TEMPLATE 2.GDT 10/4/18

LOG OF AUGER HA01

Core Education
121 Thorndon Quay
Thorndon, Wellington
15394.000.000

Client : Matt Tippen
Client Ref. : -
Date : 04/10/2018
Hole Depth : 0.45 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : CM
Reviewed By :
Latitude : 174.783341
Longitude : -41.274464

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	CONCRETE		Reinforced Concrete.				-		
	FILL	SW	Fine to coarse SAND with minor gravel; brown mixed yellowish brown. Well graded; gravel is fine to medium, poorly graded, angular to subrounded. Contains shell and organic fragments.			M	Medium dense		
							Dense		
0.5			End of Hole Depth: 0.45 m Termination Condition: Practical refusal						

Scala Penetrometer: Blows per 100mm — 2, 4, 6, 8, 10, 12; >>

Hand auger met practical refusal at 0.45 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Investigation termanated due to suspected services

LOG OF AUGER HA02

Core Education
121 Thorndon Quay
Thorndon, Wellington
15394.000.000

Client : Matt Tippen
Client Ref. : -
Date : 04/10/2018
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : CM
Reviewed By :
Latitude : 174.783304
Longitude : -41.274357

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	CONCRETE		Reinforced Concrete.				-		
	FILL	GP	Sandy fine to medium GRAVEL; grey mixed dark brown. Poorly graded, angular to subangular; sand is course, poorly graded.			M	Dense		
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 1.3 m depth.

NZGD ID: BH_107036

Beca

BOREHOLE No: **BH1**

MACHINE BOREHOLE LOG

SHEET 1 of 2

PROJECT:	Wellington Station Entry Project 602	JOB NUMBER:	3320677/400
SITE LOCATION:	East of Johnsonville Line Embankment	CLIENT:	ONTRACK

CIRCUIT: Wellington Geodetic Datum 1949 BOREHOLE LOCATION: South end of proposed retaining wall
COORDINATES: N 703,005.00 m R L: 1.6 m
E 300,603.00 m DATUM: Wellington 1953 (MSL)

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	ROD	CASING	IN-SITU TESTS: SV (kPa)	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	Vacuum											Vacuum excavation for service check - no recovery, logged downhole and from spoil. Loosely packed silty GRAVEL; moist, clast supported. Gravel: Coarse, subangular, grey/brown, SW greywacke. Minor subangular, MW greywacke cobbles. Tightly packed, clast supported medium to coarse grey/brown MW greywacke GRAVEL, minor silty matrix; moist.		1
														Coarse gravel, and cobbles.		
		89 %	SPT					3 2 2 N=4		1		ML	M	Stiff gravelly sandy SILT, trace clay, orange-brown; moist, low plasticity. Gravel: Medium, greyish brown, brown stained, subrounded to subangular, HW greywacke.	Reclamation Fill	
	24/8/08 (2.15pm)	100 %	OB									ML	M	Very stiff (compacted by drilling), sandy SILT, some gravel, minor clay, trace cobbles, orange-brown; moist, low plasticity. Gravel: Medium to coarse, subangular, MW and SW, grey stained brown, strong greywacke.		0
														Trace cobbles: MW and SW, grey stained brown, strong greywacke.		
		62 %	SPT					2 5 7 N=12		2		MH GP	M W	Very stiff (compacted by drilling) SILT, some sand, some clay, some gravel; moist, high plasticity. Gravel: Fine to coarse, subangular, grey stained brown, MW, moderately strong greywacke.		
														Firm silty sandy GRAVEL, trace clay, orange-brown; wet, low plasticity. Gravel Medium to coarse, greyish brown, stained brown HW, poorly cemented sandstone, and MW moderately strong greywacke.		
		0 %	CC											Concentrix - no recovery, described from cuttings: Gravelly sandy SILT, minor clay, orange-brown; wet, high plasticity.		-1
														Concentrix - no recovery, described from cuttings: Silty SAND, minor fine gravel, minor clay, greenish/brownish grey; wet, high plasticity. Gravel: Subangular, HW-MW greywacke.	Marine sediments	
		11 %	SPT					2 1 1 N=2		3		MH	W	Poor recovery, sample disturbed: Soft sandy SILT, some clay, minor gravel, brownish green/orange; wet, high plasticity. Gravel: Fine, subangular sandstone/greywacke.		
		0 %	TT/CC									MH	S	Poor recovery, sample disturbed (partially drilled with concentrix): Soft gravelly fine sandy SILT, minor to some clay, yellowish brownish green; saturated, high plasticity. Gravel: Medium to coarse, subrounded, brown and black stained MW and SW greywacke.	Pleistocene deposits	-2
		100 %	SPT					4 8 9 N=17		4			M	Firm, some clay, yellowish brown; moist, high plasticity. Gravel: Medium, subangular, greyish brown, stained orange-brown, HW, extremely to very weak sandstone/greywacke.		
		69 %	TT									ML	W	Stiff, trace clay; wet, low plasticity. Gravel: Fine to medium, subangular, greyish brown, stained orange brown, HW, extremely weak sandstone, and MW, moderately strong greywacke.		-3
								3								

DATE STARTED:	24/8/08	DRILLED BY:	Griffiths Drilling (NZ) Ltd
DATE FINISHED:	24/8/08	EQUIPMENT:	Longyear H170
LOGGED BY:	JUB	DRILL METHOD:	TT/OB/CC/SPT
SHEAR VANE No:		DRILL FLUID:	Water + mud/compressed air
VANE CALIBRATION:		DIAMETER/INCLINATION:	- / 90°

COMMENTS:
Water level measured after drilling ceased, with all drill equipment removed. RL estimated from site plan. Coordinates approximate only, +/- 2m, measured on site by tape. CC = Concentrix drilling, no recovery with this method.

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

A4 Scale 1:25

MACHINE_BOREHOLE P:\3321332067\7400\TGE\WELLINGTON STATION ENTRY PROJECT 602.GPJ BECA.GDT 26/9/08

NZGD ID: BH_107036

Beca

BOREHOLE No: **BH1**

MACHINE BOREHOLE LOG

SHEET 2 of 2

PROJECT: Wellington Station Entry Project 602
JOB NUMBER: 3320677/400
SITE LOCATION: East of Johnsonville Line Embankment
CLIENT: ONTRACK

CIRCUIT: Wellington Geodetic Datum 1949
COORDINATES: N 703,005.00 m
E 300,603.00 m
BOREHOLE LOCATION: South end of proposed retaining wall
R L: 1.6 m
DATUM: Wellington 1953 (MSL)

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV (kPa)	T (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	SPT					6 11 N=17				MH	S			
													M	Moderately thin zone of stiff fine sandy SILT, minor gravel, trace clay; moist, low plasticity.		
														Gravel: Medium to coarse.		
		100 %	TT													-4
		100 %	SPT					9 18 14 N=32		6						
		91 %	TT											Minor clay.		-5
		100 %	SPT					6 8 13 N=21		7		MH	M	Stiff SILT, some fine sand, some clay, minor gravel, yellowish orange-brown; moist, high plasticity. Gravel: Fine to medium, subangular, brownish grey, stained brown, HW, very weak greywacke.	Pleistocene deposits *(Contd.)*	
		100 %	TT									ML		Some medium to coarse subangular gravel, trace clay; low plasticity.		-6
														Thin zone of laminated bedding.		
													W	Thin lens of clayey SILT; moist, high plasticity. Wet.		
		100 %	SPT					8 15 17 N=33		8		ML	M	Stiff sandy SILT, some gravel, minor clay, yellowish brown, mottled grey; moist, low plasticity. Gravel: Fine to medium, subangular, orange/brown, HW, extremely to very weak greywacke.		
														END OF LOG @ 8.45 m		-7
										9						-8

DATE STARTED: 24/8/08
DATE FINISHED: 24/8/08
LOGGED BY: JUB
SHEAR VANE No:
VANE CALIBRATION:

DRILLED BY: Griffiths Drilling (NZ) Ltd
EQUIPMENT: Longyear H170
DRILL METHOD: TT/OB/CC/SPT
DRILL FLUID: Water + mud/compressed air
DIAMETER/INCLINATION: - / 90°

COMMENTS:
Water level measured after drilling ceased, with all drill equipment removed. RL estimated from site plan. Coordinates approximate only, +/- 2m, measured on site by tape. CC = Concentrix drilling, no recovery with this method.

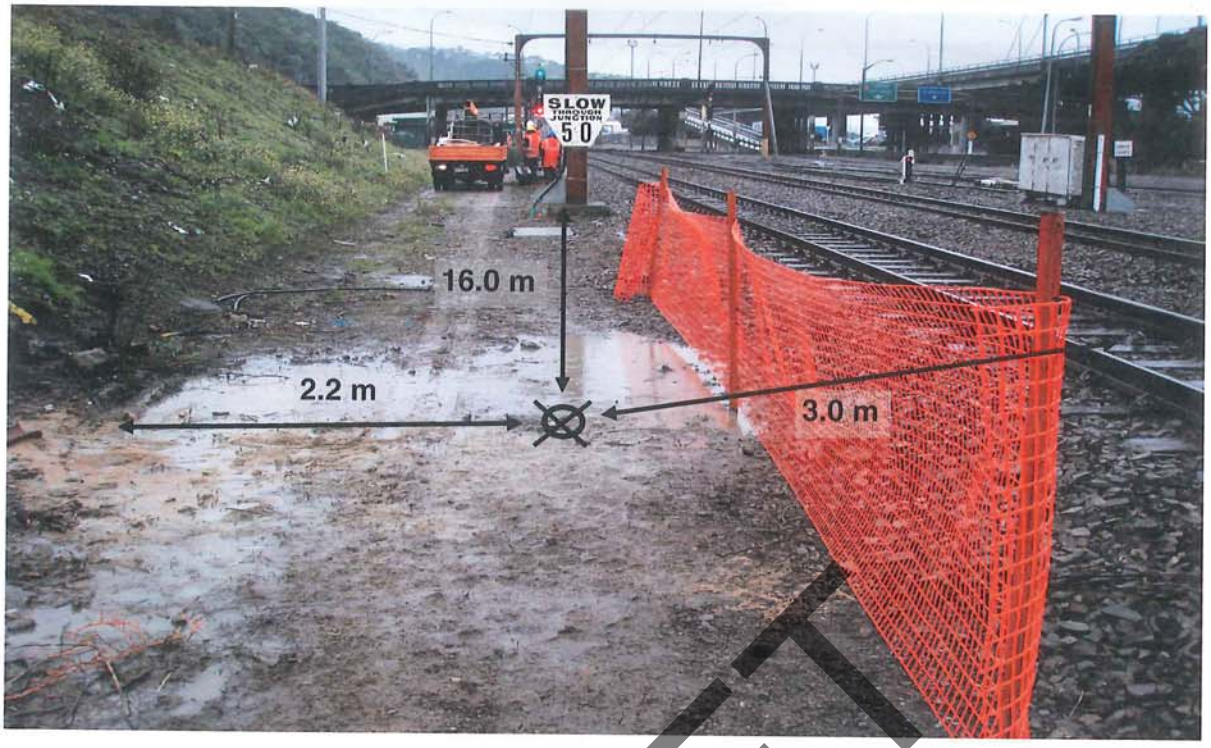
FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

A4 Scale 1:25.

