REPORT

Shelly Bay Road Upgrades

Options Assessment Report

Prepared for
Wellington City Council

Prepared by
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Executive Summary

In April 2017[1], a resource consent was granted to The Wellington Company Limited for a housing and public space development at Shelly Bay. The resource consent included works to upgrade Shelly Bay Road, comprising a 6m-wide carriageway (two 3m-wide traffic lanes) and a 1.0 to 1.5m-wide width for use by pedestrians and cyclists. These are the minimum consented road works.

At a Council meeting on 27 September 2017, Wellington City Councillors resolved that Council officers were to further investigate the upgrade of Shelly Bay Road, "comprising options that more closely align to Waka Kotahi New Zealand Transport Agency (Waka Kotahi) guidance as a minimum and the Great Harbour Way (GHW) plan as an aspiration." Tonkin & Taylor Ltd (T+T) were engaged by Wellington City Council to explore these options.

Development agreement

WCC has entered into a development agreement with The Wellington Company, under which:

- The developer has agreed not to commence its consented road works until Council has completed a community engagement process and come to a decision about the upgrade of the road.
- If Council decides to progress road upgrade works that differ from the developer's consented road upgrade, Council must notify the developer. The delivery of the road works will need to occur within specific timeframes so that Council's road works meet the requirements of the developer's resource consent.
- If Council decides to do a road upgrade that is not feasible within the timeframes required under the consent, the developer will proceed with its consented road upgrade and Council will need to complete its road works afterwards.

As such, the developer's resource consent and the development agreement place a constraint on the timeframe for the road upgrade.

Options assessment

A long list of 19 options were identified for upgrading Shelly Bay Road. As a basis for identifying the long list, only options that met Waka Kotahi minimum standards were considered. The options were then evaluated using multi-criteria analysis (MCA) that assessed criteria under the following categories:

- Project objectives
- Relevant policy objectives
- Effects
- Implementation

Due to the constrained corridor width on Shelly Bay Road, many of the options on the long list would require widening of the road corridor. To understand the potential impacts of widening the road corridor, T+T completed the following studies:

- Baseline coastal assessment (Appendix D)
- Preliminary slope hazard assessment (Appendix E)
- Preliminary planning considerations (Appendix F)

[1] A resource consent was issued to The Wellington Company in 2017. In 2018, the Court of Appeal repealed the resource consent. Documentation was lodged for the reconsideration of the resource consent, and the consent was approved again in 2019.

- Ecological desktop assessment (Appendix G)

In addition to the specific engineering and environmental assessments, other members of WCC's project team and mana whenua partners contributed inputs to the MCA assessment process. This included providing high-level assessments and advice to help inform the assessment of criteria under the following categories:

- Carbon emissions (WCC)
- Urban design (WCC and Isthmus)
- Cultural and historical (WCC and mana whenua, Taranaki Whānui ki Te Upoko o Te Ika)

The results of the technical studies and the inputs from the project partners were incorporated into the MCA process to inform the implications of the options assessment and identify a short list. The short list represents the best-fit options when assessed against the chosen assessment criteria.

Short list

Delivery of the minimum consented road works on Shelly Bay Road needs to occur within the timeframes specified in the consent. Under the development agreement, any upgrades that WCC decides to do above and beyond the consent requirements needs to either:

a Meet the timeframe requirements of the developer's resource consent, or

b Be completed after the developer has completed their consented road upgrade.

As such, the developer's resource consent and the development agreement place a time constraint on when upgrade options could be delivered.

Scenario A: Short-term delivery (within the consent timeframes)

Any option that would require significant widening of the road corridor would have significant effects on delivery timeframes due to increased consent requirements and design complexity compared to the consented works. Additionally, any option that would not meet the requirements for the minimum consented road works (for example, only one traffic lane instead of two) would need to be reconsented and would also push out beyond the delivery timeframes specified under the resource consent for the development.

Given these restrictions, there are no options that both meet minimum Waka Kotahi standards and could be delivered within the consent timeframes. Any upgrade above and beyond the minimum consented road works would need to be completed after the developer has completed their consented road upgrade.

Scenario B: Long-term delivery (to be completed after the consented road works)

If the Council decides to do a road upgrade after the timeframe required under the resource consent for the development, the developer will proceed with its consented road upgrade and Council will need to complete its road works afterwards. Under this scenario, there are seven options that have come through in the short list following the MCA assessment process. These options have been categorised under three widening categories:

- **Category 1:** Options that fit largely within the existing corridor width
  - ***Option 3D:*** Shared path and one traffic lane
- **Category 2:** Options requiring a wider road corridor – up to 12m
  - ***Option 1D:*** Footpath, cycle lanes, and one traffic lane
  - ***Option 2D:*** Separated path and one traffic lane

  - ***Option 4A/4C:*** Footpath only and two mixed traffic lanes (with opportunity for pinch points)
  - ***Option 3A/3C:*** Shared path and two traffic lanes (with opportunity for pinch points)
- **Category 3:** Options requiring a wider road corridor – up to 15m
  - ***Option 1A/1C:*** Footpath, cycle lanes, and two traffic lanes (with opportunity for pinch points)
  - ***Option 2A/2C:*** Separated path and two traffic lanes (with opportunity for pinch points)

1 Introduction

Tonkin & Taylor Ltd (T+T) have been engaged by Wellington City Council (WCC) to explore options for upgrading Shelly Bay Road. This report outlines the process undertaken to identify and assess potential options to upgrade the road corridor and has been prepared as an update to the first version of this report, prepared for WCC at the long listing stage (T+T ref: 1014114, dated 23 July 2020).

The work has been carried out in accordance with T+T' s offer of service dated 15 February 2022.

1.1 Project purpose

In April 2017[2], a resource consent was granted to The Wellington Company Limited (The Wellington Company) for a housing and public space development at Shelly Bay. The resource consent included works to upgrade Shelly Bay Road, comprising a 6m-wide carriageway (two 3m-wide traffic lanes) and a 1.0 to 1.5m-wide width for use by pedestrians and cyclists (minimum consented road works).

At a Council meeting on 27 September 2017, Wellington City Councillors resolved that Council officers were to further investigate the upgrade of Shelly Bay Road, "comprising options that more closely align to Waka Kotahi New Zealand Transport Agency (Waka Kotahi) guidance as a minimum and the Great Harbour Way (GHW) plan as an aspiration."

1.2 Purpose of this report

The purpose of this report is to outline the assessment process for evaluating options to upgrade Shelly Bay Road that align with Councillor resolution. This report is not a technical assessment of:

- The suitability of Shelly Bay Road to provide access to the development (both during construction and after the development is completed); or.
- The effects of traffic associated with the Shelly Bay development (both construction traffic and increased traffic volumes once the development is completed) on Shelly Bay Road or the wider road network.

As of June 2022, work has been completed to identify a long list of options and refine the options down to a short list by applying a multi-criteria analysis process. This report provides a summary of the following key aspects of the process:

- Background information, including:
  - site context
  - related projects
  - previous studies
- The proposed multi-criteria analysis methodology for evaluating options
- The option identification process, including a summary of the long list and short list
- Next steps for the project

1.3 Project area

The project route under assessment is approximately 2.3km long, extending along Shelly Bay Road. The southern extent is the intersection with Miramar Avenue/Cobham Drive, not including the

[2] A resource consent was issued to The Wellington Company in 2017. In 2018, the Court of Appeal repealed the resource consent. Documentation was lodged for the reconsideration of the resource consent, and the consent was approved again in 2019.

intersection. The northern extent of the route is the southern end of Shelly Bay, not including the bay itself. The extent of the project area is as shown in Figure 1.1.

Figure 1.1: Project area (project route shown in red; coastal areas outside of the project scope are highlighted in yellow)

2 Background

2.1 Site context

The project route is located along a 2.3km length of Shelly Bay Road, on the Wellington Harbour coastline. The width of the existing formed road varies between approximately 6m and 7m, with two traffic lanes (one in each direction) and short sections of narrow shoulders. There is a footpath on the western side of the road from the intersection with Miramar Avenue/Cobham Drive for a length of approximately 450m. Beyond this, there are no provisions for pedestrians or cyclists. The road is constrained by the existing topography, with the coast located immediately to the west and steep embankment slopes to the east.

In February 2019, the average daily traffic flow on Shelly Bay Road was approximately 2,540 vehicles per day. In January 2022, following extended periods of COVID-19 restrictions and lockdowns that have had an impact on daily traffic movements, the average daily traffic flow had reduced to approximately 2,000 vehicles per day. On average, the vehicle volumes on weekends are higher than on weekdays; the weekday versus weekday traffic flows are provided in Table 2.1.

Table 2.1: Average daily traffic (ADT) flow[3]

Time period	Weekday ADT	Weekend ADT	7-day ADT
February 2019	2,060	3,760	2,540
January 2022	1,930	2,170	2,000

The long-term impact of restrictions and lockdowns on traffic volumes is not yet fully understood; therefore, for our options assessment process we have considered the traffic volumes from both 2019 and 2022.

2.2 Shelly Bay development

At Shelly Bay, located at the northern extent of the Shelly Bay Road project area, there is a relatively flat area between the coast and the steep slopes where Shelly Bay wharf and former Royal New Zealand Air Force buildings and structures are located. In 2017[4], a resource consent was granted to The Wellington Company to redevelop properties at this location. Currently, access to the site is primarily from the south, via Shelly Bay Road.

We have not completed a technical assessment of the effects of the development on the road network, including the suitability of Shelly Bay Road to access the development site. This was assessed in a transport assessment report[5] for the development, completed by Stantec in 2019.

All of the information we have provided about the development has been sourced from publicly available documents.

2.2.1 Required works on Shelly Bay Road under the consent

As part of the resource consent granted for the development, there is a requirement for the developer to complete road works on Shelly Bay Road. In 2016, Calibre prepared a service feasibility

[3] Vehicle volumes sourced from WCC traffic count data
[4] A resource consent was issued to The Wellington Company in 2017. In 2018, the Court of Appeal repealed the resource consent. Documentation was lodged for the reconsideration of the resource consent, and the consent was approved again in 2019.
[5] *Transportation Assessment Report: Shelly Bay Masterplan* (Stantec, April 2019)

report[6] for WCC to confirm the ability to appropriately service the proposed development at Shelly Bay. As a part of their study, Calibre assessed the current road access to Shelly Bay. They stated that, following the construction of the Shelly Bay development, "the primary function of [Shelly Bay Road] would be to 'move,' so only needs to have traffic lanes and appropriately allow for pedestrian/cycle traffic."

In concept plans[7] for Shelly Bay Road, Calibre allowed for two 3m-wide traffic lanes and a 1.0 to 1.5m-wide "pedestrian/cycle lane" as a minimum requirement. They concluded that, while the specified design may not be compliant with the WCC Code of Practice, it would "be of a scale and standard that sufficiently and appropriately caters for the development proposal." This concept design represents the minimum required road works on Shelly Bay Road under the resource consent for the development.

In 2019, Stantec completed a transport assessment of the proposed development for The Wellington Company. In the report, they concluded that improvements were warranted on Shelly Bay Road to improve amenity for pedestrians and cyclists (for both existing users and future demand generated by the development). Stantec referred to the servicing feasibility report prepared by Calibre for the recommended pedestrian and cyclist improvements.

2.2.2 Interface with the southern end of the development

Any upgrade to Shelly Bay Road would tie into the road at the southern extent of the Shelly Bay development. The proposed road layout at the southern area of the development allows for a minimum 2.5m-wide shared path on the seaward side of the road and a minimum 1.5m-wide footpath on the landward side of the road (as per the Shelly Bay Design Guide[8] included in the resource consent application for the development, prepared by others for The Wellington Company).

2.2.3 Trip generation

The Wellington Company's proposal will see the subdivision of the site to provide residential accommodation, a boutique hotel, commercial and community activities, and public open spaces. Plans for the development include up to 352 new residential units, consisting of multi-level apartment buildings, townhouses, and individual dwellings. The development will generate increased travel demand on Shelly Bay Road to access the site.

In their transport assessment report from 2019, Stantec estimated the projected increase in motor vehicle trips that the development would generate. The assessment considered the effects of site traffic from the development on Shelly Bay Road and Miramar Avenue. In the assessment, Stantec found that the development would increase motor vehicle volumes by around 3,500 vehicles per day, resulting in traffic volumes of 5,500 to 6,040 vehicles per day[9] on Shelly Bay Road. Their assessment concluded that Shelly Bay Road would be able to accommodate this increased traffic flow without requiring any upgrades for vehicle traffic.

In the report, Stantec anticipated that the proposed upgrade to Shelly Bay Road would support an increase in active mode demand on Shelly Bay Road (with the provision of a "dedicated shared pedestrian and cycle path" along the route). However, their trip generation assessment did not provide projected pedestrian and cyclist volumes based on the impacts from the development.

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[6] *Shelly Bay, Wellington: Servicing Feasibility* (Calibre Consulting, September 2016)

[7] In July 2019, Envelope Engineering prepared a memo for The Wellington Company on engineering matters, which included an updated set of preliminary design plans for the road upgrades based on Calibre's concept plans.

[8] *Shelly Bay Design Guide* (architecture+, McIndoe Urban, and Wraight + Associates; September 2016)

[9] Based on vehicle volumes recorded in February 2019 and January 2022

2.2.4 Development agreement

WCC has entered into a development agreement with The Wellington Company, under which:

- The developer has agreed not to commence its consented road works until Council has completed a community engagement process and come to a decision about the upgrade of the road.
- If Council decides to progress road upgrade works that differ from the developer's consented road upgrade, Council must notify the developer. The delivery of the road works will need to occur within specific timeframes so that Council's road works meet the requirements of the developer's resource consent.
- If Council decides to do a road upgrade that is not feasible within the timeframes required under the consent, the developer will proceed with its consented road upgrade and Council will need to complete its road works afterwards.

As such, the developer's resource consent and the development agreement place a constraint on the timeframe for the road upgrade, which will impact on Council's decision on options and opportunities to upgrade the Shelly Bay Road.

2.3 The Great Harbour Way – Te Aranui o Pōneke

The Shelly Bay Road project area is located within the GHW route (refer Figure 2.1). The GHW is a concept plan for a recreational route along Wellington Harbour. The concept includes the provision of a continuous pedestrian and cycle route located immediately beside the harbour edge, following the coastline from Pencarrow Head to Red Rocks.

The vision for GHW is to provide a safe and continuous public route for pedestrians and cyclists around the Wellington Harbour. The primary focus of the vision is on recreational use, but it also forms part of Wellington's active transport network.

Figure 2.1: Great Harbour Way route (Shelly Bay Road project area shown in red) [10]

The following are the objectives for the GHW route:

- Provide a safe continuous walking and cycling route for both transport and recreation movement around the perimeter of the harbour between Pencarrow Head and Red Rocks
- Be predominantly designed to accommodate a continuous two-way path
- Provide a safe cycling commuter route between the communities along the route
- Be located immediately beside the harbour edge as far as is practicable
- Be planned and designed in such a way as to avoid adverse effects on environmentally sensitive areas
- Highlight Māori cultural history and values and other historical values
- Recognise the opportunities of this route to act as a catalyst for new ancillary or development opportunities within the corridor of land it traverses
- Enhance knowledge and awareness of the Wellington Harbour environment and immediate environs through interpretation, storytelling, and art
- Become a nationally recognised cycleway/walkway, and a key part of the National Cycleway project promoted by the Government
- Be developed and upgraded over time and in stages as resources allow. The initial focus is on providing at least a basic level of access along the entire length

The GHW vision has been identified by WCC as the aspiration for walking and cycling facilities on Shelly Bay Road.

[10] *The Great Harbour Way: Issues and Opportunities Analysis* (Boffa Miskell, 2009)

2.4 Relevant transport projects

There are several ongoing transport projects that interface with Shelly Bay Road at the Miramar Avenue intersection. These projects are outlined below, and their locations are shown in Figure 2.2.

Figure 2.2: Related transport projects adjacent to the project area

2.4.1 Tahitai

Tahitai is a coastal route connection between Miramar and the central city. The path is a coastal recreational route, with a two-way cycle path, a separate footpath, landscaping, and seating. The area is a recreation destination, and it also forms part of a popular commuter route from the eastern suburbs. The eastern extent of path is just west of the Miramar cutting, approximately 40m west of the Shelly Bay Road/Miramar Avenue intersection.

Planning is currently underway for the final section of Tahitai, between Cobham Drive and Greta Point on Evans Bay Parade. Once complete, it will provide a continuous, high-quality route for walking, cycling, and other active modes between the Miramar cutting and the city. It will make it possible to ride the 7km journey without having to ride on the road.

2.4.2 Let’s Get Wellington Moving: City Streets

City Streets is a package of work under the wider Let’s Get Wellington Moving programme. It’s focused on improving connections for public transport, cycling, and walking on key routes between the central city and Wellington’s suburbs. Investigation and planning for City Streets is underway, and the first phase of work includes a project targeted at improving the section of Miramar Avenue/Cobham Drive/Wellington Road between Shelly Bay Road and Hamilton Road. Construction is planned to commence from 2023.

2.4.3 Miramar town centre improvements

WCC has recently made changes on Miramar Avenue between Shelly Bay Road and Tauhinu Road to make the road safer and easier for everyone. The works include walking and biking improvements, including the addition of a two-way cycle path on the northern side of Miramar Avenue between Shelly Bay Road and Tauhinu Road.

2.4.4 Innovating Streets: Massey Road

WCC has been completing projects around the city as part of the Innovating Streets programme, which aims to create safer, healthier and more people-friendly towns and cities. These projects will be done using tactical urbanism and are about co-designing quick, low-cost, scalable improvements that help to create more vibrant, people-friendly spaces in our neighbourhoods. This could be through pilots or pop-ups that can become permanent based on community feedback.

WCC was planning an Innovating Streets project for Massey Road, north of the Shelly Bay development site. The project has been placed on hold due to this assessment of upgrades for Shelly Bay Road.

2.5 Design standards and guidance

As outlined in the project objective, Waka Kotahi guidance will be referenced as the minimum standards for walking and cycling facilities. Additionally, the following standards and guidance will be referenced for the option identification and assessment process:

- **Waka Kotahi's Pedestrian Network Guidance (PNG)**
  Waka Kotahi's Pedestrian Network Guidance is an online resource that outlines a consistent, best-practice approach for planning, designing, and creating walkable communities. It sets out a principles-based process for deciding what cycling provision is desirable and provides best-practice guidance for the design of cycleways. It outlines the process for deciding on the type of provisions that should be made for pedestrians and provides design guidance and standards.
- **Waka Kotahi's Cycle Network Guidance (CNG)**
  Waka Kotahi's Cycle Network Guidance is an online resource that outlines a consistent, best-practice approach to cycle route planning. It sets out a principles-based process for deciding what cycling provision is desirable and provides best-practice guidance for the design of cycleways.
- **WCC's Code of Practice, 2012 (COP)**
  The Code of Practice provides guidance on the land development standards required by WCC. This Code defines the minimum standards for the design and construction of infrastructure, including roading.
- **WCC's Cycling Framework, 2015**
  The WCC Cycling Framework provides design guidelines for the implementation of a cycling network in Wellington. In particular, the framework provides minimum design standards to be adopted for new cycle infrastructure in Wellington.
- **Austroads Guides**

  Austroads Guides inform the design, construction, maintenance, and operation of the road network in Australia and New Zealand. In particular, Waka Kotahi's CNG refers to Austroads Guides as additional guidance where information is not provided in the CNG.

Section 4.2 provides further details on how the guidance will be applied to the long list development and assessment process.

2.6 Relevant policies and initiatives

WCC has several policies and ongoing initiatives that are relevant to any upgrades being considered for the Shelly Bay Road corridor:

- **WCC Te Atakura – First to Zero, 2019**

  Te Atakura is a policy adopted by WCC in June 2019 to make Wellington City a zero-carbon capital by 2050. Under the policy, transport has been identified as one of the main initiative areas to reduce Wellington's greenhouse gas emissions. Therefore, the policy is relevant to any changes being made to Wellington's road network.

- **WCC Paneke Pōneke – Bike Network Plan, 2021 (draft)**

  Paneke Pōneke was approved by the Planning and Environment Committee in March 2022. The plan sets out WCC's approach to creating a safe, connected, and high-quality network of routes for biking and scooting in Wellington. In the proposed future bike network outlined in the plan, Shelly Bay Road is classified as a secondary bike route. The vision is for the entire proposed network to be delivered by 2031.

- **Let's Get Wellington Moving**

  Let's Get Wellington Moving (LGWM) is a joint initiative between WCC, Greater Wellington Regional Council, and Waka Kotahi to work with the people of Wellington to improve transport and create a more liveable city. The focus area for LGWM is from Ngā Ūranga Gorge to Miramar, which includes Shelly Bay Road.

3 Assessment methodology: Multi-criteria analysis

A multi-criteria analysis (MCA) is a tool that evaluates how effective potential options would be at addressing a specified problem. The options are assessed and ranked against a set, or multiple sets, of pre-defined criteria. The outcome of an MCA allows decision makers to understand the appropriateness of each option at meeting the criteria and see a comparison of each option's costs and benefits. This information can assist decision makers in arriving at a recommended short list.

To assess options for the Shelly Bay Road upgrades, an MCA has been used to identify a short list of options. This section outlines the general methodology used in an MCA process. The specific assessment process completed to date is outlined in Section 4.

3.1 MCA process

An MCA begins with many options, referred to as the long list. These options are evaluated sequentially against a set or sets of criteria. Options that do not pass the criteria assessment(s) are filtered out and eliminated from further consideration. This process allows the long list to be distilled down to select options that pass the criteria assessment. The resulting options are referred to as the short list.

The short list represents the best-fit options when assessed against the chosen assessment criteria.

The MCA starts with a fatal flaws assessment and flows through evaluation against key criteria. Some commonly identified sets of criteria for an MCA include project objectives and a technical and cultural effects assessment. A summary of the evaluation process used is represented in Figure 3.1, below.

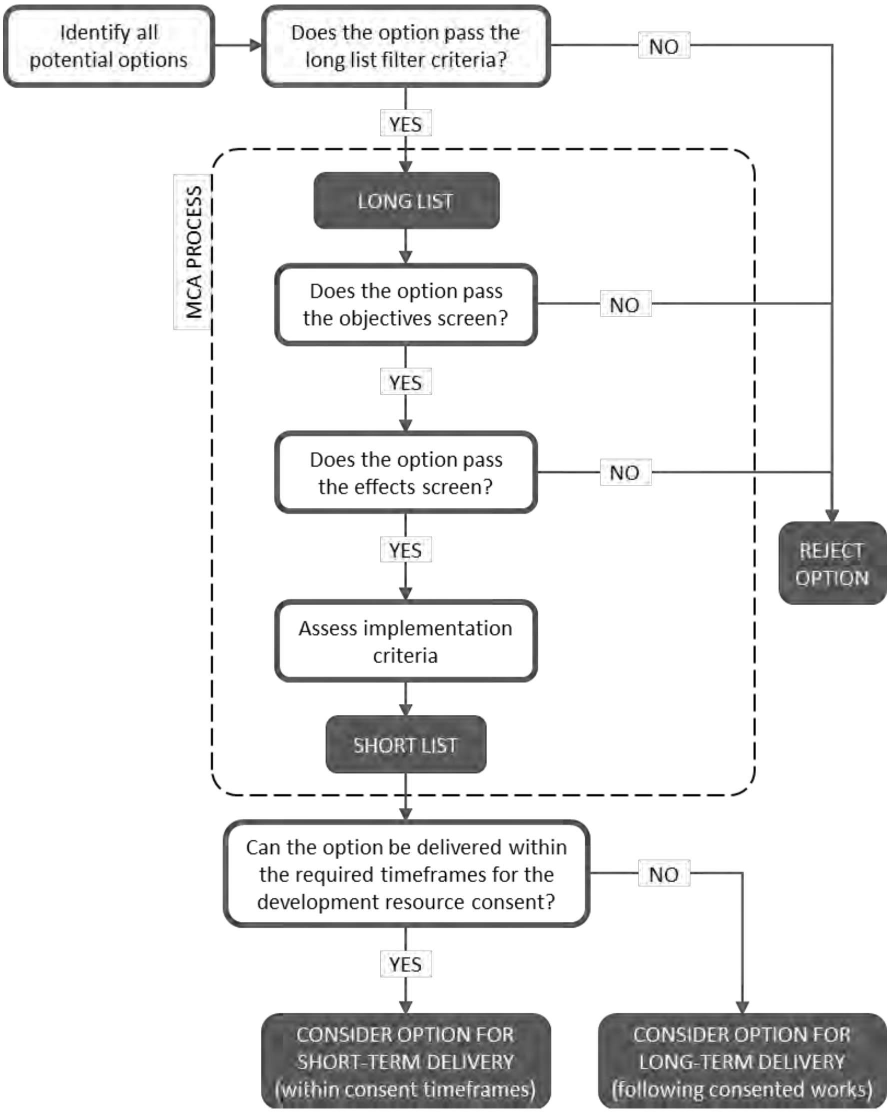


Figure 3.1: MCA evaluation process

3.2 "Do-minimum" scenario

In an MCA process, options are assessed against a "do-minimum" scenario. This scenario provides the benchmark against which to assess whether an option would contribute to or detract from a selected effect compared to the benchmark. Often, the existing situation is used as the "do-minimum" scenario. For this project, we are working under the assumption that the Shelly Bay development will proceed. Since the developer has a requirement under the resource consent conditions to complete road works on Shelly Bay Road, the consented road works have been used as the "do-minimum" scenario for the MCA effects and implementation assessments. The minimum consented road works are illustrated in Figure 3.2.

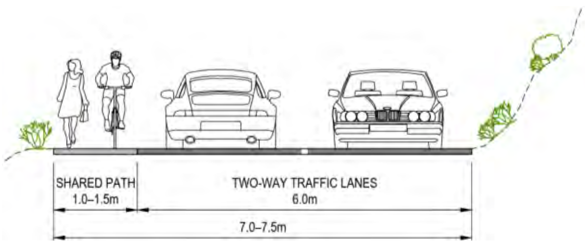


Figure 3.2: Indicative cross section of the minimum consented road works for the development

3.3 MCA criteria

The following section provides a brief explanation of the MCA criteria filters used to assess the options to upgrade Shelly Bay Road. For a full list of the objectives/considerations within each category, refer Appendix I. These criteria were developed through a series of workshop sessions with WCC representatives held on 28 February 2022, 4 March 2022, and 23 March 2022.

3.3.1 Objectives

To help evaluate how effective the options would be at achieving the desired outcome for the upgrade to Shelly Bay Road, specific project objectives were identified with WCC representatives:

- Provide a safe and accessible environment for walking
- Provide a safe and accessible environment for cycling and other micro-mobility
- Maintain safe access for motor vehicles
- Achieve a net benefit of ecological values
- Maintain or improve the public space amenity and the natural aesthetic of the coastal environment
- Highlight the cultural and historical values of mana whenua and other communities
- Enhance knowledge and awareness of Te Motu Kairangi through interpretation, storytelling, art, and creativity

To ensure alignment with Wellington's strategic direction and consistency with the other Wellington-based projects, the options were assessed against the following criteria from relevant policies and initiatives:

- Great Harbour Way – Te Aranui o Pōneke: Guiding principles/ objectives
- WCC Paneke Pōneke – Bike Network Plan: Performance measures
- WCC Te Atakura – First to Zero: Transport key considerations
- **LGWM:** Investment objectives

All options (including the consented option) were evaluated for how effectively they would contribute to each objective using a seven-point scale of effectiveness as per Table 3.1. New options that could not achieve the objectives were discounted.

Table 3.1: Objectives effectiveness scale

+3	Significantly contributes to achieving the desired outcome
+2	Contributes the achieving the desired outcome
+1	Partially contributes to achieving the desired outcome
0	Neutral/could detract from achieving the desired outcome but can be managed through design
-1	Partially detracts from achieving the desired outcome
-2	Detracts from achieving the desired outcome
-3	Significantly detracts from achieving the desired outcome

3.3.2 Effects

Options were assessed against a set of effects criteria that was identified and tested with WCC representatives. The effects assessment considered criteria across the following categories:

- Transportation (including safety)

- Environmental
- Resilience
- Carbon emissions
- Urban design
- Cultural
- Property

Options were evaluated for how much they would impact each of the effects criteria relative to the "do-minimum" scenario of the consented option. A seven-point scale of impact was applied as per Table 3.2. This MCA has not reassessed effects of the consented option (which have already been tested through the RMA process). Instead, a "neutral" score has been applied to allow relative assessment of the other options.

Table 3.2: Effects impact scale

+3	Significant positive effect
+2	Moderate positive effect
+1	Slight positive effect
0	Neutral/no effect
-1	Slight negative effect
-2	Moderate negative effect
-3	Significant negative effect

3.3.3 Implementation

In the final assessment of the MCA, options are assessed against the following implementation criteria:

- Planning
- Delivery

These criteria assessed the feasibility each option. At this stage, cost and timeframes constraints have not yet been identified for the project. This is because budgets and timeframes have not yet been set by the Council. Therefore, this stage of the MCA assessment did not act as a filter (i.e., no options were rejected at this stage), and the feasibility of the options were assessed for information only.

Options were evaluated against the implementation criteria relative to the "do-minimum" scenario of the consented option. A four-point scale of impact was applied as per Table 3.3. This MCA has not reassessed impact of the consented option (which have already been tested through the RMA process). Instead, a "neutral" score has been applied to allow relative assessment of the other options.

Table 3.3: Implementation impact scale

0	Neutral/no effect
-1	Slight negative effect
-2	Moderate negative effect
-3	Significant negative effect

4 Options assessment

4.1 Assumptions

For the assessment process, assumptions have been made regarding the scope and purpose of the project. These assumptions were confirmed with the WCC project team members in a workshop held on 4 March 2022, prior to the MCA assessment process. The assumptions have directed the development of the options.

The assumptions comprise:

- The route will generally follow the existing road corridor on Shelly Bay Road, with some considerations made for improving the alignment.
- The southern extent of the project route is the intersection of Shelly Bay Road with Miramar Avenue/Cobham Drive (excluding the intersection).
- The northern extent of the project route is the proposed southern boundary for the Shelly Bay development (as described in Section 2.2).
- The proposed Shelly Bay development will proceed, which influences the projected road user demands (including catering for 5,500 to 6,040 motor vehicles per day, as per Stantec's trip generation estimates).

4.2 Design dimensions

Local and national design guidance was referenced to identify design widths for the elements being considered in the long list of options. Specifically, three sets of guidance were considered:

- Waka Kotahi guidance, specified as the minimum project standard
- GHW guidance, identified as the project aspiration
- WCC guidance, for local Wellington reference

Table 4.1 outlines the absolute minimum, desirable minimum, and desirable widths for relevant transport facilities, as noted in the reference guidelines. The table includes pedestrian, cyclist, and motor vehicle design elements.

Table 4.1: Design guidance recommended widths

Design element	Recommended widths from design guidance			Reference
	Absolute minimum	Desirable minimum	Preferred	
Footpath	1.5m	1.8m	3.0m	PNG[1]
	1.5m	--	2.0m	COP[2]
Cycle lane	1.4m	1.6m	2.0m	CNG[3]
	1.5m	--	2.2m	CF[4]
Cycle path (two-way)	2.3m	2.5m	3.0m	CNG
	2.5m	--	--	CF
Recreational shared path	3.0m	3.5m	4.0m	CNG (refers to Austroads[5])
Buffer zone (between a path and a traffic lane)	0.3m	0.5m	1.0m	CNG
	0.6m	--	--	CF
Wide traffic lane (mixed motor vehicles and cyclists)	4.0m	4.2m	4.5m	CNG
Traffic lane	3.0m	--	3.5m	SHGDM[6]
	--	--	3.5m	COP
	--	--	3.5m	CF

1 – Waka Kotahi Pedestrian Network Guidance
2 – WCC Code of Practice for Land Development – Part C: Road Design and Construction
3 – Waka Kotahi Cycle Network Guidance
4 – WCC Cycling Framework
5 – Austroads Guide to Road Design, Part 3 and Part 6A
6 – Waka Kotahi State Highway Geometric Design Manual *DRAFT*

To assist in identifying and assessing options, we have selected the minimum and maximum widths for each of the design elements being considered. These dimensions are provided in Table 4.2. These ranges provide a lower and upper bound for indicative cross section widths; the typical dimension for each design element will be specified at a later stage during design.

Table 4.2: Recommended design dimension

Design element	Width	
	Minimum	Maximum
Footpath	1.5m	3.0m
Cycle lane	1.5m	2.0m
Cycle path (two-way)	2.5m	3.0m
Shared path	3.0m	4.0m
Buffer zone	0.5m	1.0m
Mixed traffic lane	4.0m	4.5m
Traffic lane	3.0m	3.5m

4.3 Identifying the long list

In alignment with the Councillor resolution, the primary objective of this project is to assess options to create an environment on Shelly Bay Road that provides a safer and more inviting setting for pedestrians, cyclists, and other road users along the Wellington coast. All options considered for the long list meet Waka Kotahi minimum standards.

The long list of options was identified by considering a series of different option combinations for active modes[11] facilities and motor vehicle facilities. At this stage, only conceptual options for corridor facilities have been considered. No detailed design work has been completed.

The following section outlines all the facilities considered for the long list and the filter process applied to condense the long list.

4.3.1 Facility options

The long list was developed by considering a matrix of the options for active modes facilities (Options 1 to 4) combined with the options for motor vehicles (Options A to F), as listed in the following sections. Further detailed explanations for each option are included in Appendix A.

4.3.1.1 Active modes options

The following facilities were considered as options for active modes on the corridor:

1 Footpath and cycle lanes
2 Separated path
3 Shared path
4 Footpath only

Within the active modes facility options, the following sub-options were identified:

1 The active modes facilities can be located on either the seaward side or the landward side of the road.
2 As well as providing a primary facility (for example, a separated path or a shared path) on one side of the road, an additional footpath could be provided on the other side of the road. This would increase pedestrian amenity on the corridor, providing a connection to existing facilities on the landward side of the road, including walking trails.

4.3.1.2 Traffic facility options

The following facilities were considered as options for motor vehicle traffic on the corridor:

A Two traffic lanes
B Two traffic lanes: time restricted
C Two traffic lanes with local pinch points
D One traffic lane: northbound or southbound flow
E One traffic lane: tidal flow
F No traffic lanes

4.3.1.3 Options considered but not progressed

In addition to the above facilities, two additional options were considered but not progressed:

1 **Shared narrow traffic lanes with a 30km/h speed limit:** Waka Kotahi standards state that narrow traffic lanes (3.0m wide) where motor vehicles and cyclists share the lane can be

[11] Active modes include walking, cycling, and users of other micro-mobility devices (such as scooters, skateboards, etc.)

appropriate at speeds of 30km/h or less. However, this is only suitable under certain conditions, and the environment on Shelly Bay Road wouldn't be suitable for two reasons:

– Traffic volumes should be low, up to 3,000 vehicles per day. The current environment on Shelly Bay Road meets this criterion. However, the projected vehicle volumes following completion of the development (5,500 to 6,040 vehicles per day) would not.
– The treatment should only be applied over short lengths, approximately one or two blocks. Longer distances (such as the 2.3km-long Shelly Bay Road) may evoke driver impatience.

2 **Advisory shoulders (also known as "two minus one"):** This is a road layout that consists of shoulders on either side of the road for cyclists with enough width for only one motor vehicle between the shoulders (see Figure 4.1). When two vehicles meet, both drivers must pull into the shoulder to pass after giving way to any users in the shoulder.
Ultimately, it was decided with the WCC project team that the option of advisory shoulders would not be progressed due to the following reasons:

– Guidance dictates that the preferred volumes on roads with advisory shoulders is 3,000 vehicles per day, up to a maximum of 6,000 vehicles per day. This would suit the current environment on Shelly Bay Road; however, the projected vehicle volumes from the development (5,500 to 6,040 vehicles per day) would push the road to the upper end of the acceptable vehicles speeds and wouldn't future proof for any additional growth on the corridor.
– This layout is common in some countries, but an initial trial in New Zealand was controversial. The layout may be suitable in other locations and Waka Kotahi is looking to conduct more trials. However, it was determined that a permanent solution was needed for Shelly Bay Road, not a short-term trial.

Figure 4.1: Advisory shoulders in The Netherlands[12]

[12] Source: Waka Kotahi Cycle Network Guidance (mirror image; photo John Lieswyn)

4.3.2 Criteria for filtering the long list

When considering all options and sub-options, there are a total of 84 possible combinations for the road corridor. To condense the number of options on the long list, several filters have been applied. The filters and their associated rationale are outlined in Table 4.3.

Table 4.3: Filter criteria

Filter (options not considered)	Rationale
Options where the primary active modes facility is located on the landward side of the road	The primary facility can be located on either the seaward side or landward side of the road. While both options would require the same corridor width, and thus the same options for widening the existing corridor, the seaward side options have the following key advantages: • The vision for the Great Harbour Way is to provide a continuous route for pedestrians and cyclists around the perimeter of Wellington Harbour, with an objective to locate the route immediately beside the harbour edge where possible. A seaward side facility is better aligned with this vision and objective than a landward side one. • There is an existing hazard for potential rockfall on the slope side of Shelly Bay Road[1]. Locating an active modes facility on the landward side of the road at the base of the slope would increase the exposure of pedestrians and cyclists in a known hazard area.
The sub-option of adding a second footpath to the opposite side of the road of the primary facility	This option will not be considered as a unique option on the long list. Instead, this option will be assessed as a potential add-on that can be applied to any option as a variation.
Options with two traffic lanes that are time-restricted if cycling facilities (i.e., cycle lanes, a separated path, or a shared path) are included	The purpose of the time restriction is to provide times where the traffic lanes can be used by cyclists. This would not be required if there are already full-time cycle facilities provided on the corridor.
The option with cycle lanes and no traffic lanes	Cycle lanes are an on-road option and are, therefore, not applicable where there are no traffic lanes.
Options with only a footpath and no traffic lanes	The existing corridor is wide enough to accommodate a footpath and a cycling or motor vehicle facility (only one lane wide) without needing widening.