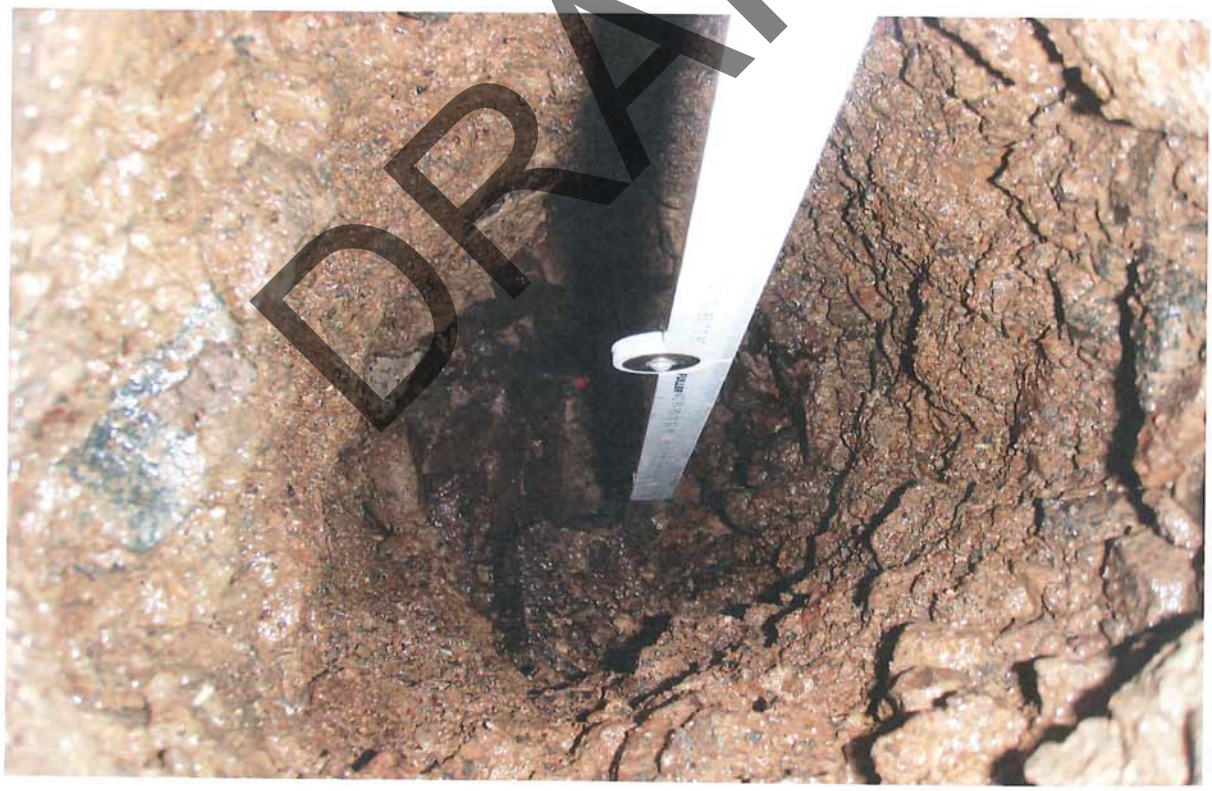
Revision A

MACHINE_BOREHOLE P:\3321\3320677\400\TG\EWELLINGTON STATION ENTRY PROJECT 602.GPJ BECA.GDT 26/9/08

NZGD ID: BH_107036



Borehole Location



Downhole View
(vacuum excavated):

DEPTH: 0 to 1.0m

Beca

Borehole Photos

NZGD ID: BH_107036

BOX: 1 **DEPTH: 1.0 to 6.0m**

BOX: 2 **DEPTH: 6.0 to 8.45m**

NZGD ID: TP_107039

Beca

TEST PIT LOG

TEST PIT No: **TP 0.8**

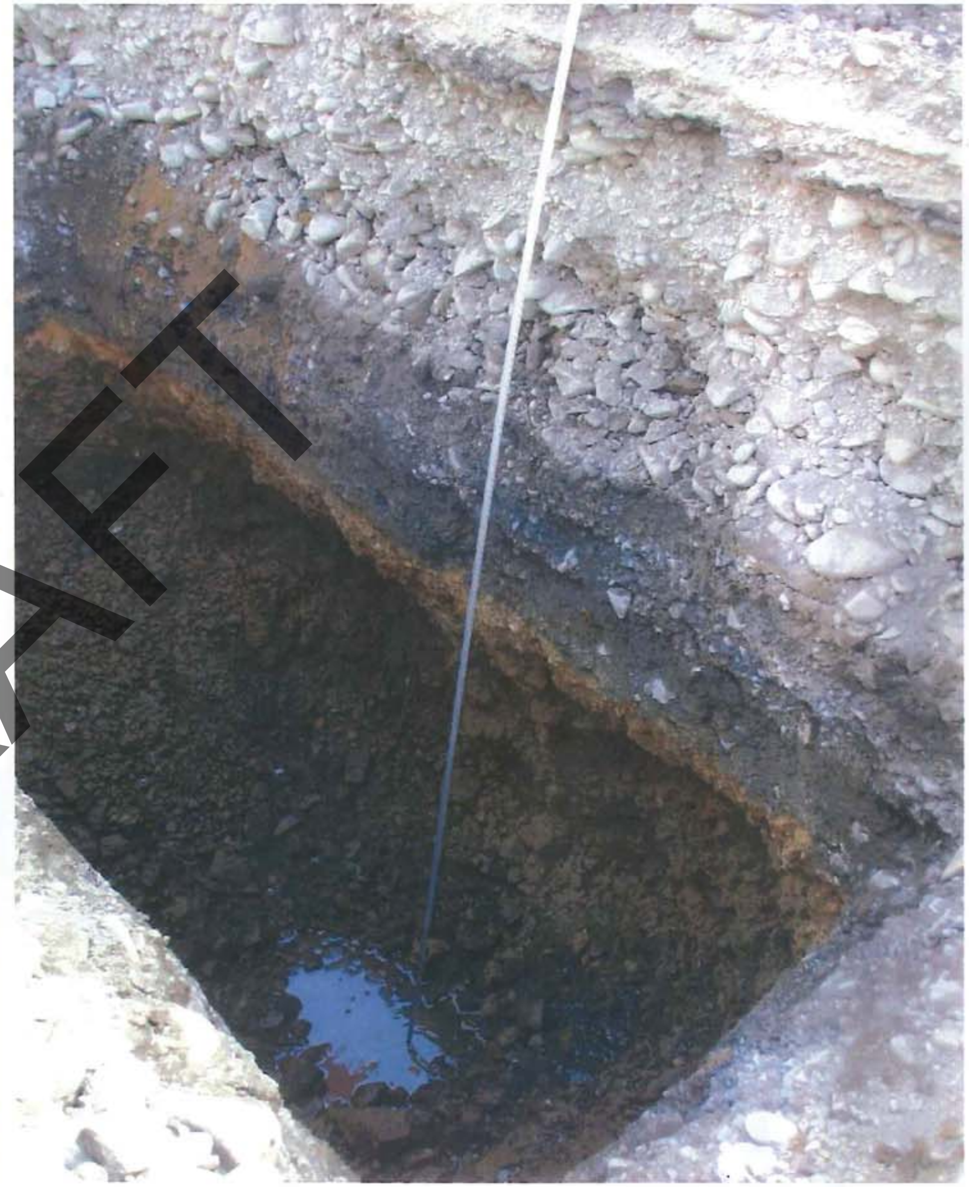
SHEET 1 of 1

PROJECT:	Wellington Station Entry Project 602	JOB NUMBER:	3320677/240
SITE LOCATION:	Wellington Station Yard	CLIENT:	ONTRACK
TESTPIT LOCATION:	Approx. 0.8 km from Wellington Station, near the stadium		
COORDINATES:	N 703,005 m E 300,608 m	R L: 1.87 m DATUM: Horizontal: Wellington Geodetic 1949; Vertical: Wellington 1953 (MSL)	

GEOLOGICAL UNIT	R L (m)	DEPTH (m)	WATER LEVEL	GRAPHIC LOG	CLASSIFICATION	MOISTURE	CONSISTENCY	SOIL DESCRIPTION	SAMPLES	Scala (Blows/150mm)	SV (kPa)	τ (kPa)
Fill	1	0			GM	D	MD	Tightly packed, 'medium dense', brown and grey layered silty GRAVEL; dry, non plastic, matrix supported.	D1			
					GW	D	MD	Loosely packed, 'medium dense', brown/grey GRAVEL, minor silt, minor sand; dry, non plastic, gravel supported. Gravel: Strong, SW, grey, fine to coarse, minor cobbles, well graded, subrounded and rounded greywacke.				
						M		Dark brown, silty sandy GRAVEL; moist.				
					GM	M	MD	Tightly packed, 'medium dense', grey GRAVEL, some silt, some sand, trace clay; moist, non plastic, gravel supported. Gravel: Strong, SW, grey, medium, some coarse, poorly graded, subangular greywacke.				
					SP	M	L	Tightly packed, 'loose/medium dense', brownish grey silty gravelly SAND, trace clay; moist, slightly plastic (matrix), matrix supported. Gravel: Strong, SW, grey, fine to medium, subrounded and subangular greywacke. Sand: Medium. Thin (20 mm) layer of black, silty gravelly SAND; moist, non plastic.				
					GM	M	MD	Tightly packed, 'medium dense', orange-brown, silty sandy GRAVEL, trace clay; moist, slightly plastic (matrix), gravel supported. Gravel: Weak to moderately strong, HW-MW, orange/brown, medium to coarse (well graded), subangular greywacke.				
		2	▽ 24/2/08 (10.45 am)					End of Test Pit 2 m.				

DATE DRILLED:	24/2/08	EXCAVATION METHOD: Hitachi EX60	COMMENTS: Pit located at 7.1 m offset east of NIMTL down main. Tidal conditions - falling.
LOGGED BY:	JUB	CONTRACTOR: HRS	
PILCON VANE No:			

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET



3320677/240

Test Pit Photos

TP 0.8

NZGD ID: TP_107039

Beca

TEST PIT LOG

TEST PIT No: **TP 1.15**

SHEET 1 of 1

PROJECT:	Wellington Station Entry Project 602	JOB NUMBER	3320677/240
SITE LOCATION:	Wellington Station Yard	CLIENT	ONTRACK
TESTPIT LOCATION:	Approx. 1.15 km from Wellington Station		
COORDINATES:	N 703,370 m E 300,462 m	R.L:	1.88 m
		DATUM:	Horizontal: Wellington Geodetic 1949; Vertical: Wellington 1953 (MSL)

GEOLOGICAL UNIT	R.L (m)	DEPTH (m)	WATER LEVEL	GRAPHIC LOG	CLASSIFICATION	MOISTURE	CONSISTENCY	SOIL DESCRIPTION	SAMPLES	Scala (Blows/150mm)	SV (kPa)	τ (kPa)
Fill	1	1			GM	D	D	Tightly packed, 'dense', brown sandy GRAVEL, some silt; dry, non plastic, gravel supported. Gravel: Strong, SW, grey, fine to medium, minor coarse, well graded, subrounded and subangular greywacke.				
					GM	M	D	Tightly packed, 'dense', dark brown silty GRAVEL, some sand, trace clay, minor refuse (rags, timber); moist, non plastic. Gravel: Strong, SW, grey, medium to coarse, minor cobbles, well graded, rounded and subangular greywacke.				
					GM	M	D	Tightly packed, 'dense', black and dark grey, silty sandy GRAVEL, trace clay; moist, slightly plastic (matrix), matrix/gravel supported. Gravel: Strong, SW, grey, medium to coarse, poorly graded, subangular to angular, greywacke and black, subangular coal.				
					GM	M	MD	Tightly packed, 'medium dense', greyish brown, sandy silty GRAVEL; moist, non plastic, gravel supported. Gravel: Strong, SW, grey, medium to coarse, poorly graded, subrounded and subangular greywacke.				
					SP	W	L	Loosely packed, 'loose', dark brown gravelly SAND, some refuse (bricks, broken terracotta pipe); wet, non plastic, matrix supported, hydrocarbon odour. Gravel: Strong, SW, grey, medium to coarse, poorly graded, subrounded greywacke, and black coal. Sand: Medium to coarse.	D1			
	0	2	24/2/08 (9.45 am)					End of Test Pit 1.8 m.				
	-1											

DATE DRILLED:	24/2/08	EXCAVATION METHOD: Hitachi EX60	COMMENTS: Pit located at 5.0 m offset east of NIMTL down main. Tidal conditions - falling.
LOGGED BY:	JUB	CONTRACTOR: HRS	
PILCON VANE No:			

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

NZGD ID: TP_107040

Beca
3320677/240

Test Pit Photos

TP 1.15

NZGD ID: TP_107040

T82749.003-HA1

TONKIN & TAYLOR LTD.

BOREHOLE LOG

BOREHOLE NO: HA1
SHEET 1 OF 1

PROJECT: WCC - 1 STONE HILL
LOCATION: 1 Stone Hill, Thorndon
JOB NO: 82749.003-HA1
CO-ORDINATES:
DRILL TYPE: Hand Auger
HOLE STARTED: 5 September 2000
DRILL METHOD:
HOLE FINISHED: "
RL: 1.15m below AC surface @ SC1
DRILLED BY: MRT
DATUM:
DRILL FLUID: None
LOGGED BY MRT CHECKED BY: BS

DRILLING AND TESTS					ENGINEERING DESCRIPTION						GEOLOGICAL	
FLUID LOSS	WATER	CORE RECOVERY	METHOD/CASING	SAMPLES, TESTS	RL (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DETECTS, STRUCTURE	UNIT
N/A	DRY ON COMPLETION	N/A	N/A		0.0		ML	SILT, slightly plastic, brown, some CLAY, some ORGANICS, minor GRAVELS (med. subangular)	M	VL		TOPSOIL	
					0.5		ML	... as above, mixed brown, light grey, orange-brown, minor GRAVELS	M	F		FILL	
					1.0								
					1.35		ML	SILT, slightly plastic, light grey with orange mottles, some GRAVELS (fine, angular) trace fine SAND	M	H			
								REFUSAL @ 1.35m					

D

Appendix C – Historical Investigations: Aotea Quay Roundabout

D.1 Previous Geotechnical Investigations in Proximity to Aotea Quay Roundabout.

NZGD ID	Consultant	Year	Location	Type	Depth (m)
BH_72203	ENGEO Ltd	2015	North-West of roundabout	Machine Borehole	19.91
BH_137712	ENGEO Ltd	2018	North-West of roundabout	Machine Borehole	1.50
CPT_72648	ENGEO Ltd	2016	North-West of roundabout	CPT	9.00
BH_72202	ENGEO Ltd	2015	South-West of roundabout	Machine Borehole	19.95
CPT_72644	ENGEO Ltd	2015	South-West of roundabout	CPT	9.00
BH_115248	Tonkin & Taylor Ltd	2008	East of roundabout	Machine Borehole	24.18

ENGEO Expect Excellence

LOG OF BORING BH4

Aotea Quay Toll Depot
151 Aotea Quay
Wellington 6011
12051

Client : KiwiRail
Date : 05/05/15
Hole Depth : 19.91 m
Drilling Method : Sonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 100 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 1749588.9
Longitude : 5429825.7

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.5	SITE FILL	NR		Core loss.	NR								
1.0			ML	Sandy gravelly SILT, brown. Low plasticity. Sand is coarse. Gravel is fine, subangular to subrounded.				S					
1.5			SP	SAND with minor gravel and a trace of silt, grey. Sand is medium to coarse. Gravel is fine to medium, subangular to subrounded. Shell fragments.				MD	4/3//3/3/3/3 N=12				
2.0		NR		Core loss.	NR								
2.5	RECLAMATION FILL		SP	Gravelly fine to coarse SAND with minor silt, brown. Gravel is fine to coarse, subangular to subrounded. Shell fragments and rootlets.		▼							
3.0								L	3/3//2/2/2/3 N=9				
3.5													
4.0													
4.5			ML	Sandy SILT with some gravel, grey. Low plasticity. Sand is medium to coarse. Gravel is fine to medium, subangular to subrounded. Shell fragments.				F					
5.0			ML					VS	1/1//1/0/1/0 N=2				
5.5		NR		Clayey SILT with minor sand and a trace of gravel, grey. Moderate plasticity. Core loss.	NR								
6.0			MH	Clayey SILT, grey. High plasticity. - 5.25 m to 5.75 m with minor sand and a trace of fine gravel.				VS	0/0//0/1/1/0 N=2				
6.5													
7.0													

GEOSCIENCE MACHINE BORING BOREHOLES REV 01.GPJ NZ DATA TEMPLATE 2.GDT 1/3/16

ENGEO Expect Excellence

LOG OF BORING BH4

Aotea Quay Toll Depot
151 Aotea Quay
Wellington 6011
12051

Client : KiwiRail
Date : 05/05/15
Hole Depth : 19.91 m
Drilling Method : Sonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 100 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 1749588.9
Longitude : 5429825.7

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
7.5	INTERBEDDED MARGINAL MARINE / FAN DEPOSITS		MH	Clayey SILT, grey. High plasticity. - 5.25 m to 5.75 m with minor sand and a trace of fine gravel.				VS	0/0//1/0/1/1 N=3				
8.0													
8.5								S					
9.0				- 8.75 m to 8.95 m layer of black organic silt.									
			ML	Sandy SILT with some gravel, dark grey. Moderate plasticity. Sand is medium to coarse. Gravel is fine to medium, subangular to subrounded. Shell fragments.					2/1//0/1/1/2 N=4				
9.5			ML	SILT with some sand and gravel, dark grey. Moderate plasticity. Sand is coarse. Gravel is fine to medium, subangular to subrounded. - 9.45 m to 9.55 m layer of black organic silt. - at 9.8 m becomes gravelly and sandy. Low plasticity. Gravel is fine to coarse, subangular to subrounded. - at 10.0 m becomes bluish grey, sandy with some fine gravel.				F					
10.0													
10.5								St	3/4//2/2/3/6 N=13				
11.0				- from 10.95 m with some sand and fine gravel.									
			MH	Moderate plasticity. SILT with minor sand, bluish grey. High plasticity.				S					
11.5				- 11.4 m to 11.7 m with some sand and gravel. Low plasticity. Gravel is fine to medium, subangular to subrounded.									
12.0								F					
			ML	Sandy gravelly SILT, bluish grey. Low plasticity. Sand is coarse. Gravel is fine to medium, subangular to subrounded.					9/11//11/10/10/13 N=44				
12.5								H					
13.0								VSt					
13.5			ML	SILT, grey with purple laminations. Moderate plasticity.				St	7/3//2/2/2/4 N=10				
14.0													

GEOSCIENCE MACHINE BORING BOREHOLES REV 01.GPJ NZ DATA TEMPLATE 2.GDT 1/3/16

LOG OF BORING BH4

Aotea Quay Toll Depot
151 Aotea Quay
Wellington 6011
12051

Client : KiwiRail
Date : 05/05/15
Hole Depth : 19.91 m
Drilling Method : Sonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 100 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 1749588.9
Longitude : 5429825.7

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	INTERBEDDED MARGINAL MARINE / FAN DEPOSITS		ML	SILT, grey with purple laminations. Moderate plasticity. - at 14.3 m becomes with some gravel and minor sand. Gravel is fine to coarse, subangular.				St					
15.0			ML	Sandy SILT with some gravel, bluish grey. Low plasticity. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded.				H	7/11//13/13/13/11 N=50				
15.5				- 15.45 m to 15.55 m core loss. - from 15.55 m moderate plasticity. - 15.75 m to 16.05 m with a trace of fine gravel and sand. - 16.05 m to 16.4 m low plasticity. - from 16.4 m with a trace of sand.									
16.0													
16.5			ML	SILT with minor sand, grey. Moderate plasticity.				VSt	2/5//3/3/5/6 N=17				
17.0													
17.5			ML	Sandy SILT with some gravel, bluish grey. Moderate plasticity. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded.				St					
18.0			ML	SILT with minor sand and a trace of gravel, grey. Moderate plasticity. Sand is coarse. Gravel is fine to medium, subangular to subrounded.					7/7//11/10/9/8 N=38				
18.5			ML	SILT with some sand and a trace of gravel, bluish grey. Moderate plasticity. Sand is fine to medium. Gravel is fine, subangular to subrounded. - from 18.6 m with minor sand and no gravel.				H					
19.0				- at 19.0 m becomes partially cemented.									
19.5									8/12//13/13/16/8 for 35 mm N=50+				

End of Hole Depth: 19.91 m
Termination: Target depth

NZGD ID: BH_72203

GEOTECHNICS

BOREHOLE LOG

BOREHOLE No.: **WS 24**

Hole Location: Refer to TLP

SHEET: 1 OF 1

PROJECT: GWN TOLL AOTEA QUAY ENGEO | LOCATION: Aotea Quay, Pipitea, Wellington | JOB No.: 1006494.0000

CO-ORDINATES: (NZTM)
R.L.:
DATUM

DRILL TYPE: Window Sampler
DRILL METHOD: WS
DRILL FLUID: N/A

HOLE STARTED: 27/03/2018
HOLE FINISHED: 27/03/2018
DRILLED BY: GEOTECHNICS
LOGGED BY: JMG | CHECKED: ABB

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%) 25 50 75	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa) 10 25 50 100 200	COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250	DEFECT SPACING (cm) 20 60 200 600 2000	Description and Additional Observations
			100		100mm Concrete cutter											Concrete.
			100		35mm	WS24-1 @ 0.5m			1		M	D				SAND (SP), with minor silt, with trace gravel; orange brown. Dense; moist; poorly graded; sand, fine to medium; gravel, fine, subangular to subround.
												MD				*0.60m:* Medium dense.
			100		35mm							VL				Silty SAND (SP); grey . Medium dense; moist; poorly graded; sand, fine.
		DRY 27/03/2018														*1.15m:* Very loose.
												MD				SAND (SW), with trace shell fragments; grey . Medium dense; Moist; well graded; sand, fine to coarse.
																1.5m: Target depth