1 – Slope hazard risk assessed in T+T report *Preliminary Slope Hazard Assessment – Shelly Bay Road Upgrades* (2020)

4.3.3 Long list

After filtering all the possible combinations for the road corridor, 19 options were identified for the long list. The long list of options is summarised in Table 4.4 below.

The full list of options considered for the long list and the rationalisation for filtering out options is summarised in Appendix B. A summary of each long list option is provided in Appendix C, including typical indicative cross sections.

Table 4.4: Long list

			Active modes facility options			
			1	2	3	4
			Footpath and cycle lanes	Separated path	Shared path	Footpath only
Traffic facility options	A	Two traffic lanes	Option 1A	Option 2A	Option 3A	Option 4A
	B	Two traffic lanes: time restricted				Option 4B
	C	Two traffic lanes: local pinch points	Option 1C	Option 2C	Option 3C	Option 4C
	D	One traffic lane: north-bound or southbound flow	Option 1D	Option 2D	Option 3D	Option 4D
	E	One traffic lane: tidal flow	Option 1E	Option 2E	Option 3E	Option 4E
	F	No traffic lanes		Option 2F	Option 3F	

For simplicity through the rest of the options assessment process, all Option A (two traffic lanes) and Option C (two traffic lanes with local pinch points) variations have been paired together with their counterpart as one option. The two options are largely the same, with the only difference being that Option C variations allow for local pinch points to reduce widening requirements. The number of pinch points and their locations have not yet been determined; this would need to be explored in the next level of design if any of these options were progressed to the next stage of the project.

4.4 Engineering and environmental assessments

Due to the constrained corridor width on Shelly Bay Road, many of the options on the long list would require widening of the road corridor, with up to 7m of additional width needed for some options.

To understand the potential impacts of widening the road corridor and to assist in the MCA assessment process, T+T completed the following studies:

- Baseline coastal assessment (Appendix D)
- Preliminary slope hazard assessment (Appendix E)
- Preliminary planning considerations (Appendix F)
- Ecological desktop assessment (Appendix G)

The results of these assessments informed a constraints mapping exercise (refer Appendix H). Engineering and environmental constraints were mapped along the length of the project scope to identify and assist in identifying mitigation strategies. The results of the studies and the constraints mapping exercise have been incorporated into the MCA process to inform the implications of the options assessment, including effects on consenting, the environment, and feasibility.

At the long list stage, no detailed level of design has been undertaken for any of the options. Therefore, there is uncertainty in the preferred approach to widen the road corridor. The road could be widened seaward, landward, or a combination of the two. To assist in the MCA process and keep it as simplified as possible, each option that would require more corridor width was assessed for the following two scenarios:

1 Widen seaward only
2 Widen landward only

If an option that required widening the road corridor were progressed to the next stage of the project, it's likely that corridor widening could be achieved through a combination of seaward and landward widening to minimise costs and environmental impacts. This would need to be tested in subsequent design phases.

4.5 Additional assessments

In addition to the specific engineering and environmental assessments that T+T has completed, other members of WCC's project team and mana whenua partners contributed inputs to the MCA assessment process. This included providing high-level assessments and advice to help inform the assessment of criteria under the following categories:

- Carbon emissions (WCC)
- Urban design (WCC and Isthmus)
- Cultural and historical (WCC and mana whenua, Taranaki Whānui ki Te Upoko o Te Ika)

The MCA results reflect the inputs provided by these project partners.

4.6 MCA results

The following section summarises the results of the MCA, including the short list. The full MCA is provided in Appendix H.

4.6.1 Project objectives screen

Many of the long list options were filtered out during the first stage of the MCA, which assessed the options against the project objectives. Any option that didn't achieve even one of the objectives was discounted and not carried forward through the rest of the MCA process. The results of the project objectives assessment are summarised in Table 4.5.

Table 4.5: Results of the project objectives assessment

Option	Sub-option description	Pass project objectives screen?
Option 1: Footpath and cycle lanes		
1A/1C	Two traffic lanes (with opportunity for pinch points)	✓
1D	One traffic lane: northbound or southbound flow	✓
1E	One traffic lane: tidal flow	✗ A tidal flow approach would not achieve the project objectives to maintain safe access for motor vehicles. as it would be confusing and have a significant negative impact on travel options for people travelling to / from Shelly Bay.
Option 2: Separated path		
2A/2C	Two traffic lanes (with opportunity for pinch points)	✓
2D	One traffic lane: northbound or southbound flow	✓
2E	One traffic lane: tidal flow	✗ A tidal flow approach would not achieve the project objectives to maintain safe access for motor vehicles. as it would be confusing and have a significant negative impact on travel options for people travelling to / from Shelly Bay.
2F	No traffic lanes	✗ This option would not achieve the project objective to maintain safe access for motor vehicles.
Option 3: Shared path		
3A/3C	Two traffic lanes (with opportunity for pinch points)	✓
3D	One traffic lane: northbound or southbound flow	✓
3E	One traffic lane: tidal flow	✗ A tidal flow approach would not achieve the project objectives to maintain safe access for motor vehicles. as it would be confusing and have a significant negative impact on travel options for people travelling to / from Shelly Bay.
3F	No traffic lanes	✗ This option would not achieve the project objective to maintain safe access for motor vehicles.
Option 4: Footpath only		
4A	Two traffic lanes (with opportunity for pinch points)	✓
4B	Two traffic lanes: time restricted	✗ One of the project objectives is to maintain safe access for motor vehicles. Time restrictions would not achieve this objective as it would be confusing and have a significant negative impact on travel options for people travelling to and from Shelly Bay.
4D	One traffic lane: northbound or southbound flow	✗ This option would not achieve the project objective of providing a safe and accessible environment for cycling and other micro-mobility, as it would restrict movement to one direction and require a significant detour.
4E	One traffic lane: tidal flow	✗ A tidal flow approach would not achieve the project objectives to maintain safe access for motor vehicles. as it would be confusing and have a significant negative impact on travel options for people travelling to / from Shelly Bay.

4.6.2 Short list

As per the resource consent conditions for the Shelly Bay development, delivery of the minimum consented road works on Shelly Bay Road needs to occur within the timeframes specified in the consent. WCC has entered into a development agreement with The Wellington Company, under which any upgrades that WCC decides to do above and beyond the consent requirements needs to either:

a Meet the timeframe requirements of the developer's resource consent, or

b Be completed after the developer has completed their consented road upgrade.

As such, the developer's resource consent and the development agreement place a time constraint on when upgrade options could be delivered.

4.6.2.1 Scenario A: Short-term delivery (within the consent timeframes)

Any option that would require significant widening of the road corridor (i.e., 2m or more of extra width) would have significant effects on delivery timeframes due to increased consent requirements and design complexity compared to the consented works. Additionally, any option that would not meet the requirements for the minimum consented road works (for example, only one traffic lane instead of two) would need to be reconsented and would also push out beyond the delivery timeframes specified under the resource consent for the development.

Given these restrictions, there are no options that both meet minimum Waka Kotahi standards (i.e., no options on the long list) and could be delivered within the consent timeframes. Any upgrade above and beyond the minimum consented road works would need to be completed after the developer has completed their consented road upgrade.

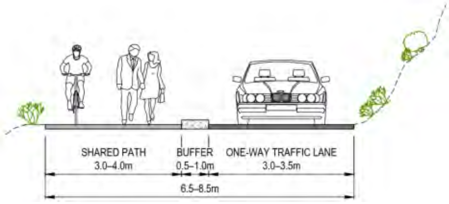
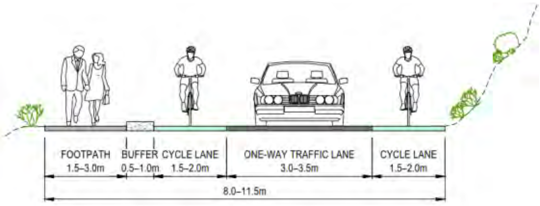
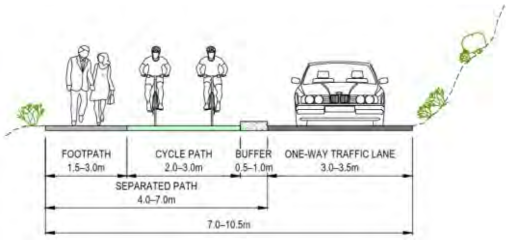
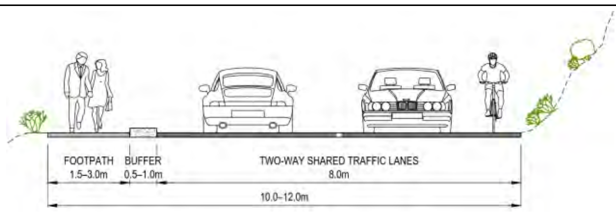
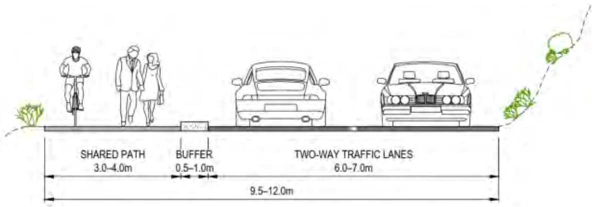
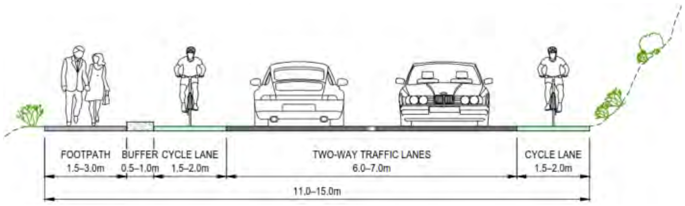
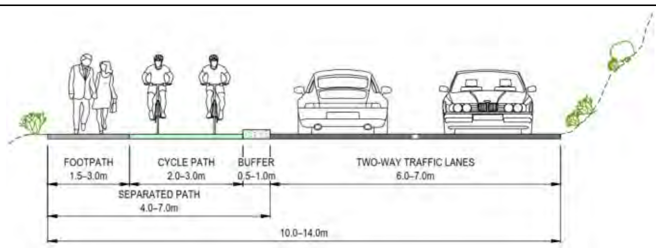
4.6.2.2 Scenario B: Long-term delivery (to be completed after the consented road works)

If the Council decides to do a road upgrade after the timeframe required under the resource consent for the development, the developer will proceed with its consented road upgrade and Council will need to complete its road works afterwards. Under this scenario, there are seven options that have come through in the short list following the MCA assessment process. These options have been categorised under three widening categories:

- **Category 1:** Options that fit largely within the existing corridor width
- **Category 2:** Options requiring a wider road corridor – up to 12m
- **Category 3:** Options requiring a wider road corridor – up to 15m

A summary of each short list option is provided in Table 4.6, including typical indicative cross sections.

Table 4.6: Short list

Option	Description	Typical indicative cross section
Category 1: Options that fit within the existing corridor width		
3D	Shared path and one traffic lane (northbound or southbound flow)	
Category 2: Options requiring a wider corridor – up to 12.0m		
1D	Footpath, cycle lanes, and one traffic lane (northbound or southbound flow)	
2D	Separated path and one traffic lane (northbound or southbound flow)	
4A/4C	Footpath only and two mixed traffic lanes (with opportunity for pinch points)	
3A/3C	Shared path and two traffic lanes (with opportunity for pinch points)	
Category 3: Options requiring a wider corridor – up to 15m		
1A/1C	Footpath, cycle lanes, and two traffic lanes (with opportunity for pinch points)	
2A/2C	Separated path and two traffic lanes (with opportunity for pinch points)	

5 Council decision

This report and its supporting appendices have been prepared in part to support a recommendations report that is being prepared by WCC Council officers to go to Councillors in June 2022. Based on the recommendations report, Councillors will vote on how to proceed with the upgrades to Shelly Bay Road. The outcome of that vote will determine the next steps for this project.

To support the recommendations report, WCC have commissioned a detailed planning review, building on the work completed to date. WCC have also engaged Bond Construction Management (BondCM) to complete a cost estimation exercise, considering the following two scenarios:

1 The minimum consented road works for the Shelly Bay development

2 Option 2A/2C, the option that best aligns with the GHW aspiration

These two scenarios were selected as they represent the lower and upper bounds of the cost and planning impacts of potential options for the road upgrade.

5.1 Cost estimates

The results of BondCM's costing exercise are provided in the letter report *Shelly Bay Road Upgrade – Physical Works Budget* (BondCM, June 2022). The report includes commentary on high-level risks and considerations for the lower and upper range costs for upgrading Shelly Bay Road. The estimates provided by BondCM are summarised in Table 5.1.

Table 5.1: Cost estimates (provided by BondCM, June 2022)

Option	Indicative cost range		
	Base estimate	Expected estimate	Project estimate 95th percentile
Minimum consented road works for the Shelly Bay development	\$0.85m	\$0.94m	\$1.1m
Option 2A/2C (Great Harbour Way aspiration)	\$13.6m – \$21.7m	\$16.3m – \$26.0m	\$19.0m – \$30.4m

6 Applicability

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

Tonkin & Taylor Ltd

Report prepared by:

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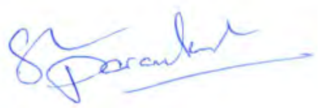
Janine Sziklasi

Transportation Engineer

Report reviewed by:



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Senior Environmental Engineer

Report reviewed by:

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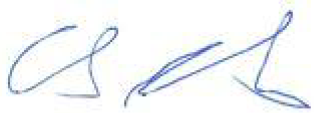
Senior Transportation Planner

Authorised for Tonkin & Taylor Ltd by:



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Chris Purchas

Project Director

JASZ
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Appendix A: Facility options

A1 Active modes facility options

The following facilities were considered as options for pedestrians and cyclists on the corridor:

1 **Footpath and cycle lanes**
This option includes a footpath for pedestrians and on-road cycle lanes for cyclists. Cycle lanes are located on both sides of the road and delineated from motor vehicles by road markings, with the opportunity to provide protection through narrow separators, such as bollards.

2 **Separated path**
This option includes a separated path that provides designated areas for pedestrians and cyclists. Separated paths are physically protected from motor vehicles using design features such as safety barriers and/or grade separation.

3 **Shared path**
This option includes a shared path that provides shared space for pedestrians and cyclists. Shared paths are physically separated from motor vehicles and may be physically protected from motor vehicles using design features such as safety barriers and/or grade separation.

4 **Footpath only**
This option includes a footpath for pedestrians and no cycle-only infrastructure. Cyclists would be required to share the traffic lane with motor vehicles.

A2 Traffic facility options

The following facilities were considered as options for motor vehicle traffic on the corridor:

A **Two traffic lanes**
This option includes two traffic lanes that accommodate two-way motor vehicle traffic at all times.

B **Two traffic lanes: time restricted**
This option includes two traffic lanes that are restricted to use by certain road users depending on the time of day and/or the day of the week. At times, the traffic lanes would allow for two-way motor vehicle traffic, while at other times motor vehicles would be restricted and the lanes would be available for use by active transport modes.

C **Two traffic lanes: local pinch points**
This option typically provides two traffic lanes that accommodate two-way motor vehicle traffic, with pinch points at isolated sections. Pinch points slow down motor vehicles by restricting the road to a single lane for short sections. This requires opposing drivers to take turns passing through. The operation is similar to a one-way bridge.

D **One traffic lane: northbound or southbound flow**
This option includes one traffic lane for one-way motor vehicle traffic at all times. The traffic flow may be in the northbound or southbound direction (not selected at the long list stage).

E **One traffic lane: tidal flow**
This option includes one traffic lane for tidal flow of motor vehicles. Tidal flow would allow for traffic to travel in one direction at times, and in the opposite direction other times.

F **No traffic lanes**
This option does not include any facilities for motor vehicle traffic at any times. Motor vehicle would be required to use an alternative route.

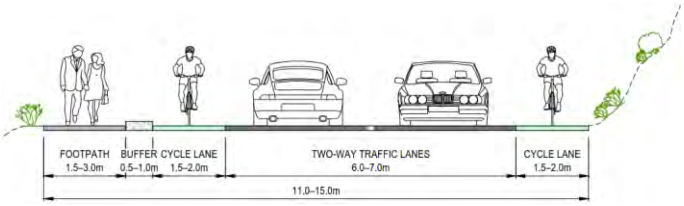
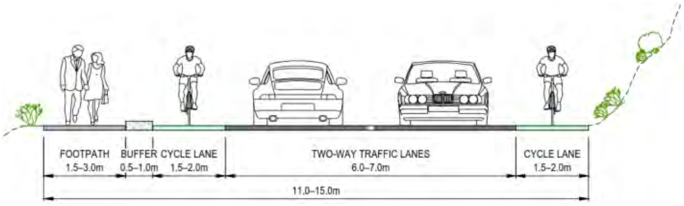
Appendix B: Identifying the long list

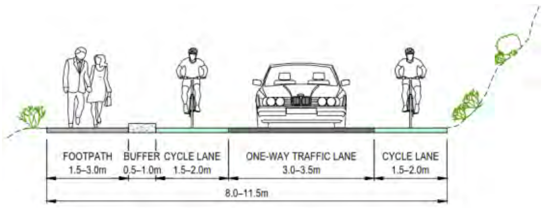
The long list was developed by considering a matrix of the options for active modes facilities (Options 1 to 4) combined with the options for motor vehicles (Options A to F). The full matrix of options considered is included in Appendix B Table 1.

Appendix B Table 1: Rationalisation for filtering options from the long list

Traffic facility options			Active modes facility options													
			1			2				3				4		
			Footpath and cycle lanes			Separated path				Shared path				Footpath only		
			Seaward side footpath	Landward side footpath	Footpaths on both sides	Seaward side separated path only	Landward side separated path only	Seaward side separated path with landward side footpath	Landward side separated path with seaward side footpath	Seaward side shared path only	Landward side shared path only	Seaward side shared path with landward side footpath	Landward side shared path with seaward side footpath	Seaward side footpath	Landward side footpath	Footpaths on both sides
	A	Two traffic lanes	✓	Not considering landward options	Variation to Option 1A; assessed separately	✓	Not considering landward options	Variation to Option 2A; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 3A; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 4A; assessed separately
	B	Two traffic lanes: time restricted	Full-time cycle lanes, time restrictions not needed	Full-time cycle lanes, time restrictions not needed	Full-time cycle lanes, time restrictions not needed	Full-time separated path, time restrictions not needed	Full-time separated path, time restrictions not needed	Full-time separated path, time restrictions not needed	Full-time separated path, time restrictions not needed	Full-time shared path, time restrictions not needed	Full-time shared path, time restrictions not needed	Full-time shared path, time restrictions not needed	Full-time shared path, time restrictions not needed	✓	Not considering landward options	Variation to Option 4B; assessed separately
	C	Two traffic lanes: local pinch points	✓	Not considering landward options	Variation to Option 1C; assessed separately	✓	Not considering landward options	Variation to Option 2C; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 3C; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 4C; assessed separately
	D	One traffic lane: northbound or southbound flow	✓	Not considering landward options	Variation to Option 1D; assessed separately	✓	Not considering landward options	Variation to Option 2D; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 3D; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 4D; assessed separately
	E	One traffic lane: tidal flow	✓	Not considering landward options	Variation to Option 1E; assessed separately	✓	Not considering landward options	Variation to Option 2E; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 3E; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 4E; assessed separately
	F	No traffic lanes	Cycle lanes are an on-road option	Cycle lanes are an on-road option	Cycle lanes are an on-road option	✓	Not considering landward options	Variation to Option 2F; assessed separately	Not considering landward options	✓	Not considering landward options	Variation to Option 3F; assessed separately	Not considering landward options	Enough existing width for additional facility	Enough existing width for additional facility	Enough existing width for additional facility

Appendix C: Long list summary

<table>
<tr><th>Option</th><th>Description</th><th>Indicative cross section(s)</th></tr>
<tr><td colspan="3">Option 1: Footpath and cycle lanes</td></tr>
<tr><td>1A</td><td>Two traffic lanes</td><td>
</td></tr>
<tr><td>1C</td><td>Two traffic lanes: local pinch points</td><td>Typical cross section:


Cross section at pinch points:

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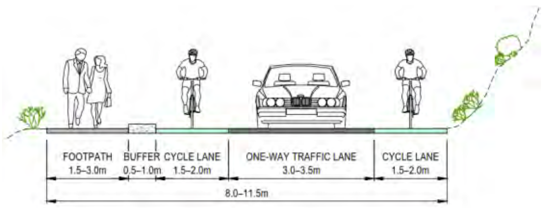
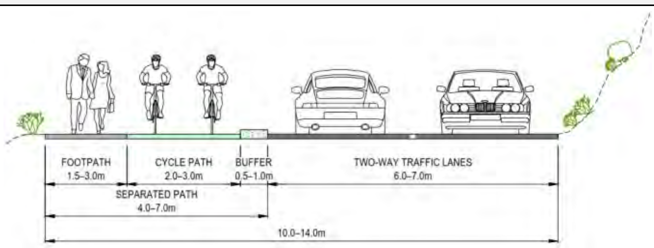
<tr><td>1D</td><td>One traffic lane: northbound or southbound flow</td><td rowspan="2">
</td></tr>
<tr><td>1E</td><td>One traffic lane: tidal flow</td></tr>
<tr><td colspan="3">Option 2: Separated path</td></tr>
<tr><td>2A</td><td>Two traffic lanes</td><td>
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<table>
<tr><th>Option</th><th>Description</th><th>Indicative cross section(s)</th></tr>
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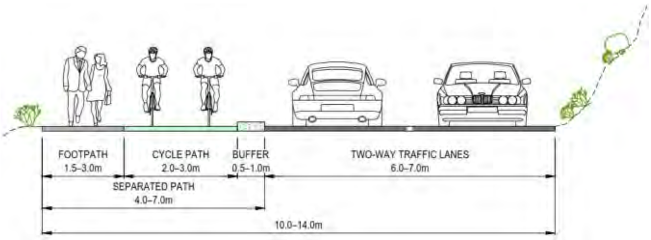

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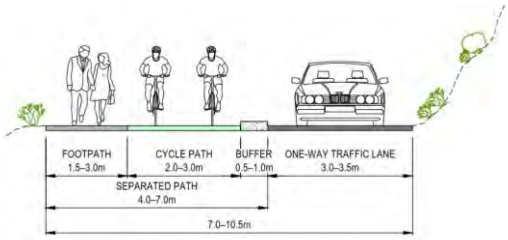
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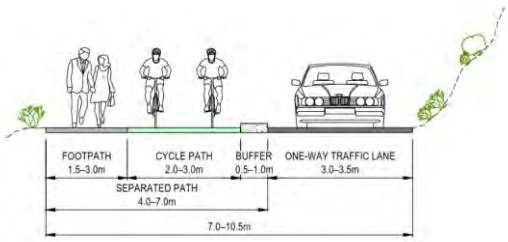
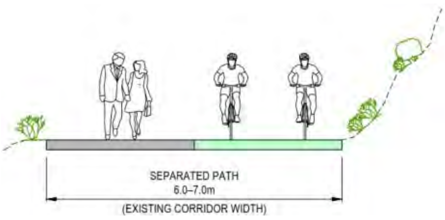
<tr><td>2D</td><td>One traffic lane: northbound or southbound flow</td><td rowspan="2">
</td></tr>
<tr><td>2E</td><td>One traffic lane: tidal flow</td></tr>
<tr><td>2F</td><td>No traffic lanes</td><td>
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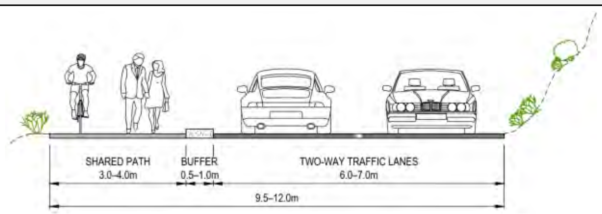
<tr><td>3A</td><td>Two traffic lanes</td><td>
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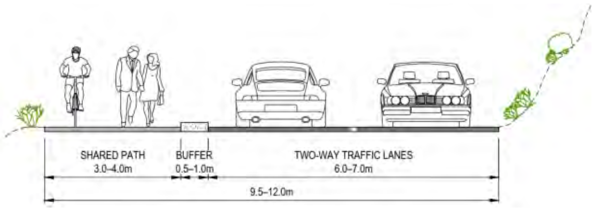

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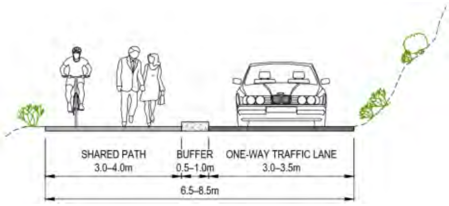
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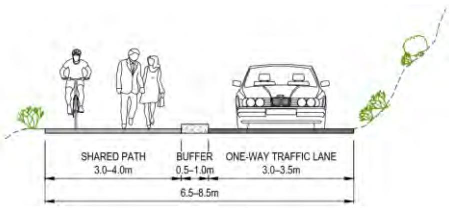
<tr><td>3D</td><td>One traffic lane: northbound or southbound flow</td><td rowspan="2">
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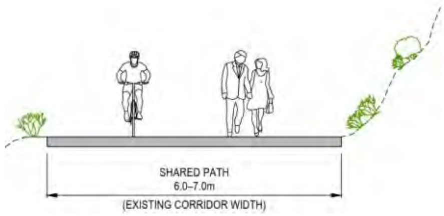
<tr><td>3F</td><td>No traffic lanes</td><td>
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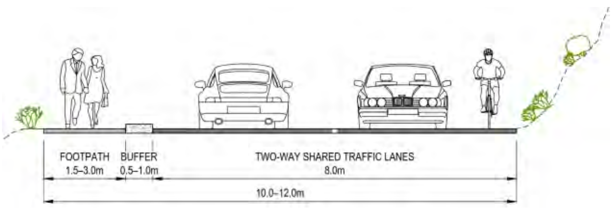
<tr><td>4A</td><td>Two traffic lanes</td><td rowspan="2">
</td></tr>
<tr><td>4B</td><td>Two traffic lanes: time restricted</td></tr>
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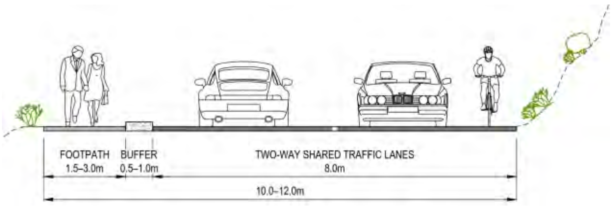
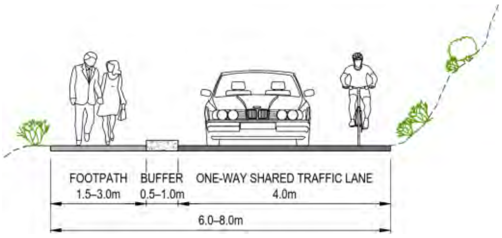
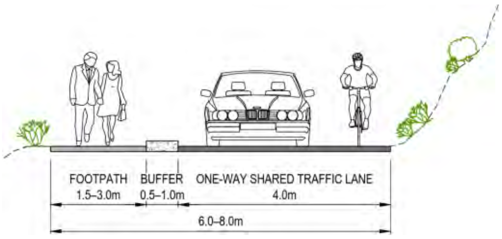
Option	Description	Indicative cross section(s)
4C	Two traffic lanes: local pinch points	Typical cross section:  Cross section at pinch points: 
4D	One traffic lane: northbound or southbound flow	
4E	One traffic lane: tidal flow	

Appendix D: Coastal assessment

- **Baseline Coastal Assessment: Shelly Bay Road Upgrades (T+T report, July 2020)**

REPORT

Tonkin+Taylor

Baseline Coastal Assessment

Shelly Bay Road Upgrades

Prepared for
Wellington City Council
Prepared by
Tonkin & Taylor Ltd
Date
July 2020
Job Number
1014113.v2

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Document Control

Title: Baseline Coastal Assessment					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
26.06.20	1	Draft for client review	Verity Taylor Michael Paine	Tom Shand	Richard Cole
17.07.20	2	Final	Verity Taylor Michael Paine	Tom Shand	Richard Cole

Distribution:

Wellington City Council	1 copy
Tonkin & Taylor Ltd (FILE)	1 copy

Table of contents

Executive summary

Wellington City Council (WCC) have engaged Tonkin and Taylor (T+T) to undertake a high-level coastal assessment to assist with the planning of the upgrade of Shelly Bay Road. This is to better align with Waka Kotahi NZ Transport Agency (Waka Kotahi) guidance and the vision for the Great Harbour Way. Shelly Bay Road is located on the western side of the Miramar peninsula. The extent of the project site extends approximately 2.3 km between Miramar Avenue and Shelly Bay. The road is approximately 6 m wide-ranging in elevation from 2.1 to 4.1 m NZVD2016 with an average level of approximately 3.3 m NZVD2016. The road is constrained along the length of the site with a coastal escarpment featuring along its length between 1 and 2m from the landward edge of the road and the coastal margin a similar distance away from the seaward edge.

Wave climate and wave levels have been considered for 3 horizons: present day (2020), 2070 and 2120 based on an RCP8.5 emissions scenario. Extreme storm tide (1%AEP) water levels along the site are currently 1.0 m NZVD2016 increasing by 0.4 m and 1.0 m sea-level rise increments to 2070 and 2120 respectively. SWAN wave modelling undertaken in Wellington Harbour indicates an extreme (1%AEP) significant wave height of 1.0-1.2 m offshore of the headlands along the project site, reducing to less than 1.0 m further into the larger bays.

The extreme static water levels considered are lower than the existing road elevation for the present-day scenario, however, as sea levels rise the road freeboard reduces to around 0 m at the lowest exiting elevation when considering the 2120 horizon. However, the dynamic effect of waves results in overtopping flows above these levels which can result in health and safety risk to road users and damage to the backshore and road surface.

High level overtopping analysis shows that at the lowest road elevations there is likely to be flow in excess of safe levels for road users in present-day 1%AEP storm conditions with damage to locations of unprotected berm edge likely in this event. These flows increase as sea levels rise to levels which will likely cause damage to the pavement by 2120 in extreme events.

A high-level assessment of the condition of the coastal defences along Shelly Bay Road was undertaken in comparison with available baseline data. The key observations from the assessment are listed below:

- There are five locations where the condition of the wall differs from the baseline data. Much of the damage to the coastal defences observed is due to undermining and end-scour/outflanking of the existing walls.
- There are notable areas of erosion of unprotected slopes, the location of which has been recorded.
- Five seawalls were not included within the 2016 data, these have likely been constructed post-2016.

1 Introduction

Tonkin & Taylor Ltd (T+T) have been engaged by Wellington City Council (WCC) to explore options for upgrading Shelly Bay Road. The objective of the upgrade will be to provide an environment on Shelly Bay Road that better aligns with Waka Kotahi NZ Transport Agency guidance and the Great Harbour Way plan to provide a safer and more inviting setting for pedestrians, cyclists, and other road users along the Wellington coast. The extent of the assessment site is approximately 2.3 km, extending from Miramar Avenue to the south end of Shelly Bay, as shown in **Figure 1-1**.

To assist with the assessment of the options for upgrades, T+T has been engaged to undertake a high-level coastal assessment along this section of Shelly Bay Road. The results of the coastal assessment are outlined in this report. The assessment is to inform the coastal implications of the options, including effects on consenting, the environment, feasibility, and cost. The assessment is high-level only; a detailed coastal assessment should be undertaken at a later stage in the project to inform detailed design.

Figure 1-1: Physical scope of work (extent of the project scope (study area) shown in red; coastal areas outside of scope highlighted in yellow)

1.1 Background information

The following background information has been utilised for this assessment:

- WCC GIS database seawalls location shapefiles and 2016 condition assessment summary information.
- Site visit observations and photos from two T+T engineers on 8 June 2020.
- Bathymetric data from the Land Information New Zealand (LINZ) online data service hydrographic charts.
- GIS information publicly available including historical aerials (Retrolens) and topographical maps (LINZ data service).

1.2 Scope of work

This report provides the results of the high-level coastal assessment of the study area. The key tasks undertaken as part of this assessment are in line with T+T's Offer of Service, dated 22 May 2020, as follows:

- A desktop study of available information, including available sea level and storm tide data, historic aerial photographs to determine shoreline trends over time, Land Information New Zealand (LINZ) Wellington LIDAR survey (2013) to identify current levels and seawall structure profiles, and available bathymetric data, including New Zealand Nautical Charts.
- A high-level coastal process assessment, including location-specific wave assessment, and long-term shoreline and development trends based on available aerial imagery to indicate erosion risk.
- A high-level inundation assessment of the current road, both with present-day and future sea levels to determine risk and input into the long list assessment and shortlist considerations. This will include preparation of figures to show the extent of inundation under various sea-level rise scenarios and timeframes.
- A high-level assessment of the condition of the existing coastal protection structures along the length of the project site.

2 Physical setting

The study area is within the Wellington Harbour, along the eastern extent of Evans Bay on the Miramar Peninsula (**Figure 2-1**). Wellington Harbour is a large natural basin with an approximate surface area of 85 km^2, maximum width of 11 km, maximum depth of 31 m and an average depth of 14 m. The Harbour is connected to Cook Strait via the narrow harbour entrance passage located between Palmer and Pencarrow Heads.

The site is adjacent to Shelly Bay Road and is approximately 2.5 km in length along the eastern shoreline of Evans Bay (**Figure 2-1**). The site is accessible along the roadside and by various carparks and access ways along the length of Shelly Bay Road.

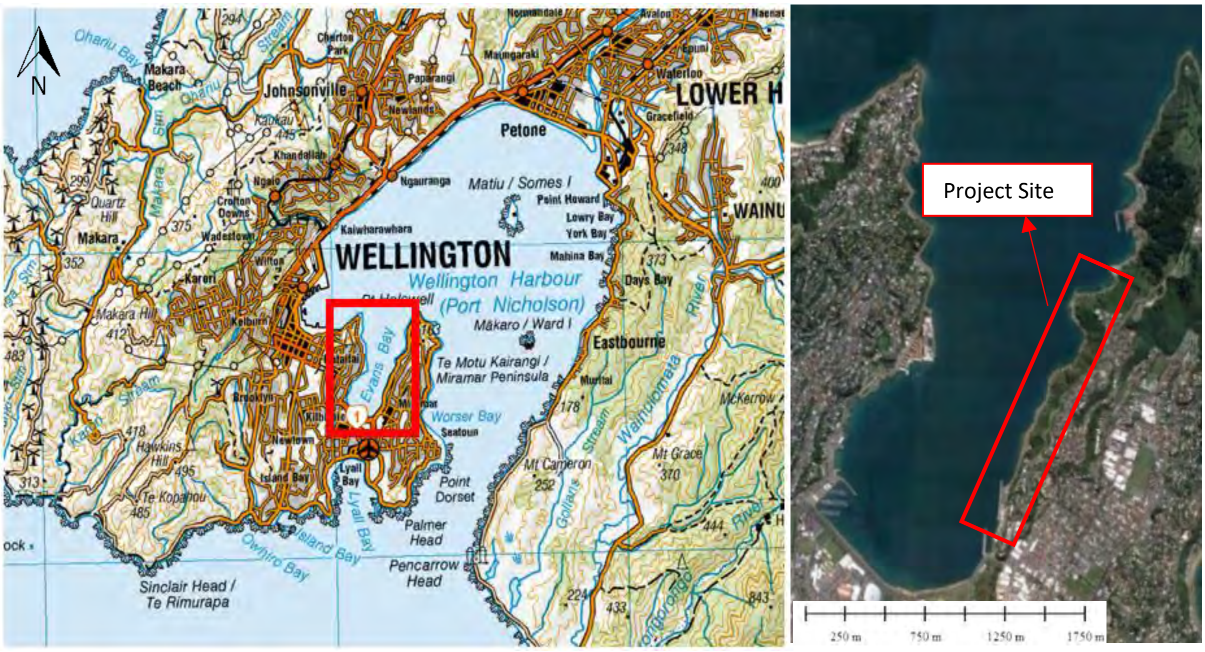

Figure 2-1: Site Location (LINZ (2019), Google Earth (2018))

2.1 Bathymetry

The LINZ (2012) hydrographic chart of Evans Bay (**Figure 2-2**) indicates the seabed shallowing gradually from the entrance of Evans Bay to approximately 14 m below chart datum approximately 100 m offshore from the road edge. Within 100 m of shore along Shelly Bay Road this chart indicates the seabed dipping at an approximate grades of between 1V:5H and 1V:10H along the length of the project site.

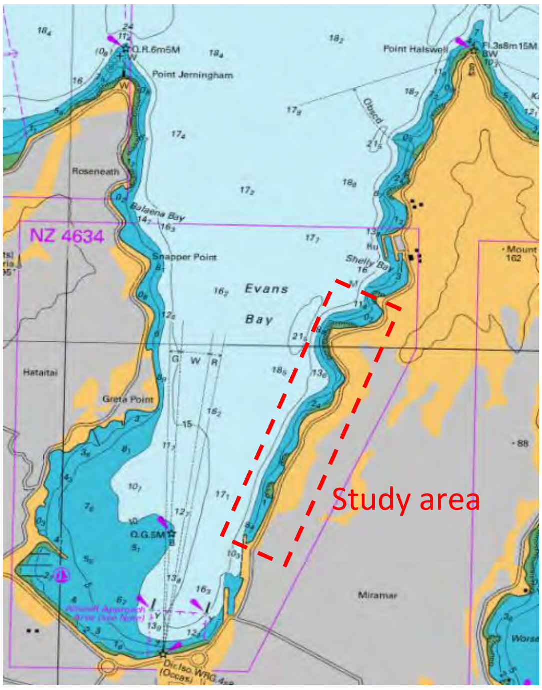

Figure 2-2: LINZ Hydrographic Chart of Evans Bay (LINZ, 2012)

2.2 Topography

Levels are reported in terms of the New Zealand Vertical Datum 2016 (NZVD2016). 2013 LiDAR and bathymetric information (**Figure 2-3**) for Wellington has been sourced from the LINZ online data service for this assessment.