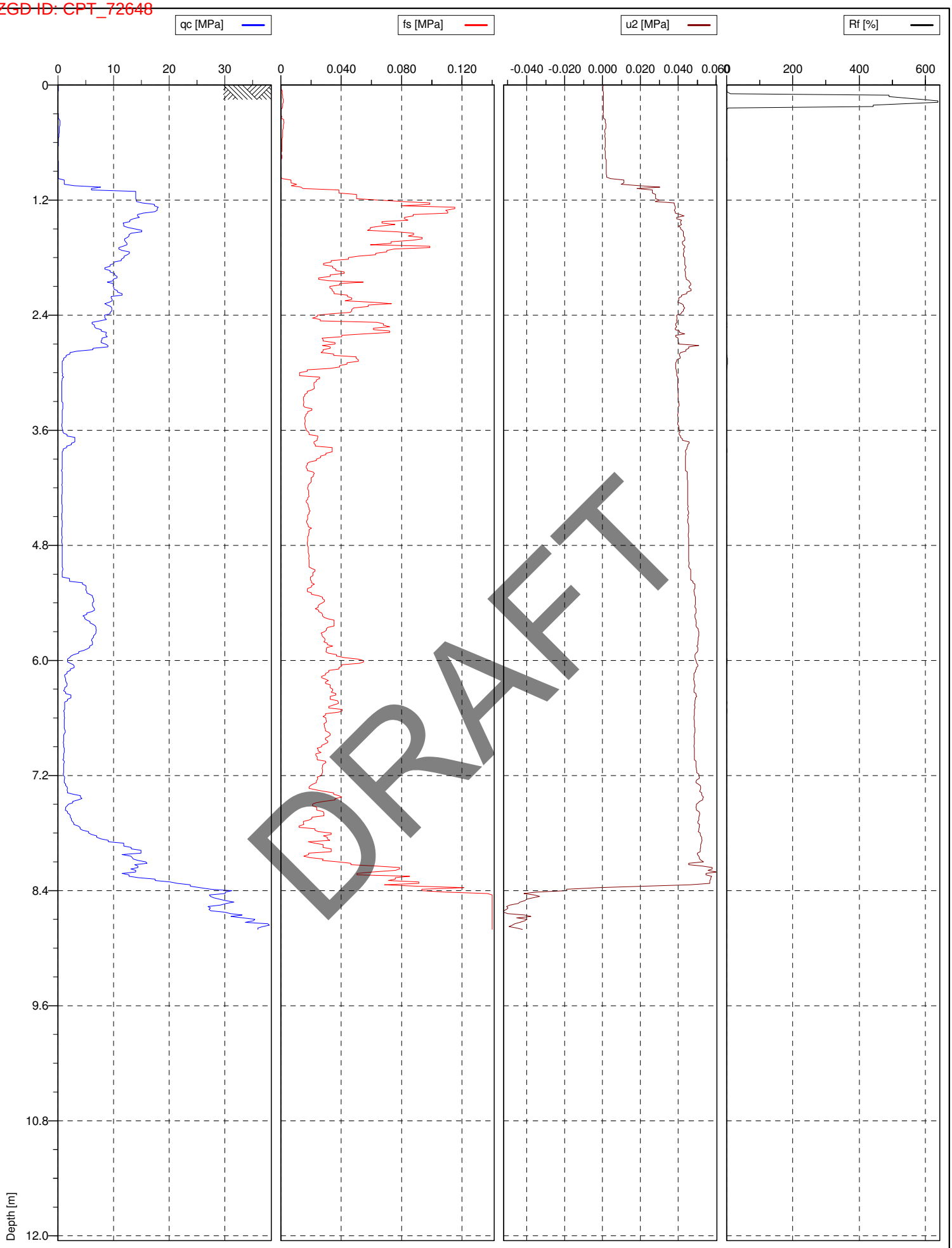
COMMENTS

Hole Depth 1.5m

Scale 1:9

Rev.: A

NZGD ID: CPT_72648



GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

U2

Cone No: 3842
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Aotea Quay	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 3
Project ID: 3	Client: ENGEO	Date: 5/05/2015	Scale: 1 : 50
Project: AOTEA		Page: 1/1	Fig:
		File: Aotea CPT3.cpt	

NZGD ID: CPT_72648

LOG OF BORING BH3

Aotea Quay Toll Depot
151 Aotea Quay
Wellington 6011
12051

Client : KiwiRail
Date : 04/05/15
Hole Depth : 19.95 m
Drilling Method : Sonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 100 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 1749607.7
Longitude : 5429756.5

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0				Concrete.									
0.5	SITE FILL		SP	Fine to coarse SAND with a trace of gravel, dark brown. Gravel is coarse, subangular.				L					
			GW	Sandy fine to coarse GRAVEL with a trace of silt, brown. Gravel is subangular to subrounded. Sand is medium to coarse.				L					
1.0			MH	SILT with occasional pockets of coarse sand and gravel, grey. High plasticity. Shell fragments and occasional steel fragments.				S					
		NR		Core loss.	NR								
1.5			MH	SILT with occasional pockets of coarse sand and gravel, grey. High plasticity. Shell fragments and occasional steel fragments.				St	2/2//3/3/4/4 N=14				
2.0		NR		Core loss.	NR								
			ML	SILT with some sand, grey. Moderate plasticity. Sand is medium to coarse. Shell fragments.				St					
2.5			SP	Gravelly coarse SAND with minor silt, grey. Gravel is fine to coarse, subrounded to rounded. Shell fragments.				L					
3.0									2/1//3/1/2/1 N=7				
3.5	RECLAMATION FILL		MH	Clayey SILT, grey. Moderate to high plasticity. Shell fragments.				VS					
4.0													
4.5									0/0//0/0/0/0 N=0				
5.0													
5.5													
6.0									0/0//0/0/0/0 N=0				
6.5													
7.0													

NZGD ID: BH_72202

ENGEO Expect Excellence

LOG OF BORING BH3

Aotea Quay Toll Depot
151 Aotea Quay
Wellington 6011
12051

Client : KiwiRail
Date : 04/05/15
Hole Depth : 19.95 m
Drilling Method : Sonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 100 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 1749607.7
Longitude : 5429756.5

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	RECLAMATION FILL		MH	Clayey SILT, grey. Moderate to high plasticity. Shell fragments. - 7.45 m to 7.95 m with a trace of coarse gravel.				VS S	0/0//1/1/1/1 N=4				
8.0			OH	Organic SILT with some sand, black. Moderate plasticity. Sand is medium to coarse. Rootlets and wood fragments.				S					
			SM	Silty coarse SAND, dark grey. Shell fragments.				L					
8.5	INTERBEDDED MARGINAL MARINE / FAN DEPOSITS		GW	Sandy fine to coarse GRAVEL with some silt, grey. Gravel is subangular to subrounded. Sand is medium to coarse. - 8.85 m to 9.45 m brown. - at 9.65 m becomes more sandy.				D	4/7//7/6/9/8 N=30				
10.0			SP	Gravelly coarse SAND with some silt, brown. Gravel is fine to coarse, subangular to subrounded.				MD					
			ML	SILT, bluish grey. Low plasticity. - from 10.5 m with some sand. - 10.5 m to 10.95 m with some fine gravel. - at 10.95 m becomes high plasticity.				St	1/0//1/1/5/7 N=14				
11.0			ML	Gravelly SILT with some sand, bluish grey. Moderate plasticity. Gravel is fine to coarse, subangular to subrounded. Sand is coarse.									
			ML	SILT, grey. Moderate plasticity. - 11.4 m to 11.5 m with some fine gravel.				F					
11.5			ML	Sandy SILT with some gravel, bluish grey. Low plasticity. Sand is medium to coarse. Gravel is fine to medium, subangular to subrounded.				VSt					
12.0			SP	Silty gravelly medium to coarse SAND, bluish grey. Gravel is fine to medium, subangular to subrounded.				D	7/9//12/10/10/10 N=42				
12.5			MH	SILT, bluish grey. High plasticity.				F					
13.0			ML	Sandy gravelly SILT, bluish grey. Low plasticity. Sand is coarse. Gravel is fine to coarse, subangular to subrounded.				H	1/11//12/9/11/9 N=41				
13.5													
14.0													

GEOSCIENCE MACHINE BORING BOREHOLES REV 01.GPJ NZ DATA TEMPLATE 2.GDT 1/3/16

ENGEO Expect Excellence

LOG OF BORING BH3

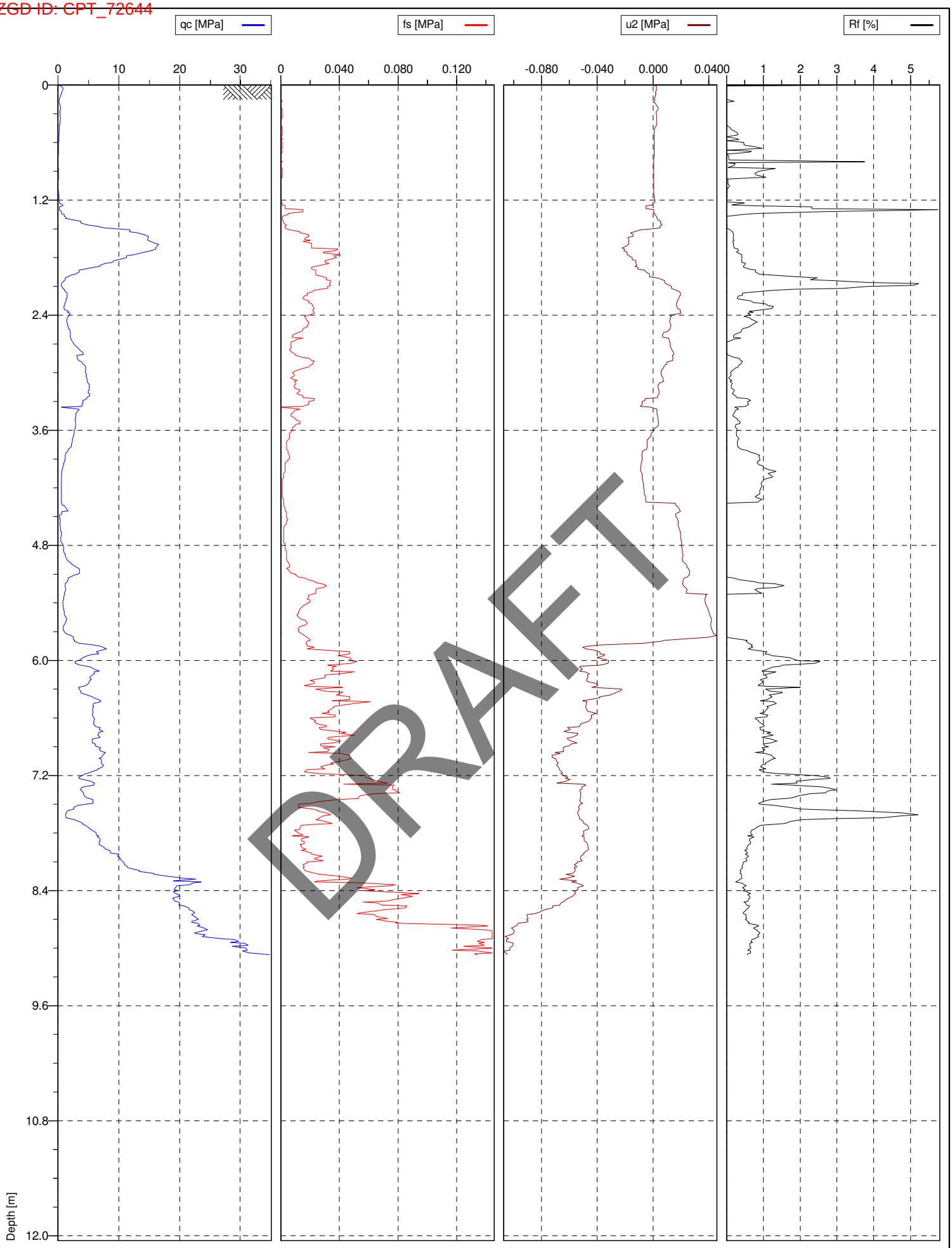
Aotea Quay Toll Depot
151 Aotea Quay
Wellington 6011
12051

Client : KiwiRail
Date : 04/05/15
Hole Depth : 19.95 m
Drilling Method : Sonic
Drilling Contractor : Griffiths Drilling

Core Diameter : 100 mm
Hammer Efficiency : 87.9 %
Logged By/Reviewed By : GL / KJ
Latitude : 1749607.7
Longitude : 5429756.5

Depth (m)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Pocket Pen. UCS (kPa)	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	INTERBEDDED MARGINAL MARINE / FAN DEPOSITS		SM	Silty medium to coarse SAND with some gravel, bluish grey. Gravel is fine to coarse, subangular to subrounded.				D					
			ML	Sandy SILT with some gravel, grey. Low plasticity. Sand is medium to coarse. Gravel is fine to coarse, subrounded to subangular. - at 14.7 m becomes more sandy and gravelly.				H					
15.0			ML GP	SILT with minor sand and gravel, bluish grey with brown laminations. Moderate plasticity. Gravel is fine, subangular.				VD	9/12//13/14/16/7 for 30 mm N=50+				
				Silty sandy fine to medium GRAVEL, bluish grey. Gravel is subangular to subrounded. Sand is coarse.									
15.5			ML	Sandy SILT with some gravel, bluish grey. Low plasticity. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded.				VSt					
16.0								H					
16.5									5/12//11/12/9/7 N=39				
17.0			ML	SILT, bluish grey with brown laminations. Moderate plasticity. Wood fragments.									
17.5				- at 17.7 m becomes gravelly with minor sand and yellow discolourations.									
18.0								VSt	6/6//4/4/8/12 N=28				
18.5			ML	SILT with some gravel and minor sand, bluish grey. Low plasticity. Gravel is fine to coarse, subangular to subrounded.									
19.0			ML	SILT with minor sand and a trace of gravel, bluish grey. Low plasticity, partially cemented.				St	0/2//2/4/3/4 N=13*				* SPT result appears annomalous. Consistency based on visual assessment.
19.5				End of Hole Depth: 19.95 m Termination: Target depth									

GEOSCIENCE MACHINE BORING BOREHOLES REV 01.GPJ NZ DATA TEMPLATE 2.GDT 1/3/16



GRIFFITHS DRILLING
RESULT DRIVEN GEOTECHNICAL SPECIALISTS

U2

Cone No: 3842
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location: Aotea Quay	Position: X: 0.00 m, Y: 0.00 m	Ground level: 0.00	Test no: 5
Project ID: 5	Client: ENGEO	Date: 7/05/2015	Scale: 1 : 50
Project: AOTEA		Page: 1/1	Fig:
		File: Aotea CPT5.cpd	

TONKIN & TAYLOR LTD.

BOREHOLE LOG

BOREHOLE NO: 103
SHEET 1 OF 2

PROJECT: Centreport Springer Piles | LOCATION: Centreport | JOB NO: 84464
CO-ORDINATES: Refer to Figure 1 | DRILL TYPE | HOLE STARTED: 11/4/08
DRILL METHOD: Rotary Wash drilling & SPT | HOLE FINISHED: 11/4/08
RL: | DRILLED BY: Griffiths Drilling
DATUM: | DRILL FLUID: Water + Quick Mud | LOGGED BY CWP CHECKED BY: RJK

DRILLING AND TESTS						ENGINEERING DESCRIPTION						GEOLOGICAL	
FLUID LOSS	WATER	CORE RECOVERY	METHOD/CASING	SAMPLES, TESTS	RL (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DETECTS, STRUCTURE	UNIT
					15			Depth from wharf to sea-bed. Drilling commenced at 15.73m					
SLOW LOSS			SPT 1	13/14/11/13/12 N=50 R=280	16		SM	Gravelly SAND with some Silt. Dark greenish grey; Sand, well graded, medium grained; Gravel, Sub angular particles, up to 30mm diameter; low plasticity;	M	D		Alluvial/ Colluvial derived sediments	
			SPT 2	6/11/11/11/17 N=50 R=440	17		OH	Silty Clay Dark brown; Uniformly graded; Moderate plasticity; Traces of organics: bark & plant material.	M	H		Harbour sediments	
					18		SM	Gravelly SAND with some Silt. Dark greenish grey; Sand, well graded, medium grain size; Gravel, Sub angular particles, up to 30mm diameter; low plasticity;	M	D		Alluvial / colluvial derived sediments	
							OH	Silty Clay - Dark brown; uniformly graded; Mod plasticity; Trace of organics: bark & other plant material	M	VS		Harbour sed.	
			SPT 3	21/12/8/7/7 N=34 R=420	19		GM	Silty GRAVEL with some Sand Dark greenish brown; Gravel, fine to medium, sub angular, up to 20mm diameter; Sand, well graded, fine to coarse; Silt, concentrates in uniformly graded pockets, low plasticity.	M	D		Alluvial/ colluvial derived sediments	
			SPT 4	6/19/12/24/5(5mm) N=50+ R=400	20				M	VD			

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BOREHOLE LOG

BOREHOLE NO: 103
SHEET 1 OF 2

PROJECT: Centreport Springer Piles | LOCATION: Centreport | JOB NO: 84464
CO-ORDINATES: | DRILL TYPE | HOLE STARTED:
DRILL METHOD: Rotary Wash drilling & SPT | HOLE FINISHED:
RL: | DRILLED BY: Griffiths Drilling
DATUM: | DRILL FLUID: Water + Quick Mud | LOGGED BY CWP CHECKED BY: RP.

DRILLING AND TESTS						ENGINEERING DESCRIPTION						GEOLOGICAL	
FLUID LOSS	WATER	CORE RECOVERY	METHOD/CASING	SAMPLES, TESTS	RL (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
				N=50+	20		GM	(continued) Silty GRAVEL with some Sand				Alluvial/ Colluvial derived sediments	
			SPT 5	60 (90mm) N=50+ REFUSAL R=NIL	21				M	VD			
			SPT 6	16/12/17/16/15 (15mm) N=50+ R=380	22		GM		M	VD			
Slow Loss							CH	Silty Clay with traces of gravel. Dark brown; Uniformly graded; Mod plasticity; traces of organics - plant material; Gravel, fine to med, sub angular, up to 20mm	M	VS		Marine Sediments	
			SPT 7	9/17/14/20/9 (35mm) N=50+ R=420	23		GM	Sandy GRAVEL with some Silt. Dark Greenish Brown; Low plasticity; Gravel well graded, fine to coarse, up to 40mm diameters; Sand, well graded; fine to medium; Particles are sub angular; Traces of organic material: Plant matter.	M	VD		Alluvial/ Colluvial derived sediments	
			SPT 8	35/150 (60mm) N=50+ R=240	24								
								Borehole Terminated at 24.18m. Target depth achieved.					
					25								

Appendix E

Safety in Design Register

Safety in Design Risk Assessment Register

Author (Role): Blaise Cummins
Job No: 3821501
Approved By: Will Maguire
Date: 7 October 2021
Revision: 2
Stage of Design / Project: Preliminary Design
Project Name: LGWM - Thorndon Quay & Hutt Road

Green = Thordon Quay; Orange = Hutt Rd; Purple = Aotea Quay; Blue = General

(Note: minimum of 2 reviews per project)

RISKS ASSOCIATED WITH DESIGN ELEMENTS					Risk Matrix			PROPOSED & APPROVED MITIGATION MEASURES	Mitigated Risk & Resolution						RESIDUAL RISK	
Ref	Chainage	Hazard (Guideword)	Cause & Outcome	Existing controls, if any	L	C	LR	Proposed Control (1 Eliminate, 2 Substitute, 3 Reduce, 4 Control)	L	C	LR	Risk Owner	Client Approved	Design Status	Date	Risk Owner	Action Required
1	**Construction Phase**																
1.001		*Position / Location*	Working in close proximity to live road hence the potential to causing accidents		2	4	H	Contractor to have appropriate training and produce safe working systems/STMS plans. Construction work will need to be split into manageable sections.	1	4	M						
1.002		*Position / Location*	Working in close proximity to power poles and under ground services results in services being struck.		2	4	H	Obtain the information on service location from DialB4UDig and representatives from Chorus/Gas operators to be present during excavation.	1	3	M						
1.003		*External safety interfaces*	Lack of communication with local residents causes issues.		2	2	L	Adequate communication with locals prior to construction via letter drops etc.	1	1	L						
1.004		*Position / Location*	Improper removal of vegetation causes issues		2	2	L	Adequate consultation with locals and use of professional arborists.	1	1	L						
1.005		Signals and telecommunications	Underground KiwiRail assets get struck during construction eg signals cables		3	4	H	Contractor to arrange for on-site mark out of all services prior to construction and arrange for a copy of the current services plans.	1	4	M						
1.006		Signals and telecommunications	Underground telecommunications assets get struck during construction		3	4	H	Contractor to arrange for on-site mark out of all services prior to construction and arrange for a copy of the current services plans.	1	4	M						
1.007		*Position / Location*	Provision of access to properties during construction phase may be difficult to impossible, Off street parking and the like		2	1	L	Contractor to arrange good traffic management	1	1	L						
1.008		*Position / Location*	Road to be kept operational at all times.		2	1	L	Phasing and programme to be developed to suit safely maintaining operation of the highway at all times	1	1	L						
1.009		*Position / Location*	work to be carried out adjacent to operational rail land, with live overhead catinery.		1	5	H	Agreement with Kiwi Rail on the risks and mitigations will be necessary	1	1	L						
2		**Operation & Maintenance Phase**															
2.001	CH 220m	*Egress / Access*	Cyclists collide with pedestrians and / or vehicles at Sky Stadium entrance	Is TMP in use already when a large event is held?	4	4	E	Landscaping / fencing to guide pedestrians at such points should be considered.	2	2	L						
2.002	CH240m, CH320m, CH460m, CH540m	*Egress / Access*	Cyclists collide with vehicles at accessways of existing Capital Gateway car parks		3	4	H	Appropriate width for traffic coming in and out, enough warning for traffic to think about cyclists. Remove the first car park on the north of the most southern exit of Capital Gateway car park. Rumble strips to slow cyclists either side of driveways. Working with Capital Gateway to have proper infrastructures installed at the car park exits to make drivers more aware of path users - include during next phase of design (RSA for Prelim Design - Finding 4.6)	2	2	L						
2.003	Various	*External safety interfaces*	On Thorndon Quay corridor: conflicts between cyclists and pedestrians on the proposed new shared path with segregation	A step to delineate between the users	3	2	M	A different colour and texture is preferred to delineate different road users on the shared path.	1	2	L						
2.004	CH 160m - CH 1500m	*External safety interfaces*	On Thorndon Quay corridor: Cyclists and motorcyclists may use the space between on-street parallel parking and central carriageway and maybe crash into doors opening on them		3	3	H	Add appropiate signage such as all cyclists to use cyclepath etc	2	2	L						
2.005	CH 240m - CH 1500m	*Egress / Access*	Western side of Thorndon Quay corridor: Business vehicles reversing out of properties collide with pedestrians	It is an existing issue. Adequate footpath width will be retained.	2	3	M	Possible addition of signage	1	2	L						