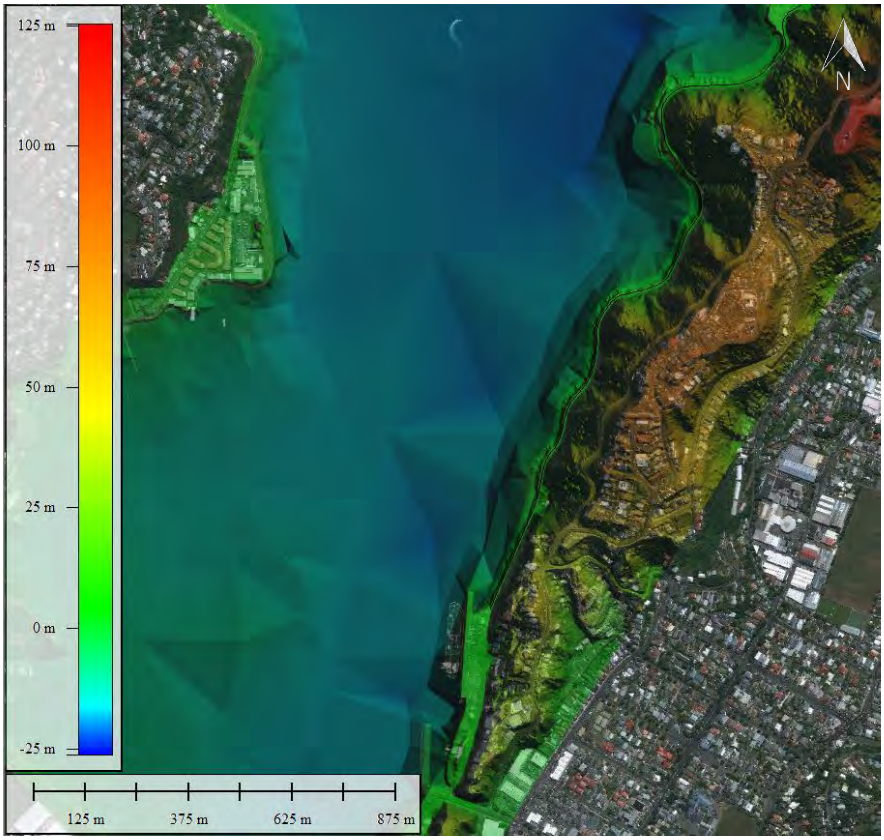

Figure 2-3: LINZ bathymetry and topography for the study area

The predominate topographic profile along the study consists of a gradually sloped beach face and berm or greywacke rock outcrop ranging from 0 m and 0.5 m NZVD2016 followed by an approximate 2 m vertical natural slope or seawall that leads to Shelly Bay Road. Shelly Bay Road itself is approximately 6 m wide and ranging in elevation from 2.1 to 4.1 m NZVD2016. The landward edge of the road features a coastal escarpment with a steep base (40 to 60 degrees) typically between 20 to 40 m high followed by a less steep upper slope (20 to 30 degrees). The road is generally located within 1 to 2 m from the seaward slope or seawall edge and less than 1 m from the base of the landward escarpment.

While the slope beach profile and topography vary slightly along the project site, an indicative topography profile compared against the Mean High-Water Springs (MHWS) is in shown in **Figure 2-4**.

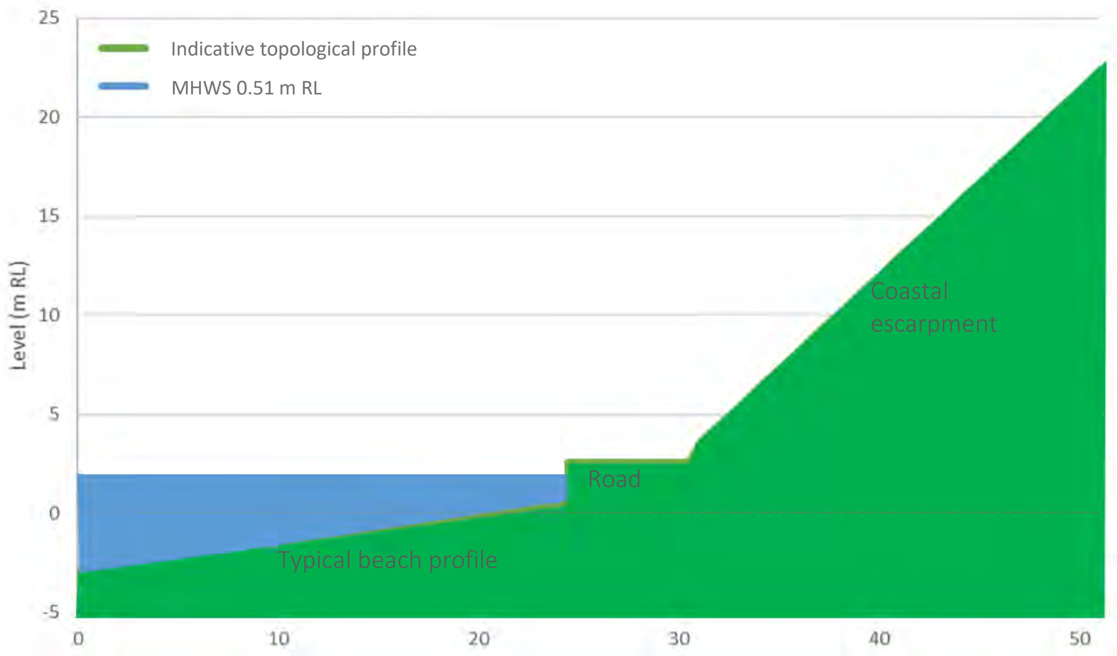

Figure 2-4: Indicative topographic profile for Shelly Bay Road

2.3 Geology and sediments

The geological setting map[1] shown in **Figure 2-5** shows Shelly Bay Road in the context of the regional geology. The map indicates that the slopes of the coastal escarpment are comprised mainly of steeply bedded, alternating sandstone / mudstone. The coastal escarpment has formed by the persistent erosion at the toe of the slope by the sea, in conjunction with the progressive tectonic uplift and tilting of the Miramar Peninsula.

A more detailed analysis of the terrain and geology can be found in T+T Preliminary Slope Hazard Assessment Shelly Bay Road report dated 26 June 2020.

[1] Begg, J.G., Mazengarb, C., 1996. Geology of the Wellington area, scale 1:50 000. Institute of Geological & Nuclear Sciences geological map 22. 1 sheet + 128 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

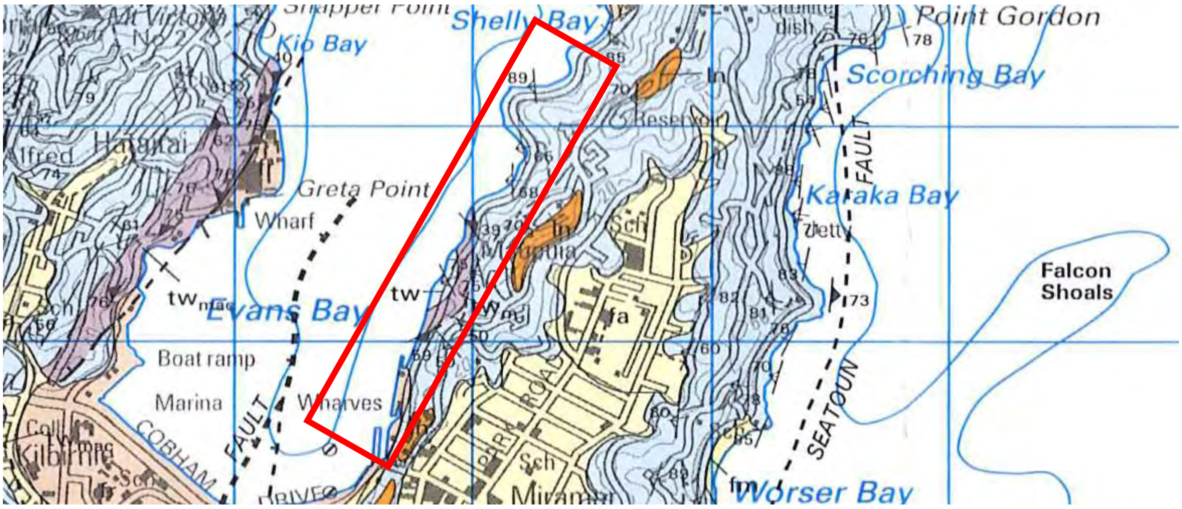

Figure 2-5: Geological setting and extent of study (red line). Note that this map only describes the general geology of the area and does not provide site specific detail

The coastline itself consists of gravel beaches and greywacke rock outcrops. There are pocket beaches located along the project site located between greywacke rock outcrops. These beaches predominately consist of mixed gravel and cobble. The less exposed pockets generally consist of a build-up of poorly sorted, angular and coarse erosion products. Whereas within the more exposed beach pockets the gravel has passed through continual erosion leading to well-rounded and graded shingle (Van der Linden 1967). These beaches have a natural sediment grade occurring from coarser to finer gravels from the lower to the upper beach. Formation of a finer gravel berm above the high tide mark is also a notable feature (refer **Figure 2-6**).

Figure 2-6: Naturally graded beach with finer sediments increasing towards the upper beach and greywacke rocky outcrop in the background

2.4 Land development

The coastline and Shelly Bay roadside are largely natural with some locations of minor reclaimed land and hillside excavation to provide short sections of reclamation fill for the road platform. The most significant area of reclamation is located at the southern end of the project site between the escarpment and the Miramar Wharf.

Due to the steep topographic profile along Shelly Bay Road the area has remained largely undeveloped. Except for within Shelly Bay itself (just north of the project site), where, in the late 19th century the area was occupied by an anti-submarine mining base (Te, M. 2020). In the early to mid-20th century this land was used Royal New Zealand Navy and Royal New Zealand Airforce for the development of the World War II naval base and armament depot. The base was closed in 1995 (Te, M. 2020). Currently, the previously used defence base buildings are rented out for industrial or hospitality purposes.

At the southern end of the project site, the Miramar Wharf is 171 m long and 18 m wide and was constructed in 1901 and predominantly used for transporting coal to the city gas works. The wharf was closed in 2015 due to public safety concerns (NatLib, 2020).

Figure 2-7: Aerial view of Miramar Peninsula 30 September 1931. Evans Bay is in the foreground, with the Miramar and Burnham (right) wharves. Shelly Bay Road runs alongside. (Alexander Turnbull Library Ref: 1/2-061244-F).

Figure 2-8: Shelly Bay Airforce Base 1948 (Alexander Turnbull Library Ref: 1/2-046266-G).

Figure 2-9: Aerial view of Watts Peninsula, Miramar, Wellington March 1966. (Alexander Turnbull Library Ref: EP/1966/1339-F).

3 Coastal processes

3.1 Water levels

The water level at any location varies across a range of timescales. Key components that determine water level are:

- Astronomical tides.
- Barometric and wind effects, generally referred to as storm surge.
- Medium-term fluctuations, including El Nino-Southern Oscillation (ENSO) and Interdecadal Pacific Oscillation (IPO) effects.
- Long-term changes in relative sea level due to climatic or geological changes.
- Nearshore wave effects (wave set-up or run-up).

These components combined either form a static extreme water level, which typically includes storm tide and wave set-up, or dynamic extreme water level, which typically include storm tide and wave run-up. **Figure 3-1** shows a schematisation of the water level components.

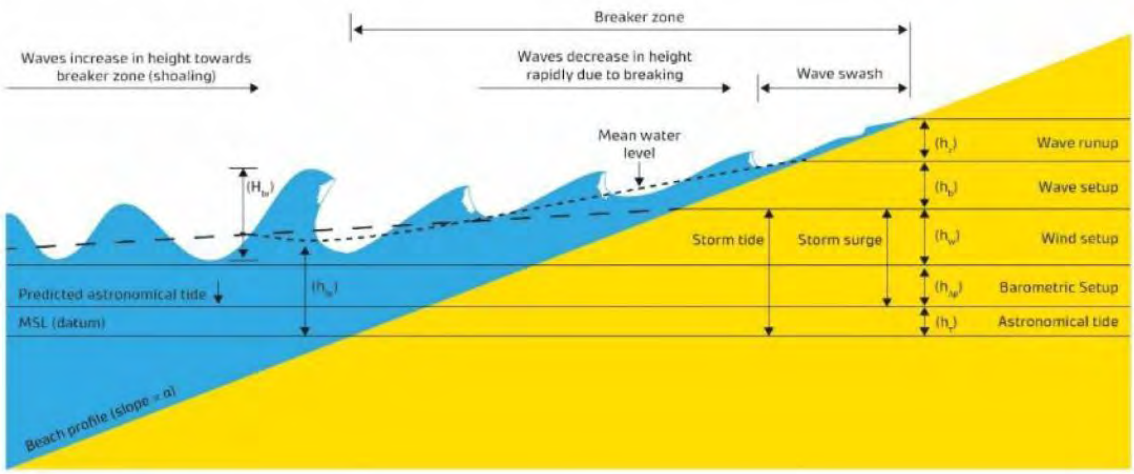

Figure 3-1: Schematisation of water level components (source: T+T 2017).

3.1.1 Astronomic tide

Standard Port Tidal Levels given by LINZ (2019) are based on the average predicted values over the 18.6-year astronomical tidal cycle. When tidal information is used as part of a MHWS determination for cadastral surveys these values should be used (LINZ, 2019). Tidal levels available for the Port of Wellington and are shown in **Table 3-1**.

Table 3-1: Tidal levels for Port of Wellington

Tidal level	Chart Datum CD (m)	WVD53 (m)	NZVD2016 (m)
Highest Astronomical Tide (HAT)	1.87	0.96	0.61
Mean High Water Spring (MHWS)	1.77	0.86	0.51
Mean High Water Neap (MHWN)	1.45	0.54	0.19
Mean Sea Level (MSL)	1.13	0.22	-0.13
Mean Low Water Neap (MLWN)	0.70	-0.21	-0.56
Mean Low Water Spring (MLWS)	0.45	-0.46	-0.81
Lowest Astronomical Tide (LAT)	0.38	-0.53	-0.88

3.1.2 Storm surge

Storm surge results from the combination of barometric setup from low atmospheric pressure and wind stress from winds blowing along or onshore which elevates the water level above the predicted tide. The combination of the mean level of the sea, astronomical tide and storm surge is known as storm tide.

Stephens et al. (2009) assessed annual maxima sea level at Queens Wharf, Wellington (dates of data not specified) and derived a range of extreme values presented in **Table 3-2**. A 1% AEP (equivalent to a 100 year return period or average recurrence interval event) storm tide level of 0.97 m NZVD2016 was derived, approximately 0.46 m above the LINZ MHWS level. It should be noted that the Stephens et al. (2009) assessment included a simulated storm tide of 0.98 m NZVD2016 on 2 February 1936.

During extreme storm tide events, wave processes are expected to further increase the mean water level at the shoreline through wave setup. Lane et al. (2012) estimated the 1%AEP joint probability of extreme sea level including wave setup (i.e. storm tide + wave setup) for Evans Bay of 1.12 m NZVD-16 indicating wave setup may contribute an additional **0.15 m** to total sea level during this event.

Table 3-2: Storm tide elevations

Annual Exceedance Probability (AEP)	Average Recurrence Interval (ARI)	Extreme Sea Level (m WVD53)	Extreme Sea Level (m NZVD2016)
0.2	5 year	1.20	0.85
0.1	10 year	1.23	0.88
0.05	20 year	1.26	0.91
0.02	50 year	1.30	0.95
0.01	100 year	1.32	0.97

3.1.3 Medium-term sea-level fluctuations

The mean sea level can fluctuate on time scales ranging from months to decades due to atmospheric factors such as season, ENSO and IPO. The combined effect of these fluctuations may cause variation in the local water level by up to 0.25 m (Bell, 2012). This effect has not been included in the water levels considered as part of this assessment.

3.1.4 Long term sea levels

Historic sea level rise for the Wellington region has averaged 2.2 ± 0.1 mm/year (Hannah and Bell, 2012). Climate change is predicted to accelerate this rate of sea-level rise into the future. The New Zealand Coastal Policy Statement (NZCPS, 2010) requires that the identification of coastal hazards includes consideration of sea-level rise over at least a 100-year planning period. For these assessments, a planning horizon of 2120 has been used as a practical minimum and a planning horizon of 2070 has been used as an intermediate time frame.

We have used four sea-level rise Representative Concentration Pathway (RCP) scenarios derived from those presented in MfE (2017). These are the median projections of the RCP2.6, RCP4.5 and RCP8.5 scenarios, and an RCP8.5+ projection representing the 83rd percentile of the RCP8.5 scenario. The projections of the potential future scenarios adjusted to the New Zealand regional scale are presented in **Table 3-3** below for the two planning horizons.

Table 3-3: Sea level rise projections adjusted to 2009 sea levels from the 1986-2005 baseline for the four emission scenarios

Year	RCP 2.6 M1	RCP 4.5 M	RCP 8.5M	RCP 83rd %
2070	0.28 m	0.32 m	0.40 m	0.55 m
2120	0.51 m	0.63 m	1.01 m	1.30 m

[1] - M = median

For this assessment, we will consider the RCP8.5 scenario as shown in **Table 3-4** below.

Table 3-4: Extreme sea-level predictions including the sea level rise component associated with the RCP 8.5M emission scenario

AEP	ARI (years)	Extreme Sea Level (m NZVD2016)		
		Present Day	RCP 8.5M 2070	RCP 8.5M 2120
0.2	5	0.85	1.25	1.86
0.1	10	0.88	1.28	1.89
0.05	20	0.91	1.31	1.92
0.02	50	0.95	1.35	1.96
0.01	100	0.97	1.37	1.98

3.2 Wind and wave climate

Located within Evans Bay inside Wellington Harbour protects the coastline along Shelly Bay Road from open coast swell. The north-south alignment of Evans Bay also serves to limit exposure to wind waves generated from directions other than the north and south.

National Institute of Water and Atmospheric Research (NIWA) have published a wind rose based on wind data collected at the Wellington Airport. The wind data used was collected at hourly intervals from December 1959 to March 2011. Although not explicitly stated these measurements are taken to be 10-minute mean wind speeds. The wind rose in **Figure 3-2** shows annual wind frequency of surface wind speed and direction.

This wind rose shows a bimodal wind distribution with winds from either the north or the south, with more frequent and higher wind speeds from the north.

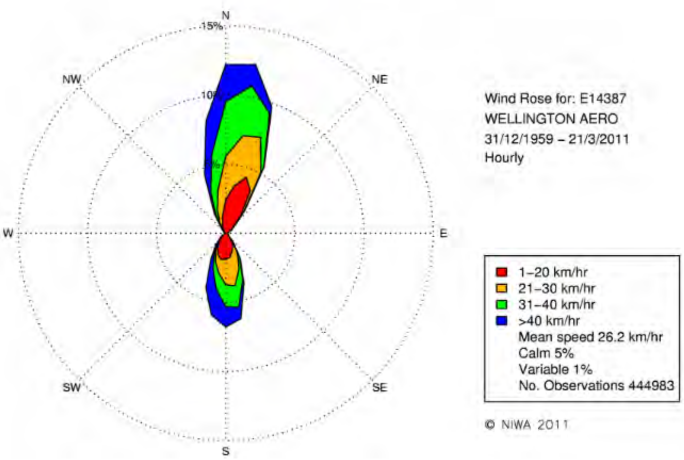

Figure 3-2: Wind rose and monthly mean wind speed for Wellington Aero (NIWA, 2011)

Design wind speeds calculated using AS/NZS 1170.2 and modified for a one-hour duration, indicates a 100-year return period wind speed of 112 km/hr (31 m/s).