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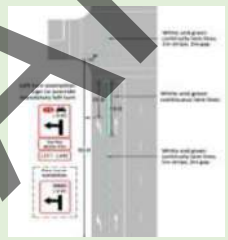
2.006	CH 700m	*Position / Location*	Davis St/TQ intersection: The right turn in movement on TQ would block the southbound traffic. Southbound vehicles may jump lanes (undercutting) to go around the vehicle which increases the potential for accidents.		3	3	H	Confirmed constrained by available width (not enough room for separate right turn lane)	3	3	H						
2.007	CH1500m	*Position / Location*	Tinakori Rd/TQ intersection: Left turn in vehicles on TQ may collide with the vehicles on the right lane of Tinakori Road due to the tight and sharp turn.		4	3	H	Share turn issue still remains however: 1. The left turn and through movement should be allowed in the same phase. 2. Understand the demand of left turn in movements. If the demand of left turn in movement is significant, the designation of lanes can follow the design from Auckland Transport Code of Practice Figure 22. Change the shared lane to a left turn only lane. Buses can proceed straight ahead in a left turn only lane where signage allowing this movement has been provided. 3. Consider the continuity to Sars St intersection. It is likely that no parking or special vehicle lane or bus lane will be provided between Sars St and Tinakori Rd intersections as they are so close to each other. After drivers are familiar with the new layout, it is likely that they will intend not to use this lane for going straight in order to avoid changing lanes movement. 	2	2	L						
2.008	CH 1500m	*External safety interfaces*	Tinakori Rd/TQ intersection: Northbound vehicles on the jump lanes in order to go around other vehicles which increases the potential for conflict accidents.		3	3	H		2	2	L						
2.009	Various	*External safety interfaces*	Parked vehicle users getting out of cars step off separator into cycle lane		3	3	H	Increase buffer to 0.8m wide	1	3	M			Done			
2.010	Sheet 1	*Position / Location*	(RSA for Prelim Design - Finding 4.4) The waiting space of the crossing adjacent to Sky Stadium - insufficient waiting space post-event.		3	3	H	This area of landscaping will be modified to hard landscaping as part of prelim design to allow for pedestrian storage.	1	3	M			Done			
2.011	Sheet 1	*Position / Location*	(RSA for Prelim Design - Finding 4.5) Visibility issue at left turn at Mulgrave Street	Proposal to signalise the bus terminal/left turn from Mulgrave Streeet.	3	3	H	The visibility could be improved with pruning some vegetation. Include signalisation of this intersection during the next phase of design.	1	3	M						
2.012	Sheet 1	*Position / Location*	Bus-stop Friendly - need to ensure these users have a safe crossing environment at Bus Station entry from Molesworth area	Crossing signals	1	3	M	Safe design crossing	1	1	L						
2.013	Sheet 1	*External safety interfaces*	Speed & Cycle user space - Concerns re high speed traffic (from Hutt Rd areas) coming into Thordon area - and cyclists not protected from vehicle movements due to cycle way width whilst cyclists making passing manoeuvres		3	3	H	Designed separated grade between Cycle and Vehicles; and cycles	1	3	M						
2.014	Sheet 1	*Egress / Access*	Car parking - lack of parking, unsafe parking exit movement	Designed to 250 parks (from approx 350) based on analysis of utilisation, and numbers will drop due to parallel park configuration and exit line of sight needs	2	3	M	To WCC standards	1	1	L						
2.015	Sheet 1	*Egress / Access*	Vehicle Crossings on Through Routes - safety risks	Lots of road markings for road users	2	3	M	To Standards	1	2	L						
2.016	Sheet 2	*Position / Location*	Right Turn Lanes - insufficient space for designed right turn	Separate lanes	2	3	M	Joint Lanes	1	2	L						

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Approved By: Will Maguire | Date: 7 October 2021

Revision: 2 | Stage of Design / Project: Preliminary Design

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2.017	Sheet 3	*External safety interfaces*	Cycle Speed controls - accident and conflict of movement		2	3	M	Designed raised Zebra crossing to encourage reduced cycle and driver speed	1	2	L						
2.018	Sheet 4	*Position / Location*	Right Turn Lanes - insufficient space for designed right turn	Separate lanes	2	3	M	Joint Lanes	1	2	L						
2.019	Sheet 4	*External safety interfaces*	Raised Zebra Crossing Noise - Issues with noise on raised on crossings in other regions recorded.	Raised crossing for safety; road speed dropped from 50 to 40KM	1	1	L	Confirm height and texture , and impacts of heavies; assess noise effects (Carterton issues reported - get WK report - Mark Owen)	1	1	L						
2.020	Sheet 4	*External safety interfaces*	Bus Lane path areas on curves - safety issues with bus lane width a curve insufficient - riding footpaths		2	2	L	Model turning to confirm curves widths for bus movements	1	1	L						
2.021	Sheet 5		NIL raised														
2.022	Sheet 6	*Egress / Access*	Raised exits to Businesses - issues with varied widths, and line of sight in the immediate area is constrained	Parking set back to allow for improved visibility	3	3	H	WK request to re-check set-back lengths - looks minimal	2	2	L						
2.023	Sheet 7	*Egress / Access*	(RSA for Prelim Design - Finding 4.7) Te Puna Reo Childcare facility at 238 Thorndon Quay - the issue of providing safe vehicle stoppping space for this childcare facility		3	2	M	It has been confirmed that there is suitable space through this area to include a dedicated drop off zone similar to the design at CH3090m	1	1	L			Done			
2.024	Sheet 8	*Egress / Access*	(RSA for Prelim Design - Finding 4.8) Future bus parking area for electric buses under the motorway - the vehicle crossing will need to be modified to cater for safe bus entry and exit.		3	3	H	The vehicle crossing will be modified in the next phase of design.	2	2	L						
2.025	Sheet 9	*Egress / Access*	(RSA for Prelim Design - Finding 4.9) Access at former Target building - safety concerns due to the wide crossing.		3	3	H	To be investigated at the next stage including consultation with the new occupiers.	2	2	L						
2.026	Sheet 9	*External safety interfaces*	(RSA for Prelim Design - Finding 5.4) Intersection layout at Hutt Rd/Tinakori Rd: a. drivers have to stop far away from the intersection as the limit line on Tinakori Road is too far away from the intersection. Drivers may fail to stop at the limit line and make turns at Hutt Rd when pedestrians or other phases are running. b. no provision for pedestrians on the western side of Hutt Rd to enable pedestrians to cross Tinakori Rd safely. c. cyclists on Tinakori Rd to access the signalised crossing to the cycle path on the eastern side of Hutt Road.		5	1	M	a. Revise the layout so that the limit line on Tinakori Rd is closer to the intersection. b. Provide an informal crossing point on Tinakori Rd for pedestrians c. Provide access for cyclists on Tinakori Rd to access the signalised crossing to the cycle path on the eastern side of Hutt Road and *vice versa* .	2	1	L			Done			
2.027	Sheet 9	*Egress / Access*	(RSA for Prelim Design - Finding 5.5) Vehicle accesses at Tinakori Rd intersection: 1. The two vehicle crossings on the eastern side of Hutt Road will be difficult and unsafe for vehicles to exit from the signalisation of the intersection. 2. Restricted intervisibility with cyclists at the vehicle crossings		5	3	H	Rationalisation of these accesses should be considered and raised with the property owners. Explore the solutions of rationalising these accesses and siganlise private driveway, e.g. at Johnsonville/Corlett and Johnsonvlle/Broderick. - to be included during the next phase of design.	1	1	L						
2.028	Sheet 9	*External safety interfaces*	Bus lane turning Jug handle - impacts ped crossing area - disconnected journey because bus needs area to sweep around curve		3	3	H										
2.029	Sheet 9	*Egress / Access*	Peds on western side - concerns re formal crossing areas v informal crossing safety. How do peds exit large commercial premises	Design constrained by area; ramp on sheet 8 design for peds to cross area	3	3	H										

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2.030	Various	*External safety interfaces*	(RSA for Prelim Design - Finding 4.1) 0.5m wide raised safety buffers between cyclists and pedestrians: 1. A trip hazard for people going to and from parked vehicles 2. Opening of vehicles doors can be a hazard for cyclists. 3. The risk of the island being struck is high at night when there are fewer parked vehicles. 4. Cyclist may not be able to safely manoeuvre around a stationary vehicle waiting to turn onto road from a driveway.	The raised safety buffers has been widened to 0.8m for the preliminary design to address the issue related to the insufficient safety buffer.	3	3	H	Include the detailed delineation between the traffic island between the carriagway and cycle path and solution to resolve the conflicts between cyclists and vehicles waiting to turn onto the carriageway at driveways in the next phase of design.	1	3	M					
2.031	Various	*External safety interfaces*	(RSA for Prelim Design - Finding 4.2) Pay and Display machines - drivers will need to access the machines by crossing the cycle path and they may not be aware of the presence of cyclists. In addition, the landscaping between the cyclepath and the footpath may be a hazard for drivers to cross or can be damaged by foot traffic.		3	2	M	The parking machines will likely to be located on the cycle path side of the footpath - to be included in the next phase of design. Regular breaks within the landscaping strip between the cycle path and the footpath can be included for motorists to walk to and from the footpath to their vehicles - to be included in the next phase of design.	1	1	L					
2.032	Various	*Egress / Access*	(RSA for Prelim Design - Finding 4.3) There are two drainage accesses on the eastern side of Thorndon Quay. Any work being undertaken will block the cycle path.		2	2	L	Suitable traffic management can be put in place to divert cyclists up and down ramps to the footpath with appropriate shared path signage - to be discussed with Wellington Water in next phase of design.	1	1	L					
2.033		*Egress / Access*	Cyclists collide with vehicles from accessways	On Hutt Road, the cycleway is in green colour and with cycle marking on the pavement to raise drivers' awareness.	3	4	H	Suitable signages and markings to remind drivers of cyclists and enhance the priority of cyclists on the cycleway over vehicles. Could provide LED warning lights to warn drivers for coming cyclists or the other way around. Rumble strips to slow cyclists at driveways.	2	3	M					
2.034	CH 1500m - CH 5040m	*External safety interfaces*	On Hutt Road corridor: Cyclists may use the space between on-street parallel parking and central carriageway and maybe crash into doors opening on them		3	3	H									
2.035	CH 1620m	*Egress / Access*	Business exits: conflict between motor vehicles and other road users result in collisions. higher use exit/access movements.		3	4	H	Consideration of rationalising exit entry points to reduce conflict areas	2	3	M					
2.036	CH 2560m	*Egress / Access*	Spotlight exit / Hutt Road: Collisions due to complex and conflict vehicle movements for right turn out vehicle drivers from the accessway - they need to take care of cyclists and pedestrians on the road, and have to cross multiple lanes in a short distance in order to make a U-turn.		3	4	H	Consideration was given to install another controlled arm however has been discounted due to complexity.	3	4	H					
2.037	CH 2560m - CH 5040m	*External safety interfaces*	Shared pedestrian and cyclists on the northern Hutt Road corridor cause accidents	Markings and signages on the shared path and also the footpath is concrete and cycle path is asphalt providing colour differentiation.	3	2	M	Existing separation between cycleway and footpath by line marking on Hutt Road will be adopted for the northern Hutt Road. The cycleway and footpath will be on the same level but with different colours and textures.	1	1	L					
2.038	CH 3220m	*External safety interfaces*	Illegal parking on the pedestrian side of the shared path along Hutt Road increases the conflicts between vehicles and vulnerable road users and the risk of collisions. It happens in front Storage One.		2	3	M	Talk to the business owner and let them understand that the space should not be used for parking. Provide enough signages to prevent parking.	1	1	L					