3.2.1 Wind waves

Simulated Waves Nearshore (SWAN) wave modelling undertaken by T+T (2019) assesses extreme wave climate in the study area including the sheltering effects of Evans Bay on wave generation. SWAN is a third-generation wave model that computes random, short-crested wind-generated waves in coastal regions and inland waters by solving the spectral action balance equation without any restrictions on the wave spectrum evolution during growth or transformation.

A design water level of 0.92 m NZVD2016 was adopted for this model which is in between the 20- and 50-year ARI. Design wind speeds of 31 m/s corresponding to a 100-year return period event was applied throughout the model domain.

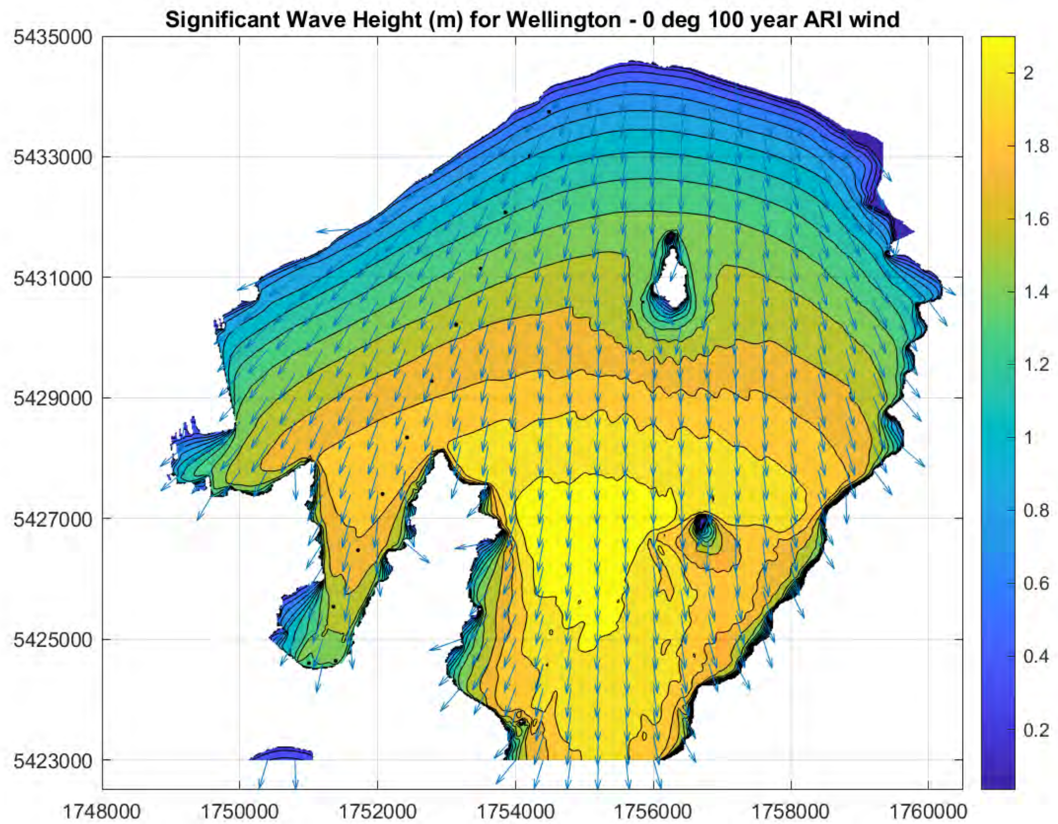

Figure 3-3: Model domain

The 100-year design wind speed was applied between 315 degrees and 30 degrees (with respect to 0 degrees North). The modelling indicates greatest wave heights at 0 degrees North (**Figure 3-4**) as this allowed for the greatest fetch relative to the coastline along the study area. This model indicates a significant wave height offshore of headlands along the site of approximately 1.0-1.2 m with a mean period of approximately 3 seconds and a peak wave period of approximately 3.8 seconds. Wave heights reduce due to refraction and shoaling effects to less than 1.0 m further into some of the larger bays (refer **Figure 3-4**). These waves can super-elevate the mean water level (i.e. storm tide level) during the breaking process (wave set-up).

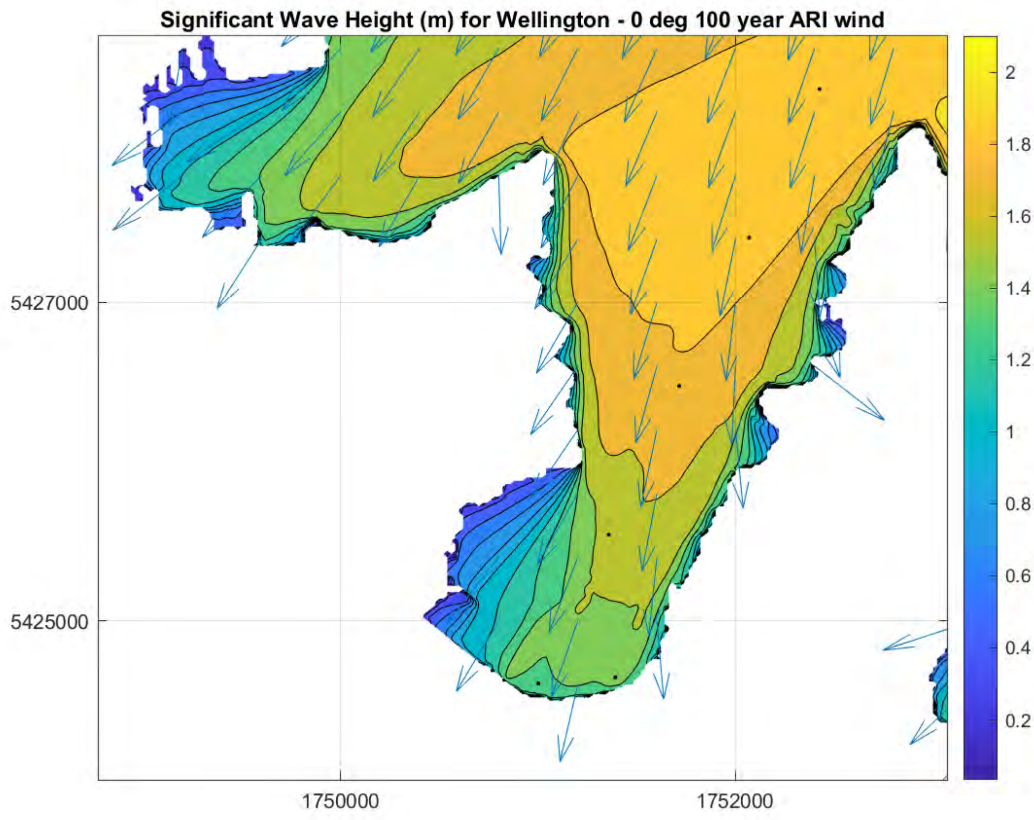

Figure 3-4: SWAN output wave height model results

3.3 Harbour sediment transport

High-level sediment transport processes with Wellington Harbour are shown in **Figure 3-5**. Within Evans Bay, available literature suggests that the source of existing sediment is largely from the Hutt River that has entered the bay through tidal dispersion (**Figure 3-6**) (Brodie 1958). The source of the larger shingle and pebbles is likely from local sources such as the greywacke rock outcrops and adjacent escarpments (Dahm 2009, Olson 2012) which have eroded over time (K. B. Lewis & D.C. Mildenhall 1985).

The funnel-like topography surrounding Evan's Bay is subject to strong southerly and northerly winds entering the bay. These strong winds can generate local seas as discussed in **Section 3.2** and define the localised sediment transport processes along the study area in the form of longshore drift (Van der Linden 1967). As the study area is within a confined bay tide effects on longshore drift are likely to be negligible due to the small tidal range.

Within the study area the wind generated waves can cause substantial localised erosion of the shoreline where it is unprotected. During less stormy periods', equilibrium is re-established by redistribution and accretion of sediment (Van der Linden 1967). Aerial and site analysis of beach planform orientations do not indicate predominant longshore drift direction. This suggests bimodal sediment transport along the study area that is reliant on the wind direction and intensity.

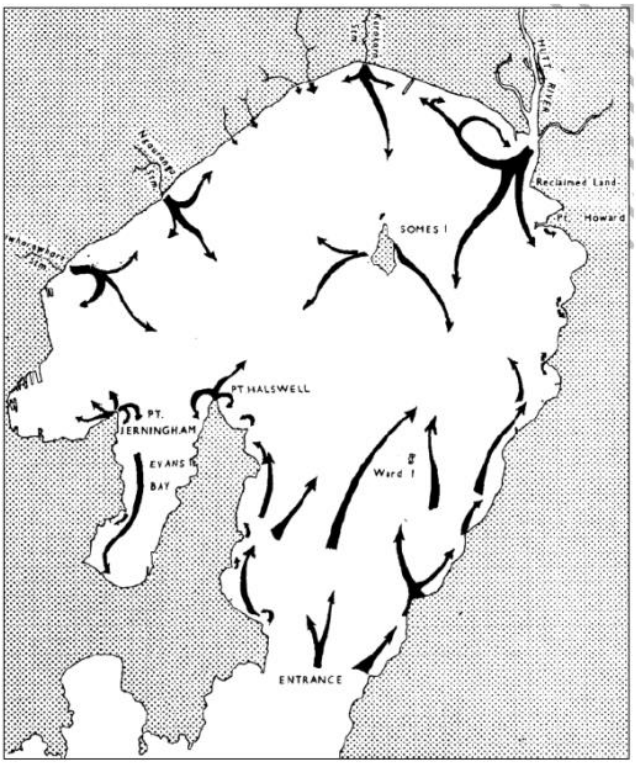

Figure 3-5: Sediment transport processes within Wellington Harbour [Source: Van der Linden (1967)].

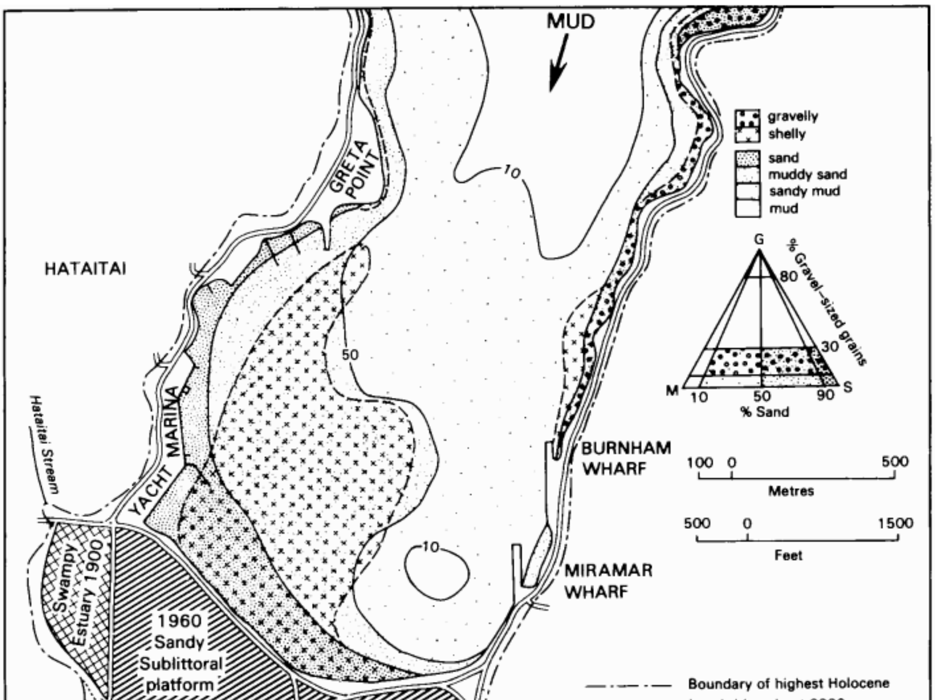

Figure 3-6: Sediments in Evans Bay showing mud derived mainly from the Hutt River (K. B. Lewis & D.C. Mildenhall (1985) adapted from Lewis and Carter (1976).

4 Coastal hazards

Coastal hazards arise when coastal processes adversely affect human assets and infrastructure. Coastal hazards which may affect Shelly Bay Road include:

- Coastal inundation.
- Wave overtopping.
- Coastal erosion and shoreline recession.

4.1 Coastal inundation hazard

Coastal inundation occurs when the seawater level rises above that which is typically considered normal fluctuation, potentially resulting in flooding of land, infrastructure and buildings.

A high-level inundation assessment was undertaken along the project site based on the existing road levels and extreme 1% AEP static storm tide levels to indicate the increased risk of coastal flooding along the road heading into the future.

The inundation levels assessed are outlined in **Table 4-1**, are based on static water levels, i.e. 1% AEP storm tide water levels + wave setup for both present sea levels and future sea-level scenarios. For this high-level assessment, a wave setup component of 0.15 m has been included as derived by Lane et al. (2012).

Table 4-1: 1% AEP static water levels (including wave setup) assessed for inundation risk along the project site

Extreme Sea Level (m NZVD2016)		
Present Day	**RCP 8.5M 2070**	**RCP 8.5M 2120**
1.1	1.5	2.1

Figure 4-1 shows a long section profile along the seaward edge of Shelly Bay Road within the project site. It can be seen that the road ranges in elevation from 2.1 to 4.1 m NZVD2016.

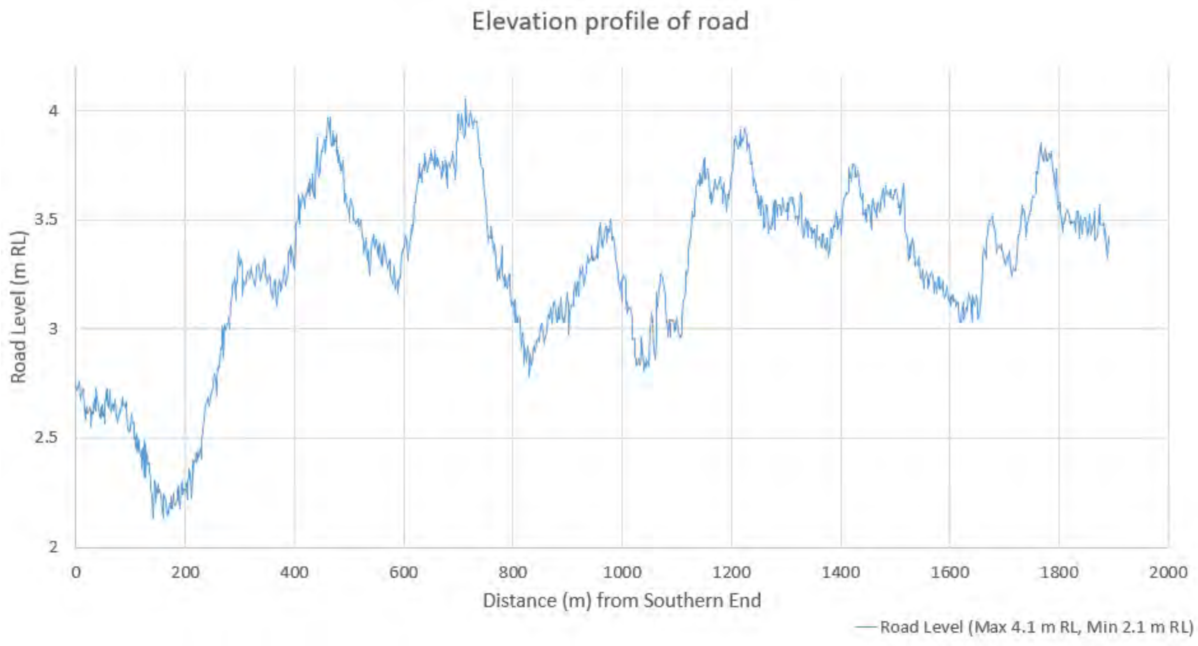

Figure 4-1: Elevation profile of Shelly Bay Road along seaward white line

These static water levels have been included on project site maps in **Appendix A** for reference of how these vary in plan along the project site.

Static water levels are unlikely to result in flooding of the road at current levels until the 2120 horizon where these levels reach the point of lowest road elevation. However, the dynamic effect of waves resulting in overtopping flows can result in health and safety risk to road users and damage to the road surface. This is assessed in **Section 4.2**.

4.2 Wave runup and overtopping

Wave overtopping occurs when the crest of a seawall is not sufficiently high to allow for wave run-up as the waves wash up the seawall face or natural berm edge. Overtopping is usually a white-water splash and/or wind-driven spray, but it can also be a flowing seawater surge that can cause localised inundation. Overtopping is affected by the seawall or berm face angle, crest height and permeability of materials in the seawall. A seawall structure with a vertical face will generally result in larger overtopping volumes than a structure with a sloping permeable face that is laid back against the slope. This is because the latter wall type dissipates the wave energy more than vertical walls. Wave overtopping is an important design criterion to consider for safety and backshore damage.

4.2.1 Limits of overtopping hazard for users

International literature contains various recommendations for various acceptable limits for wave overtopping of seawalls. Safe limits for pedestrians and vehicles using the footpath based on the EurOtop (2018) are included in **Table 4 2**. These mean overtopping values can appear conservative (low) as they are periodic flows averaged over time and are not representative of higher flows from individual waves.

Table 4-2: Limits for overtopping for people and vehicles (EurOtop Manual, 2018)

Hazard type and reason	Mean discharge q (l/s per m)	Max volume V_{max} (l per m)
People at structures with possible violent overtopping, mostly vertical structures	No access for any predicted overtopping	No access for any predicted overtopping
People at seawall / dike crest. Clear view of the sea.		
H_{m0} = 3 m	0.3	600
H_{m0} = 2 m	1	600
H_{m0} = 1 m	10-20	600
H_{m0} < 0.5 m	No limit	No limit
Cars on seawall / dike crest, or railway close behind crest		
H_{m0} = 3 m	<5	2000
H_{m0} = 2 m	10-20	2000
H_{m0} = 1 m	<75	2000
Highways and roads, fast traffic	Close before debris in spray becomes dangerous	Close before debris in spray becomes dangerous

USACE (2006) gives critical values of average overtopping for backshore damage and structural safety including:

- Grass backslopes: start of damage between 1-10 l/s/m.
- Unprotected seawall backslopes: damage >20 l/s/m.
- Pavement behind seawalls: damage >200 l/s/m.

4.2.2 Overtopping assessment

Overtopping of the road edge will increase as sea levels rise into the future. A high level overtopping assessment has been undertaken based on EurOtop (2016) empirical formula to estimate average overtopping flows during the 100-year return period storm conditions, for both extreme current sea level and the predicted future sea levels scenarios (refer to water levels in **Table 3-4**). Three road edge elevations were assessed, 2.0 m, 3.5 m, 4.0 m NZVD2016 corresponding to the approximate minimum, mean and highest current road elevations respectively. Given the proximity of the road edge to seawalls (refer **Figure 4-2**) and berm crest we have ignored any road setback as part of this high-level assessment.