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2.039	CH 3580m - CH 3900m	*External safety interfaces*	Cyclists may crash into the fence, roll over to the railway line and hit a train or are hit by a train	There is existing fences along the property boundary	1	4	M	Possible extend the east for footpath. The separated cycleway would be the side away from the fence so that the risk for cyclists could be reduced. Consider to replace the existing fence with a higher fence so that the risk could be eliminated.	1	2	L						
2.040	CH 5040m	*External safety interfaces*	Jarden Mile/Cenntenial Highway/Hutt Rd intersection: Vehicles may take a U-turn at this intersection which increases the potential for crashes.		4	4	E	Provide suitable signages and markings in advance and at the intersection to ban the U-turn at the intersection and guide drivers who want to take a U-turn to Cennetinal Highway.	2	3	M						
2.041	CH 5040m	*External safety interfaces*	Jarden Mile/Cenntenial Highway/Hutt Rd intersection - Hutt Road: Pedestrians need to cross 7 lanes which increases the risk that pedestrians collide with vehicles.		3	4	H	Provide staged pedestrian crossing with an enough and safe standing area in the middle of the road.	2	3	M						
2.042	Various	*External safety interfaces*	Parked veicle users getting out of cars step into cyclelane	0.8m wide buffer	3	2	M	Continue 0.8m wide buffer for the rest of the Hutt Rd path	1	2	L						
2.043	Sheet 10 and Sheet 23	*Egress / Access*	(RSA for Prelim Design - Finding 3.7) The Sar Street Intersection and the Onslow Intersection: Cyclists cannot safely access the cycle path on the eastern side from the side road due to the lack of crossing facilities.		2	3	M	Cycle path access locations to be included in next phase of design.	1	2	L						
2.044	Sheet 10	*External safety interfaces*	Separation between cycle / peds - safety concerns	Designed to flush surface to allow for use of Ped footpath for cycle passing	3	2	M										
2.045	Sheet 10	*Timing*	Signals control does not working - during heavy traffic - queuing issues		3	2	M	Review this in next stage of design, with modelling	2	1	L						
2.046	Sheet 10	*External safety interfaces*	U Turn Control - safety risks	Design raised medians to impove safety, reduce U-Turns. Will be a mountable kerb to accommdate "break-down" or other traffic interruption issues	2	3	M										
2.047	Sheet 10	*Egress / Access*	(RSA for Prelim Design - Finding 5.6) Waitomo Fuel stop/Lighting Plus: some motorists drive along the footpath due to the contiguous surface between the footpath and the Lighting Plus car park.		3	3	H	Install a barrier at the property boundary between the Lighting Plus car park and the footpath. Modify the vehicle crossing to provide access to the Lighting Plus car park.	1	2	L		Done				
2.048	Sheet 11	*External safety interfaces*	Speed of Cyclists - safety concerns	Markings to slow at conflict areas	4	2	M	Additional markingas and signage to be included at next design stage	2	1	L						
2.049	Sheet 12	*Egress / Access*	Bollards - Different to maintenance, and high cost of upkeep; bollards would be a significant safety hazard and should be avoided (RSA for Prelim Design - Finding 5.7)	Replace the proposed bollards on the curve with the tactile alternative in the prelim design.	3	2	M	The removal of the existing bollards can be incorporated in the next phase of design after consultation with adjacent property owner regarding their purpose.	1	1	L						
2.050	Sheet 12	*External safety interfaces*	Lighting of area - visibility and safety conerns	Currnet Lighting	2	2	L	Investigate lighting requirements in next phase, to improve user utilitisation - well lit for safety	1	1	L						
2.051	Sheet 12	*External safety interfaces*	Bus Stop & Shelter Design - concerns re safety / design, blind spots from material use (not see-through from bus shelter)	Use of WK design guides for latest configurations	3	2	M	Update design in later phase to show more detail - to reflect latest WK design (As per Hutt Rd report); include bus shelter design on drawings Need to get location and shelter design right for safety	1	1	L						
2.052	Sheet 12	*Egress / Access*	Ped OverBridge from Ferry - Concerns re way-finding for Peds and cyclists - a conflict zone	Design of "step Up"	3	3	H	Include further detail on design	2	2	L						
2.053	Sheet 13		NIL Raised														
2.054	Sheet 14		NIL Raised														
2.055	Sheet 15		NIL Raised														
2.056	Sheet 16	*Size*	Cyclist volumes due to increase 3-fold in future modelling - concerns re impact of through light on cyclist "push button" zone. Many cyclists waiting on foot path to go up Kaiphoror		3	2	M	Review design to allow additional cyclist holder / waiting space at "push button" area in middle of intersection	1	1	L						

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Approved By: Will Maguire | Date: 7 October 2021

Revision: 2 | Stage of Design / Project: Preliminary Design

Project Name: LGWM - Thorndon Quay & Hutt Road

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RISKS ASSOCIATED WITH DESIGN ELEMENTS					Risk Matrix			PROPOSED & APPROVED MITIGATION MEASURES	Mitigated Risk & Resolution						RESIDUAL RISK	
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2.057	Sheet 16	*Egress / Access*	(RSA for Prelim Design - Finding 5.6) Exit to Spotlight business area: Restricted visibility to the left for drivers exiting the Spotlight business area due to the solid panels on the handrail of the adjacent Kaiwharawhara Stream bridge and a tree.		4	3	H	Include the following in the next phase of design: 1. Move the solid panels on the eastern side of Kaiwharawhara Stream bridge handrail to the western side and replace with the 'see-through' panel from the western side; 2. Cut back the tree foliage on the stream bank at the Spotlight business area car park exit.	2	2	L						
2.058	Sheet 17		Not reviewed - similar to previous														
2.059	Sheet 18		Not reviewed - similar to previous														
2.060	Sheet 19	*Egress / Access*	Kindygarten area - footpath and parallel parking - conflict of users with Drop-offs and cycle / footpath - safety concerns	Safety audit improvements implemented	2	3	M	Look for further safety improvements to reduce conflict, or increase safety	1	1	L						
2.061	Sheet 20		Not reviewed - similar to previous														
2.062	Sheet 21	*External safety interfaces*	Ped Zebra Crossing - safety concerns - history of injury	Staggered crossings, and signalised	2	3	M	Further modelling progressing for wider area	2	2	L						
2.063	Sheet 21	*Egress / Access*	(RSA for Prelim Design - Finding 5.6) Exit from Placemakers car park - the signage on the 'see-through' fence and a shed restrict vsibility to cycle path and footpath users.		3	3	H	Work with Placemakers to eliminate the restriction to visibility (signs and shed) at the car park exit - to be included in the next phase of design.	2	2	L						
2.064	Sheet 22	*Egress / Access*	(RSA for Prelim Design - Finding 5.6) Caltex service station - At the exit to the service station, a solid fence and a fence cart within the Placemakers car park restrict visibility to cycle path and footpath users.		4	3	H	Work with Placemakers and Caltex to eliminate the restriction to visibility (fence and coffee cart) at the service station exit - to be included in the next phase of design.	2	2	L						
2.065	Sheet 23	*Size*	(RSA for Prelim Design - Finding 5.8) Hutt Road/Onslow Road Intersection: The proposed 0.95m wide median at the intersection is insufficient width for double aspect traffic signals with target boards - distance from vehicles constrained		3	2	M	Look at moving outter boundary into Kiwirail or other options. Further design and discussions to take place during next phase of design.	1	1	L						
2.066	Sheet 23	*Egress / Access*	Footpath access - lack of linakge into wider area footpath		2	4	H	Look at connectivity in this area	1	2	L						
2.067	Sheet 23	*Timing*	Right Turn Vehicle stacking - concerns of high volumes at peak times (RSA for Prelim Design - Finding 5.8)		3	2	M	The modelling results have been provided to RCA. Further design and discussions to take place during next phase of design.	2	2	L						
2.068	Sheet 24		Not reviewed - similar to previous														
2.069	Sheet 25	*Environmental conditions*	Visibility concerns from road side into corridor - trees overhanging and many exits		3	3	H	Design progressing	2	2	L						
2.070	Sheet 26		Not reviewed - similar to previous														
2.071	Sheet 27		Not reviewed - similar to previous														
2.072	Sheet 28		Not reviewed - similar to previous														
2.073	Sheet 29		Not reviewed - similar to previous														
2.074	Sheet 30		Not reviewed - similar to previous														
2.075	Sheet 31	*External safety interfaces*	(RSA for Prelim Design - Finding 5.9) Lane changing on inbound approach to Jarden Mile - weaving across lanes	Design - Terminate the northbound SPV lane 200m in advance of the lane diverges - it has been done in the Prelim Design.	4	1	M	Include the following items in the next phase of design: 1. Erect overhead signage at the above SPV lane termination to direct drivers into the correct lane for Centennial Drive (SH1) or the SH2 on-ramp. 2. Reinforce the overhead signage with destination roadmarking in each traffic lane and additional advance destination signage.	2	1	L						
2.076	Sheet 32	*External safety interfaces*	Ped / Cycle movement at Intersection - concerns re connectivity with bus stops in area	Design - moved bus stop area, to free up space for red crossing areas - currently flush levels. (RSA for Prelim Design - Finding 5.10) The central island on the southern approach has been widened to 3m in Prelim Design.	3	2	M	Look at raised platforms to encourage speed reduce - maybe speak with James Hughes; look at north bound bus stop to enable 2 buses - design a double. Speak with Scott Coburn re cycle and footpath - share drawings for proposed new development Designer to look at prioritisation at intersection (RSA for Prelim Design - Finding 5.10) Make the two-stage crossings staggered - to be included in the next phase of design.	1	2	L						

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2.077	Sheet 32	*Position / Location*	(RSA for Prelim Design - Finding 5.11) Concerns regarding proposed raised safety platforms (RSP at Jarden Mile Intersection - a speed differential could lead to heavy braking and consequential rear-end or loss of control crashes. The RSP may not be visible to most drivers until they are at the intersections.	The speed limit on Centennial Highway is proposed to be reduced to 60km/h in advance of Jarden Mile intersection.	3	3	H	Further discussions and design to be undertaken during next phase. Information on SH2 installations to be provided to RCA by LGWM.	2	2	L						
2.078	Various	*External safety interfaces*	(RSA for Prelim Design - Finding 5.1) Pedestrians using the cycle path despite of different surfaces - conflicts between cyclists and pedestrians		3	2	M	The separator will be investigated and further considered and included at the next design stage.	2	2	L						
2.079	Various	*External safety interfaces*	(RSA for Prelim Design - Finding 5.2) The southbound SPV lane on Hutt Road is changing to a Bus lane along Thorndon Quay at the intersection with Tinakori Road - vehicles on the SPV lane have to move quickly to the general traffic lane at the intersection, resulting difficiult and unsafe manouvre.	The design changes have been made to the start of the 'BUS LANE' on southbound Hutt Road - changed from CH1500m to CH1740m	4	2	M	Signage to be included at the next phase of design to make it clear for motorists who can use which lane.	1	1	L						
2.080	Various	*External safety interfaces*	(RSA for Prelim Design - Finding 5.3) No provision for safe U-turns.		5	1	M	Further work to be included in the next phase of design regarding number, location and design of u-turn facilities.	2	1	L						
2.081	Aotea Quay Roundabout	*External safety interfaces*	Safety concerns re freight traffic exiting base into fast lanes; Ped crossing have to navigate high speed traffic	Mini roundabout, with low roundabout for heavies U-turns (not signalised)	3	2	M	Modelling tracking, and safety treatments Peds will cross at "freight area" crossing - look at a "step back area" for ped crossing in front of trucks	2	2	L						
2.082	Aotea Quay Roundabout	*External safety interfaces*	(RSA for Prelim Design - Finding 6.1) Safety concerns re proposed mini-roundabout: 1. truck drivers may seek for unsafe gaps; 2. the vehicle in the right-hand lane of northbound traffic lanes may be hidden from view by a truck in the left-hand lane; 3. the southbound acceleration lane is too short for slow moving trucks to merge to the faster left lane; 4. full signalisation of the intersection might provide a better option in terms of safety, and the pedestrian crossing across the freight yard could be controlled.	The size of the roundabout has been increased in the final Prelim Design. The southbound short acceleration lane has been removed, and truck drivers will not need to merge to the left lane.	3	2	M	Further discussion and design to be undertaken during the next design phase. Modelling is being undertaken by Wellington Analytics Unit considering requiremetns for TQHR, Single User and Multi User Ferry Terminal requirements.	2	2	L						
2.083	Aotea Quay Roundabout	*External safety interfaces*	(RSA for Prelim Design - Finding 6.2) The speed limit on Aotea Quay and on ramp from Hutt Road is still 70km/h while the speed limit on Hutt Road between Centennial Highway and Onslow Road is to be reduced from 80km/h to 60km/h. The speed limits will be inconsistent.		3	3	H	A speed reduction to 50km/h on Aotea Quay is proposed on Aotea Quay to align with the proposed 50km/h on Hutt Rd from the Tinakori Rd/Hutt Rd intersection to the Onslow Rd/Hutt Rd intersection.	2	2	L			Done			
2.084		*Position / Location*	Cyclists collide with street furniture		3	3	H	Make sure the street furniture are not in the middle of the cycleway. Relocate the street furniture or provide appropriate marks/protection surrounding the street furniture.	1	1	L						
2.085		*Position / Location*	Cycle path ponding resulting in falling off bike		2	3	M	Provide suitable cross fall from centre or one side depending on location and suitable numbers of catchpits to drain away and grooves within AC cycle path.	1	2	L						
2.086		*External safety interfaces*	Insufficient lighting resulting in collision	Currently lighting is available	3	3	H	Current lighting to be assessed and upgraded as required	1	3	M						
2.087		*Position / Location*	Existing inground pits covers and frames are not flush causing cyclists to fall off		3	3	H	Raise or lower pits cover and frames to be flush with new cycle path.	1	3	M						
2.088		*External safety interfaces*	Pedestrians crossing the road collide with cyclists on cycle paths		3	3	H	Pedestrian crossings goes across the cycle path and connects footpaths. Provide adequate signages at crossing.	1	2	L						
2.089		*External safety interfaces*	Cyclists access cycle path at random points resulting in collision with vehicles		3	4	H	Crossing installed where appropriate for main access points. Suitable signages and markings.	1	3	M						
2.090	CH 240m - CH 1500m	*Position / Location*	Trees planted on the landscape areas may impact on visibility lines and cause crashes.		3	4	H	Choose tree species to suit the location either low lying shrubs or lower canopy needs to be 2m plus. Make sure any plants planted on the landscape segregation will not obscure visibility lines for all road users.	1	3	M						

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2.091		*External safety interfaces*	Onlsow and Tinakor Rd intersection: right turn filter and left turn filter increases the risk of crashes		3	4	H	Remove the right turn filter and left turn filter to allow full pedestrian protection and as well as remove the risk of right turn and left turn filtering crashes.	1	2	L						
2.092		Signals and telecommunications	Above ground assets on or near the route causes issues		2	3	M	Minimum clearance of 0.5m from any fixed asset.	2	2	L						
2.093		Network Services	Maintenance vehicles cannot access parts of the corridor.	No-stopping and no-parking control in front of the service stations.	1	1	L	The no-stopping and no-parking control will be maintained.	1	1	L						
2.094		Various	Drainage issues due to the new raised safety platforms		2	2	L	Identify the existing location of drains near the proposed raised safety platforms. Two options to address the drainage issue: 1. Relocate the sumps and build new ones if required or install slot drains.	1	1	L						
2.095		*Egress / Access*	Is their adequate / suitable fencing to prevent access to the adjacent Kiwirail land for the extents of the job. (who's responsibility is the fencing)	Existing Fencing	2	2	L	Review of existing fencing to confirm if modification required	1	1	L						
2.096		*External safety interfaces*	Catchpit cover grills catch skinny tyred wheels		1	3	M	Orientate at 90degrees to angle of movement. plus use of wave grills rather than straight ones.	1	1	L						
2.097		*External safety interfaces*	Skid resistance of existing covers and frames poor.		2	2	L	Replacement of cover and frame to be considered	1	1	L						
2.098		*Timing*	Pedestrian crossings throughout the project. As crossing multi lanes throughout the project. By it's nature takes time to cross.		4	3	H	Signalised crossings of the 4 lane highway at Thorndon Quay. Staggered signalised crossings through Hutt Rd. with central island of a suitable size for both Cyclists and Pedestrians.	2	2	L						
2.099		*Position / Location*	Safety Buffer for Disabled & others - transition between zones but result in trip/ fall risks on different levels		3	2	M	Investigate safety improvements on corridor re kerbs and transition between each modal zone	1	1	L						
2.100		*Egress / Access*	Emergency Vehicle Access on corridor - what is required re parking and bus lane use for emergency access		1	1	L	Look to design "multi-use" of lanes for emergencies - without undermining project objectives - "access" for normal traffic	1	1	L						
2.101		*External safety interfaces*	(RSA for Prelim Design - Finding 3.1) The potential cycle path users include but not limited to cyclists, e-bicycle users, e-scooters, skateboarders, etc. The high speed path users and the behaviour of failing to comply with 'Keep Left' rule will result in an increase in severity and likelihood of crashes with other road users.		2	4	H	Signs will be included at the next design stage to indicate modes of use. The directional arrows at regular intervals along the path will be included in next phase of design.	1	2	L						
2.102		*External safety interfaces*	(RSA for Prelim Design - Finding 3.2) Speed of Cyclists - safety concerns at pedestrian crossing areas, bus stops and majority of driveways	Design on TQ and existing control on HR - Green markings with cycle symbols across accessways.	2	4	H	Additional markings across the cycle path prior to driveways to highlight potential conflicts and cyclists to be included in next phase of design (e.g. zigzag, red markings).	1	2	L						
2.103		*Egress / Access*	(RSA for Prelim Design - Finding 3.3&3.4) Conflicts at vehicle crossings between cyclists and vehicles at driveways along the route: a. poor visibility to approaching cyclists due to parked vehicles. b. vehicles focusing on a gap in traffic rather than approaching cyclists c. vehicles existing a property where the driver is not forced to slow.		4	4	E	a. To ensure that drivers turning into accesses have visibility of cyclists using the cycle path, parking restriction will be put to ensure sight distance to approaching cyclists is sufficient, in accordance with Waka Kotahi Technical Note 2, as part of the next design stage. b. Speed humps to be included in next phase of design, location to be considered. c. Crossing ramps to be considered in next phase of design.	2	2	L						
2.104		*Position / Location*	(RSA for Prelim Design - Finding 3.5) Conflicts at bus stops between cyclists and passengers/pedestrians: - It is likely that passengers from buses are using the rear door and then crossing the cycle path but now the pedestrian crossing on the cycle path is leading to the front foor. - The buffer between the cycle path and footpath could be a trip hazard. - This is a high conflict area for pedestrians and cyclists.		3	3	H	To avoid any trip hazards and to minimise the conflicts between cyclists and pedestrians at bus stops, the design below is proposed. 	1	1	L						

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2.105		*Position / Location*	(RSA for Prelim Design - Finding 3.8) The rubbish bins and paper piles left out in the cycle path could be a hazard to cyclists.		3	3	H	The location and size of rubish collection areas will be considered in the next design phase which will involve consultation with property owners / tenants.	1	1	L						
2.106		*Size*	(RSA for Prelim Design - Finding 3.9) Signals infrastructures - insufficient space and may obstruct pedestrians and the public using facilities; accessibility of controllers for service vehicles		2	3	M	Detailed traffic signals infrastructure locations will be included in the next design stage	1	1	L						

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3		**Demolition Phase**															
3.01																	
3.02																	

Key;

No ledges to leave glasses on

C= Consequence: 1) Low 2) Moderate 3) Significant 4) Major 5) Critical

L= Likelihood: 1) Rare 2) Unlikely 3) Possible 4) Likely 5) Almost Certain

LR = Level o: L) Low M) Moderate H) High E) Extreme

Notes: Hazards / risks considered are those that are project / site specific, non-standard / bespoke designs, special processes, high hazard risks (e.g. non 'business as usual' hazards) that have been identified at the time of the review(s). Other risks will continue to appear during the design life of the project and should be assessed and managed by appropriate parties.

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