Figure 4-2: Shows the coast proximately of Shelly Bay Road to the coastline

We note that nearshore effects on wave height and the spatial variation of this along the project site have not been considered as part of this high-level assessment. As such the flows are likely to be an overestimate on actual flows. However, these provide an indicative estimate and can be refined at a later stage. The results of this assessment are summarised in **Table 4-3**.

Table 4-3: Overtopping volume calculations

Scenario	Mean overtopping (l/s/m)				
	Crest level = 2.0 m NZVD2016	Crest level = 2.5 m NZVD2016	Crest level = 3.0 m NZVD2016	Crest level = 3.5 m NZVD2016	Crest level = 4.0 m NZVD2016
2020 1%AEP storm	30	10	5	3	2
2120 1%AEP storm	200	70	25	10	4

This assessment shows that at the lowest road elevations are likely to result in overtopping flows in excess of safe levels for road users in 1%AEP storm conditions with damage to the unprotected berm edge likely. Overtopping flows increase to volumes that are likely to damage the pavement by 2120 with a high-end sea-level scenario.

At a crest level of 3.5 m, a 1%AEP storm will likely result in overtopping flows in line with the upper end of those considered safe for pedestrians with this increasing to likely damaging levels for unprotected backshore at the 2120 horizon. When considering road setback from the coastal edge and nearshore wave breaking effects it is likely a minimum seawall crest level or road edge in the order of 3.5 m NZVD2016 will be adequate to mitigate overtopping risk over a 100-year planning consideration. Currently, there is approximately 1250 m of road that is below 3.5 m RL and 440 m below 3 m RL.

4.3 Coastal erosion hazard

The extents of land threatened by erosion hazard is influenced by short-term storm erosion, the stability of slopes above any erosion scarp, long-term recession trends and additional recession due to future sea-level rise.

4.3.1 Short term erosional trends

There is evidence along the length of the project site that this area is subject to ongoing erosion due to wave attack. The presence of significant lengths of seawall along Shelly Bay Road indicates vulnerable areas that have been repaired over the lifetime of the road. There are also areas of recent erosion and during the site walkover evidence of damage to the backshore and some seawalls was observed reflecting this ongoing erosional trend (refer **Figure 4-3**).

Figure 4-3: Erosion trends along the coastal line of Shelly Bay Road

4.3.2 Long term shoreline trends

Long term shoreline[2] trends are unlikely along the project site due to the significant lengths of greywacke rock outcrop (which is more subject to erosion trends of geological timeframes as opposed to those relevant for this assessment) and seawalls. There been localised erosion and overtime of more vulnerable lengths of escarpment toe and road berm and coastal defence

[2] The 'shoreline' is typically represented by the MHWS location, however for historic aerial analysis coastal margin features such as berms dune and scarp alignments are considered as indicative representations of the shoreline

structures have been constructed in these areas to mitigate further erosion and road damage. This effectively holds the shoreline at the seawall location mitigating future shoreline retreat.

Historic aerial photographs between 1939 and 2018 are available in **Appendix B**. Analysis of these aerials show there are few notable long-term shoreline trends within the project site. Shelly Bay Road was constructed before 1939 and the rocky outcrops and beaches very similar to present-day can be seen in the photographs. Digitizing the 1939 shoreline shows that in locations along the more exposed shorelines within the study area there has been shoreline regression of up to 0.07 m/y. This indicates where the shoreline is unprotected or stabilised with rock outcrops, there is a general erosional trend. However, the shoreline along the majority of study area appears unchanged over this period.

4.3.3 Future shoreline response

The project site (not including seawall locations) is generally representative of a consolidated shoreline, including hard cliffs and soft estuarine banks. These respond differently to coastal processes than beaches and are not able to rebuild following periods of erosion. Cliff erosion typically has two components; a gradual retreat caused by weathering, marine and bio-erosion processes, and episodic failures due to cliff lithology and geologic structure. If cliff toe erosion is halted through either natural (i.e. establishment of a beach) or artificial (i.e. rock or seawall protection), then the above cliff will continue to retreat until a stable angle of response is reached and vegetation becomes established.

As sea levels rise into the future, the typical anticipated response of a consolidated shoreline is for the toe erosion due to the increased susceptibility to coastal processes to result in increased cliff instability and an increased regression rate from that experiences in the past.

However, considering the presence of the road and seawall structures along the project site, the shoreline is likely to be held at its current location unless these structures are removed sometime in the future to allow naturalisation of the coastal edge. As such we have not undertaken a future shoreline response analysis as part of this high-level assessment.

5 Existing structures

5.1 Baseline data and walkover

There are numerous existing coastal structures along the coastline of the Shelly Bay Road study area that reflect the longstanding attempts to manage the shoreline and erosion hazards. The majority being seawalls with varied design and age but generally have been in place since the 1960s with some sections older or newer than this date. The general different types of seawalls in place along the study area are shown in **Table 5-1** and the approximate total length of these coastal defences are summarised in **Table 5-2**.

T+T undertook a site walkover on 8 June 2020 to gain a high-level understanding of the project site, note any areas of erosion or where seawall condition has changed since the baseline dataset provided. Plans showing existing seawall locations and site notes are included in **Appendix A**.

The baseline for our assessment is the 2016 condition assessment summary supplied by WCC (refer Appendix C) and the 2013 T+T report ‘Preliminary Assessment of Storm Damage Rev A’. This section will include a summary of noted changes in the seawall and coastal edge condition since these reports based on our site walkover on 8 June 2020.

Table 5-1: Types of coastal structures along the study area

Coastal structure	Example Image
Revetment (riprap rock or concrete blocks)	
Vertical wall (sloping, mortared rock or concrete)	

Stepped vertical wall (mortared rock or concrete)	
No coastal defence (rock outcrop, plantations, bare soil)	

Table 5-2: Summary of coastal structure lengths (2016 WCC seawall condition assessment)

Existing coastal structure	Approximate Length (m)
Revetment (riprap rock or concrete blocks)	54
Vertical wall (sloping, mortared rock or concrete)	103
Stepped vertical wall (mortared rock or concrete)	393
No coastal defence (rock outcrop, plantations, bare soil)	1342

5.2 Condition assessment summary

The key observations from the site assessment are:

- There are five main areas noted where the condition of the wall differs from the 2016 baseline data. The majority of the damage to the coastal defences observed in our inspections due to undermining and end-scour/outflanking of the existing walls.

- **Table** 5-4 summarises the change in the condition noted, refer to **Appendix A** for the corresponding locations.
- There are notable areas of erosion of unprotected slopes which have been recorded on the site walkover notes in **Appendix A**.
- Five seawalls were not included within the 2016 data, these have likely been constructed post-2016. These locations are shown in **Appendix A**.

The condition of the coastal defences has previously been assessed with a rating (refer Table 5-3) from excellent to very poor. We have recorded where we consider the existing rating of these structures has changed since the 2016 assessment. There are approximately 220m of coastal defence structures that are rated very poor or poor, refer to Appendix A for the locations of these seawalls. Note that the condition assessment only includes a visual assessment, no post walkover analysis has been undertaken, i.e. specific overtopping assessments.

Table 5-3: Condition assessment criteria (Wellington City Council)

Condition rating	Description
Excellent	Sound structure well designed. Well maintained. Intervene in 50+ years.
Good	As previous condition showing wear and tear and minor deterioration of surfaces. Some spalling but with no corrosion staining; needs to be inspected in the medium term. Deterioration causing minimal influence on performance. Intervene in 25 to 50 years.
Average	Staining and vegetation growth. Deterioration beginning to be reflected in adjacent carriageway. Intervene in 10 to 25 years.
Poor	Structure functioning but with problems due to significant cracking, spalling, loss of stability, deformation and corrosion. Likely to cause a marked deterioration in performance in the medium term. Some asset rehabilitation needed within the medium term. Intervene in 3 to 10 years.
Very poor	Structure has serious problems and has failed or is about to fail in the near future resulting in unacceptable performance. Minimal life expectancy, requiring urgent replacement or rehabilitation. Intervene in 0 to years.

Table 5-4: Seawall condition update summary

Asset ID	Changes noted since 2016 condition assessment and image
14555 Vertical wall Mortared rock	2016 condition: Poor Present Day condition: Very poor • Overtopping and undermining of wall • Scour of crest • Damage to face 
14740 Vertical wall Mortared rock	2016 condition: Poor Present Day condition: Very poor • Overtopping and undermining of wall • Scour of crest • The seawall isn't protecting the bank behind • Damage to face • End-scour of wall • Higher seawall likely needed such as the one adjacent 
11205 Stepped vertical wall Mortared rock	2016 condition: Average Present Day condition: Poor • Localised undermining of wall • Localised significant damage to face

	• End-scour of wall (particularly at the southern end)  
14581 Vertical wall Mortared rock	2016 condition: Average Present Day condition: Poor • Localised undermining of wall • Damage to face • End/outflanking scour (more significant at the southern end) • At the end of a wall there are large concrete blocks that may have been put there to prevent erosion, but they have since been displaced  
14584 Vertical Wall Mortared rock	2016 condition: Average Present Day condition: Very poor • Void behind wall caused by undermining failure • Damage to face • End-scour of wall  
NW04	This wall was not included in the 2016 assessment and has likely been installed post-2016.

Revetment Rip rap rock	Present Day condition: Poor-Average • It can be seen in the image that several rocks have been plucked from this revetment and are located on the beach. This is likely due to the revetment being constructed too steep for the size of rock used. It is anticipated this plucking will continue to occur in future storm events. 

6 Coastal considerations for road upgrades

The following coastal implications should be considered through the options assessment process for future road design:

- There is evidence of erosion along the edge of the current road alignment, particularly where the road edge is unprotected along the seaward edge by natural features such as rocky outcrops (refer Figure 6-1 for high level erosion summary along the site). This indicates a general erosional trend which will increase into the future as sea levels rise. There are locations where seawall repairs and construction of new seawalls will need to be considered if the road corridor alignment remains the same width. Extending the road corridor seaward will increase this risk and will require new seawall construction along significant lengths, particularly where present day MHWS is within 5m of the road edge (refer Table 6-1).
- Inundation risk from static sea levels along this length of road are negligible for the present day. However subject to sea level rise into the future, this may become more problematic for low lying sections of the road. Even so, this risk is considered to be minor and overtopping of the road edge is a more important design consideration.
- Overtopping of the road edge during extreme storm events is an important consideration when assessing design road elevation, particularly where a seawall is required to support this road edge (refer Figure 6-2 for high level overtopping summary along the project site). High levels of overtopping can result in hazardous conditions for road users and cause damage to the backshore and road surface. Overtopping flows will increase if the road corridor shifts seaward and will also increase into the future as sea levels rise. Particular attention should be given to lengths of the road with lowest elevations, where current seawalls are present or where the road edge is within 5m of the present day MHWS. It is recommended that a minimum road/seawall crest elevation of at least 3.5m RL be considered in these locations. Where this is not feasible, alternate mitigation measures may be required in the future such as road closures during large storm events.
- The coastal hazard for the project site is expected to be similar to other sheltered, low lying inner harbour roads that follow the coastal edge, including Oriental Parade, Evans Bay Road and Massey Road. However, these roads are predominantly protected by seawalls. The sheltered nature of this location differs from more northerly and easterly harbour roads as it is not vulnerable to open coast southerly swells entering the harbour mouth, i.e. Marine Drive and Karaka Bay Road.
- Reclamation seaward to widen the road corridor will require the application for resource consent where this would extend seaward of the present day MHWS location (i.e. into the CMA). In locations where works will not reach present day MHWS but are potentially located below future MHWS levels during the 100 year planning horizon, it is recommended the consenting implications be discussed with GWRC. Table 6-1 shows the road lengths relative to 1.5m, 3.5m and 8m of present day and future CMA levels. These distances are approximately those being considered for road widening as part of the long list options selection process.
- As part of any resource consent application, consideration of coastal hazard risk to the development over the next 'at least 100 years' will be required under the MfE (2017) guidelines with general policy direction away from development in areas subject to coastal hazard risk over in this timeframe.
- An option specific coastal effects assessment will be required for the preferred option to support any resource consent application.

Table 6-1: MWHS location relative to the existing road edge[1,2]

Sea level scenario	Length of road within 1.5m of the CMA	Length of road within 3.5m of the CMA	Length of road within 8m of the CMA
Present day MHWS (0.51m NZVD2016)	0	5	1050
2070 RCP8.5 MHWS (0.91m NZVD2016)	0	150	1250
2120 RCP8.5 MHWS (1.52m NZVD2016)	5	500	1550

[1] Future MHWS location is based only on sea level rise component, no future shoreline response has been included. Where no seawalls or rock outcrops are present, future shoreline response to sea level rise will likely result in greater lengths of road within these offsets than those outlined above (refer Section 4.3.3).
[2] Based on 2013 LiDAR

Figure 6-1: High level erosion summary along the project site based on site observations

Figure 6-2: High level overtopping summary along the project site for present day (left) and 2120 (RCP8.5) (right) sea levels during a 1%AEP storm event

7 Applicability

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

We understand and agree that this report will be used by Wellington City Council in undertaking its regulatory functions in connection with erosion protection works.

Tonkin & Taylor Ltd

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....	....
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Coastal Engineer	Civil Engineer
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Appendix A: Site plans

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LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS

1% AEP STORM TIDE STATIC INUNDATION LEVELS

- 1.1m RL (2020)
- 1.5m RL (2070 RCP 8.5)
- 2.1m RL (2120 RCP 8.5)
- MHWS (0.5m NZVD2016)

- Site walkover 8.6.20 notes
- Very poor and poor condition

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED		DATE	

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 1 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F100
REV	1

UNDER REVISION

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NOTES:
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3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500
0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113	
DESIGNED	JASZ	Jun.20
DRAWN	JASZ	Jun.20
CHECKED		
APPROVED		DATE

CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE COASTAL ASSESSMENT
SITE PLAN - SHEET 2 OF 13
UNDER REVISION
SCALE (A3) 1:500 FIG No. 1014113-F101 REV 1

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

PROJECT No.	1014113	
DESIGNED	JASZ	Jun.20
DRAWN	JASZ	Jun.20
CHECKED		
APPROVED	DATE	

CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE COASTAL ASSESSMENT
SITE PLAN - SHEET 3 OF 13
UNDER REVISION
SCALE (A3) 1:500 FIG No. 1014113-F102 REV 1

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F100_F112.dwg 2020-Jun-25 7:35:09 PM Plotted By: JANINE SZIKLASI

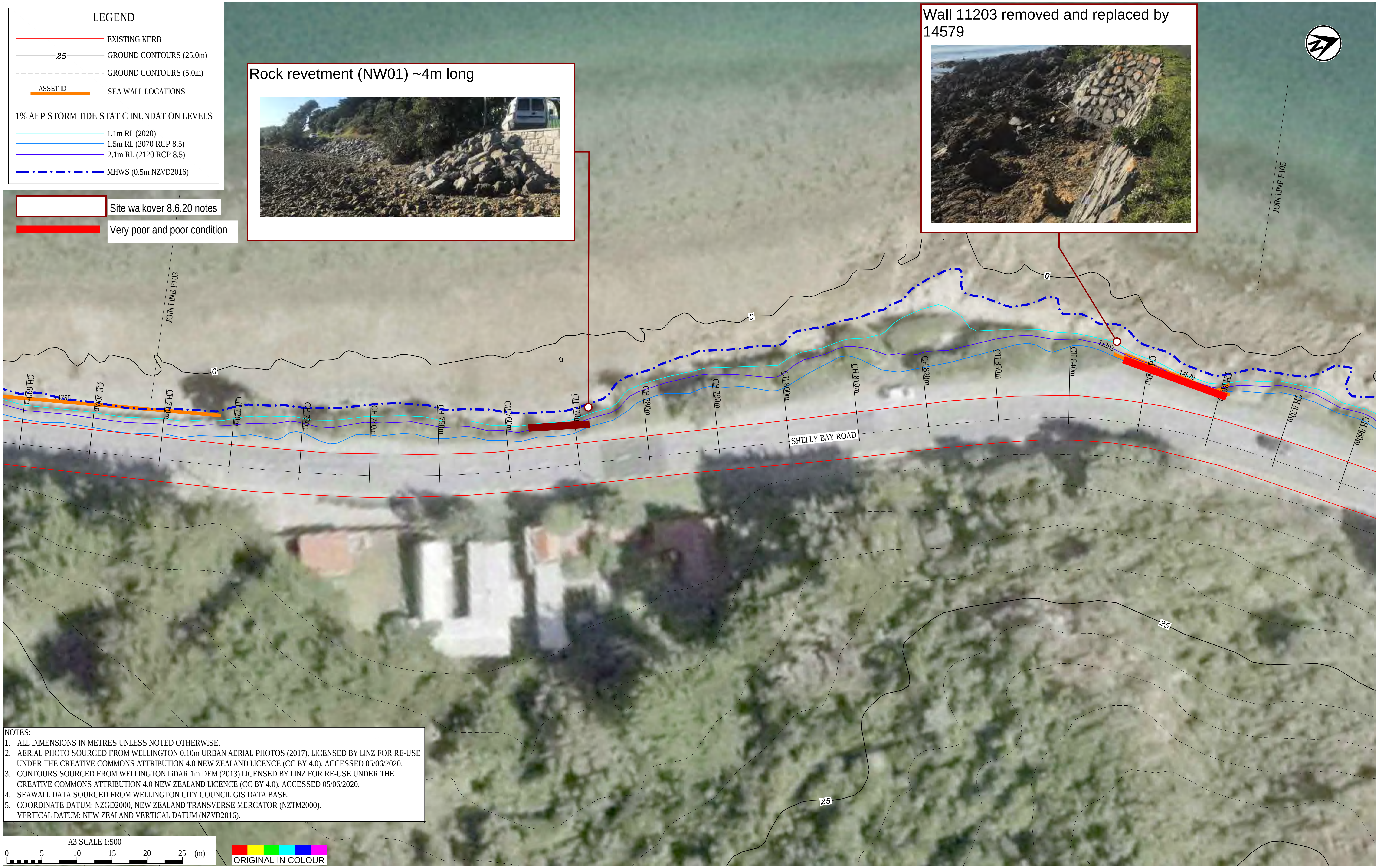
NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

PROJECT No.	1014113	
DESIGNED	JASZ	Jun.20
DRAWN	JASZ	Jun.20
CHECKED		
APPROVED	DATE	

CLIENT **WELLINGTON CITY COUNCIL**
PROJECT **SHELLY BAY ROAD, MAUPUIA**
TITLE COASTAL ASSESSMENT
SITE PLAN - SHEET 4 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F103 REV 1



LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS

1% AEP STORM TIDE STATIC INUNDATION LEVELS

- 1.1m RL (2020)
- 1.5m RL (2070 RCP 8.5)
- 2.1m RL (2120 RCP 8.5)
- MHWS (0.5m NZVD2016)

- Site walkover 8.6.20 notes
- Very poor and poor condition

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED	DATE		

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 5 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F104
REV	1

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
   VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED		DATE	

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 6 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F105
REV	1

UNDER REVISION

LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS

1% AEP STORM TIDE STATIC INUNDATION LEVELS

- 1.1m RL (2020)
- 1.5m RL (2070 RCP 8.5)
- 2.1m RL (2120 RCP 8.5)
- MHWS (0.5m NZVD2016)

- Site walkover 8.6.20 notes
- Very poor and poor condition

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED	DATE		

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 7 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F106
REV	1

UNDER REVISION

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LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS

1% AEP STORM TIDE STATIC INUNDATION LEVELS

- 1.1m RL (2020)
- 1.5m RL (2070 RCP 8.5)
- 2.1m RL (2120 RCP 8.5)
- MHWS (0.5m NZVD2016)

- Site walkover 8.6.20 notes
- Very poor and poor condition

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED		DATE	

CLIENT **WELLINGTON CITY COUNCIL**

PROJECT **SHELLY BAY ROAD, MAUPUIA**

TITLE COASTAL ASSESSMENT
SITE PLAN - SHEET 8 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F107 REV 1

LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS

1% AEP STORM TIDE STATIC INUNDATION LEVELS

- 1.1m RL (2020)
- 1.5m RL (2070 RCP 8.5)
- 2.1m RL (2120 RCP 8.5)
- MHWS (0.5m NZVD2016)

- Site walkover 8.6.20 notes
- Very poor and poor condition

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500

0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113	
DESIGNED	JASZ	Jun.20
DRAWN	JASZ	Jun.20
CHECKED		
APPROVED	DATE	

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 9 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F108
REV	1

UNDER REVISION

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NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

A3 SCALE 1:500
0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED		DATE	

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 10 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F109
REV	1

UNDER REVISION

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NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

PROJECT No.	1014113	
DESIGNED	JASZ	Jun.20
DRAWN	JASZ	Jun.20
CHECKED		
APPROVED		DATE

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	COASTAL ASSESSMENT SITE PLAN - SHEET 11 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F110
REV	1

UNDER REVISION

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NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
4. SEAWALL DATA SOURCED FROM WELLINGTON CITY COUNCIL GIS DATA BASE.
5. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000). VERTICAL DATUM: NEW ZEALAND VERTICAL DATUM (NZVD2016).

PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED		DATE	

CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE COASTAL ASSESSMENT SITE PLAN - SHEET 12 OF 13
UNDER REVISION
SCALE (A3) 1:500 FIG No. 1014113-F111 REV 1

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PROJECT No.	1014113		
DESIGNED	JASZ	Jun.20	
DRAWN	JASZ	Jun.20	
CHECKED			
APPROVED		DATE	

CLIENT **WELLINGTON CITY COUNCIL**

PROJECT **SHELLY BAY ROAD, MAUPUIA**

TITLE COASTAL ASSESSMENT
SITE PLAN - SHEET 13 OF 13

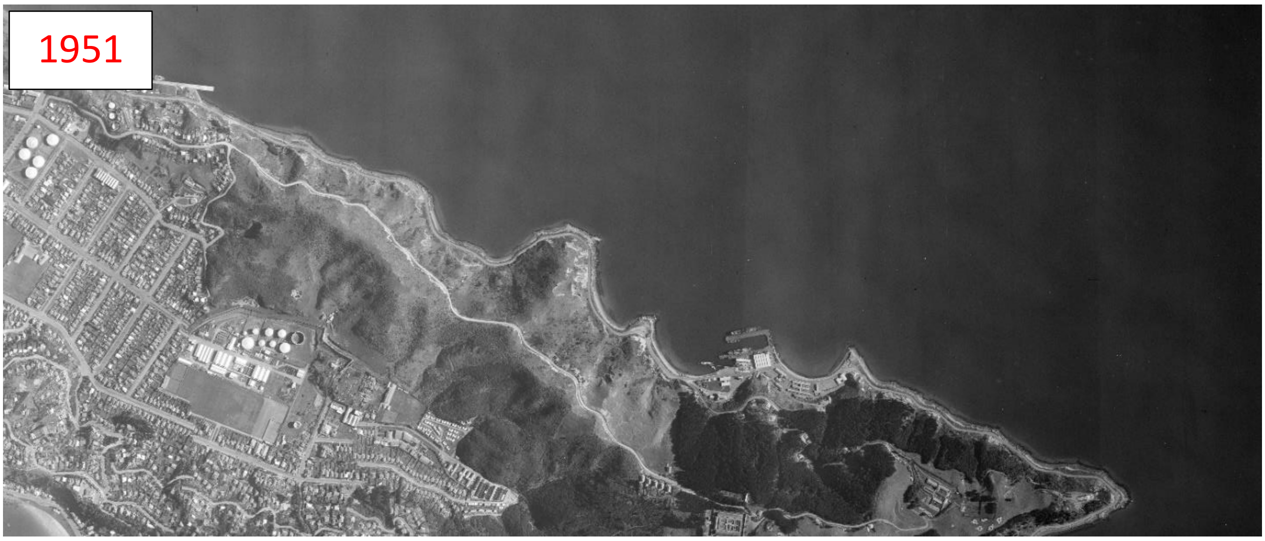
UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F112 REV 1

Appendix B: Historic Aerial Photographs

Note: Historic aerial photographs for 1939, 1951, 1961 and 1887 have been sourced from Retrolens.


1939


1951


1961


1987


2002


2018

Appendix C: 2016 WCC Condition Assessment

2016 WCC Condition Assessment

Infomation in table provided by Wellington City Council

Asset ID	Date Assessed	Condition	Cracking - C/B/R only: Extent17	Spalling - C/B only :Cond23	Spalling - C/B only :Extent25	Loss of Mortar/Binding: Cond	Loss of Mortar/Binding: Extent	Undermining (Condition)
14588	25/11/2016	Good	Moderate	2 - Good	Localised	2 - Good	Localised	3 - Average
14587	25/11/2016	Good	Localised	2 - Good	Localised	2 - Good	Localised	2 - Good
14586	25/11/2016	Poor	Moderate	4 - Poor	Widespread	4 - Poor	Widespread	5 - Very Poor
14585	25/11/2016	Good	Localised	1- Excellent	As new / No defect	2 - Good	Localised	2 - Good
14584	25/11/2016	Average	Localised	4 - Poor	Widespread	4 - Poor	Widespread	3 - Average
14582	25/11/2016	Good	Localised	1- Excellent	As new / No defect	2 - Good	Localised	2 - Good
14581	25/11/2016	Average	Localised	2 - Good	Localised	3 - Average	Moderate	2 - Good
14579	25/11/2016	Poor	Not Applicable	2 - Good	Localised	5 - Very Poor	Localised	3 - Average
11203	30/11/2016	Good	Localised	2 - Good	Localised	3 - Average	Moderate	2 - Good
14577	30/11/2016	Excellent	Localised	2 - Good	Localised	2 - Good	Localised	2 - Good
12278	30/11/2016	Good	Localised	2 - Good	Localised	2 - Good	Localised	3 - Average
11204	30/11/2016	Excellent	Localised	2 - Good	Localised	1- Excellent	As new / No defect	1- Excellent
14574	30/11/2016	Excellent	Localised	2 - Good	Localised	2 - Good	Localised	3 - Average
14573	30/11/2016	Good	Moderate	2 - Good	Localised	2 - Good	Localised	3 - Average
11205	30/11/2016	Average	Localised	3 - Average	Moderate	5 - Very Poor	Widespread	2 - Good
12279	30/11/2016	Average	Localised	1- Excellent	As new / No defect	2 - Good	Localised	3 - Average
14740	30/11/2016	Poor	Widespread	4 - Poor	Moderate	5 - Very Poor	Moderate	5 - Very Poor
14567	30/11/2016	Poor	Localised	3 - Average	Moderate	3 - Average	Moderate	2 - Good
14566	30/11/2016	Excellent	As new / No defect	1- Excellent	As new / No defect	Not Applicable	Not Applicable	1- Excellent
14565	30/11/2016	Excellent	As new / No defect	2 - Good	Moderate	1- Excellent	As new / No defect	Not Applicable
14563	30/11/2016	Excellent	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
14564	30/11/2016	Excellent	As new / No defect	1- Excellent	As new / No defect	1- Excellent	As new / No defect	1- Excellent
14562	30/11/2016	Excellent	As new / No defect	1- Excellent	As new / No defect	1- Excellent	As new / No defect	1- Excellent
14561	30/11/2016	Good	Localised	2 - Good	As new / No defect	2 - Good	Localised	2 - Good
14559	30/11/2016	Average	Localised	2 - Good	As new / No defect	2 - Good	Localised	3 - Average
14558	30/11/2016	Excellent	Localised	2 - Good	As new / No defect	2 - Good	Localised	2 - Good
14557	30/11/2016	Good	As new / No defect	1- Excellent	As new / No defect	Not Applicable	Not Applicable	2 - Good
14556	30/11/2016	Good	Localised	1- Excellent	As new / No defect	2 - Good	Localised	2 - Good
14555	30/11/2016	Poor	Moderate	3 - Average	Moderate	3 - Average	Widespread	4 - Poor
14554	30/11/2016	Average	Localised	3 - Average	Localised	2 - Good	Widespread	4 - Poor
14553	30/11/2016	Average	Moderate	3 - Average	Moderate	3 - Average	Widespread	4 - Poor
14552	30/11/2016	Poor	Moderate	3 - Average	Moderate	5 - Very Poor	Widespread	3 - Average
14551	30/11/2016	Very poor	Localised	3 - Average	Localised	2 - Good	Localised	2 - Good
14550	01/12/2016	Good	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	2 - Good

2016 WCC Condition Assessment

Infomation in table provided by Wellington City Council

Asset ID	Undermining (Extent)	Lateral Movement (Condition)	Overturning (Condition)	Bulging (Condition)	Loss of Scour Protection: Cond	Loss of Scour Protection Extnt	Erosion Protection (Condition)
14588	Localised	1- Excellent	1- Excellent	1- Excellent	3 - Average	Moderate	2 - Good
14587	Localised	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14586	Moderate	2 - Good	1- Excellent	1- Excellent	3 - Average	Localised	Not Applicable
14585	Localised	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	2 - Good
14584	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	2 - Good
14582	Localised	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14581	Localised	1- Excellent	1- Excellent	1- Excellent	3 - Average	Localised	3 - Average
14579	Widespread	1- Excellent	1- Excellent	1- Excellent	3 - Average	Localised	Not Applicable
11203	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	3 - Average
14577	Localised	1- Excellent	1- Excellent	1- Excellent	3 - Average	Moderate	3 - Average
12278	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	2 - Good
11204	As new / No defect	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14574	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	2 - Good
14573	Localised	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
11205	Moderate	2 - Good	1- Excellent	1- Excellent	4 - Poor	Localised	Not Applicable
12279	Moderate	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	2 - Good
14740	Moderate	1- Excellent	1- Excellent	1- Excellent	3 - Average	Moderate	3 - Average
14567	Localised	3 - Average	3 - Average	1- Excellent	4 - Poor	Localised	2 - Good
14566	As new / No defect	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14565	As new / No defect	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14563	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
14564	As new / No defect	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14562	As new / No defect	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14561	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Moderate	2 - Good
14559	Localised	1- Excellent	1- Excellent	1- Excellent	3 - Average	Localised	2 - Good
14558	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	2 - Good
14557	Moderate	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	1- Excellent
14556	Localised	1- Excellent	1- Excellent	1- Excellent	1- Excellent	As new / No defect	3 - Average
14555	Moderate	1- Excellent	1- Excellent	1- Excellent	4 - Poor	Moderate	Not Applicable
14554	Localised	1- Excellent	1- Excellent	1- Excellent	4 - Poor	Moderate	Not Applicable
14553	Localised	1- Excellent	1- Excellent	1- Excellent	3 - Average	Moderate	3 - Average
14552	Localised	2 - Good	1- Excellent	3 - Average	3 - Average	Moderate	3 - Average
14551	Moderate	2 - Good	2 - Good	2 - Good	2 - Good	Localised	2 - Good
14550	Localised	1- Excellent	1- Excellent	1- Excellent	2 - Good	Localised	2 - Good

2016 WCC Condition Assessment

Infomation in table provided by Wellington City Council

Asset ID	Erosion Protection (Extent)	Erosion Protection (Ext Notes	Overtopping of Waves: Cond
14588	Moderate		2 - Good
14587	As new / No defect		1- Excellent
14586	Not Applicable		5 - Very Poor
14585	Localised		1- Excellent
14584	Localised		4 - Poor
14582	As new / No defect		1- Excellent
14581	Localised		3 - Average
14579	Not Applicable	east end	1- Excellent
11203	Localised	north end,	1- Excellent
14577	Moderate	erosion at both ends of wall, 0.5m.sq at sth end	2 - Good
12278	Localised	south end maintenance required	2 - Good
11204	As new / No defect		1- Excellent
14574	Localised	nth end	1- Excellent
14573	As new / No defect		1- Excellent
11205	Not Applicable	sth end, 3m.sq removed , maintenance required	2 - Good
12279	Localised		1- Excellent
14740	Widespread	land behind wall is compromised,both ends and above	4 - Poor
14567	Localised	sth end 1m.sq	2 - Good
14566	As new / No defect		1- Excellent
14565	As new / No defect		1- Excellent
14563	Not Applicable		Not Applicable
14564	As new / No defect		1- Excellent
14562	As new / No defect		1- Excellent
14561	Moderate	east end side erosion	1- Excellent
14559	Localised	at both ends, 1m.cube of material removed.	1- Excellent
14558	Localised	east end, 2m from wall, erosion and under mining of bank. west end 1m.cube of material removed	1- Excellent
14557	As new / No defect		1- Excellent
14556	Moderate	4m of erosion at west end, beside wall	1- Excellent
14555	Not Applicable		5 - Very Poor
14554	Not Applicable		1- Excellent
14553	Severe	west end, severe 15m of undercutting bank, over road from dwelling	3 - Average
14552	Moderate		3 - Average
14551	Localised		5 - Very Poor
14550	Localised		3 - Average

2016 WCC Condition Assessment

Infomation in table provided by Wellington City Council

Asset ID	Overtopping of Waves: C Notes	Overtopping of Waves: Extnt	Overall Condition
14588		Moderate	2 - Good
14587		As new / No defect	2 - Good
14586	5m3 of material removed above wall	Moderate	4 - Poor
14585		As new / No defect	2 - Good
14584	over topping of waves causing scour along 20m section of wall	Moderate	3 - Average
14582		As new / No defect	2 - Good
14581		Localised	3 - Average
14579		As new / No defect	4 - Poor
11203		As new / No defect	2 - Good
14577		Localised	1- Excellent
12278		Localised	2 - Good
11204		As new / No defect	1- Excellent
14574		As new / No defect	1- Excellent
14573		As new / No defect	2 - Good
11205		Localised	3 - Average
12279		As new / No defect	3 - Average
14740	over topping along crest of wall and amongst bushes.	Widespread	4 - Poor
14567		Localised	4 - Poor
14566		As new / No defect	1- Excellent
14565		As new / No defect	1- Excellent
14563		Not Applicable	1- Excellent
14564		As new / No defect	1- Excellent
14562		As new / No defect	1- Excellent
14561		As new / No defect	2 - Good
14559		As new / No defect	3 - Average
14558		As new / No defect	1- Excellent
14557		As new / No defect	2 - Good
14556		As new / No defect	2 - Good
14555	over topping waves are causing the bank above to scallop and scour	Severe	4 - Poor
14554		As new / No defect	3 - Average
14553		Moderate	3 - Average
14552		Moderate	4 - Poor
14551	may not by due to over topping waves, however land above sea wall requires attention. 4x holes 2m across by upto 1m deep	Widespread	5 - Very Poor
14550		Localised	2 - Good

2016 WCC Condition Assessment

Infomation in table provided by Wellington City Council

Asset ID	Overall Condition Notes
14588	
14587	
14586	5m3 of material removed above wall. 2m section wth blocks and mortar removed below wall
14585	
14584	over topping of waves causing scour along 20m section of wall
14582	
14581	
14579	repair east end, eroded blocks and scour, 2m3
11203	
14577	
12278	
11204	
14574	
14573	
11205	sth end, 3m.sq removed , maintenance required
12279	
14740	over topping along crest of wall and amongst bushes. under mining at wst end blocks and mortar remover 1m2
14567	sth west end, 10m length, top rotating forward approx 80 degrees
14566	
14565	
14563	wall rebuilt by next wall
14564	
14562	
14561	
14559	
14558	
14557	5 bricks along the top edge require replacement
14556	
14555	over topping waves are causing the bank above to scallop and scour.
14554	Severe scour seen at east of wall by 5m, including under cutting of bank by 1m
14553	Local undermining seen at toe of wall.
14552	storm water pipes at sth end have blown out leaving 5x5m scarp.
14551	may not by due to over topping waves, however land above sea wall requires attention. 4x holes 2m across by upto 1m deep
14550	

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Appendix E: Slope hazard assessment

- **Preliminary Slope Hazard Assessment: Shelly Bay Road Upgrades (T+T report, July 2020)**

REPORT

Tonkin+Taylor

Preliminary Slope Hazard Assessment

Shelly Bay Road Upgrades

Prepared for

Wellington City Council

Prepared by

Tonkin & Taylor Ltd

Date

July 2020

Job Number

1014113.v1

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Document Control

Title: Preliminary Slope Hazard Assessment					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
26.06.20	1	Draft for client review	Tim Haxell	Nick Peters	Richard Cole
17.07.20	2	Final issue	Tim Haxell	Nick Peters	Richard Cole

Distribution:

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Table of contents

Executive summary

Wellington City Council (WCC) have engaged Tonkin and Taylor (T+T) to undertake a high-level coastal assessment to assist with the planning of the upgrade of Shelly Bay Road. This is to better align with Waka Kotahi NZ Transport Agency (Waka Kotahi) guidance and the vision for the Great Harbour Way.

1 Introduction

Tonkin & Taylor Ltd (T+T) have been engaged by Wellington City Council (WCC) to explore options for upgrading Shelly Bay Road. The objective of the upgrade will be to provide an environment on Shelly Bay Road that better aligns with Waka Kotahi NZ Transport Agency guidance and the Great Harbour Way plan to provide a safer and more inviting setting for pedestrians, cyclists, and other road users along the Wellington coast. The extent of the assessment site is approximately 2.3 km, extending from Miramar Avenue to the south end of Shelly Bay, as shown in **Figure 1**.

To assist with the assessment of the options for upgrades, T+T has been engaged to undertake a high-level slope hazard assessment along this section of Shelly Bay Road. The results of the slope hazard assessment are outlined in this report. The purpose of the assessment is to inform the geotechnical implications of the options, including effects on consenting, the environment, feasibility, and cost. The assessment is high-level only; a detailed slope hazard assessment should be undertaken at a later stage in the project to inform detailed design.

Figure 1: Physical scope of work (extent of the project scope (study area) shown in red; coastal areas outside of scope highlighted in yellow)

1.1 Scope of work

The terms and conditions of our engagement are set out in the Tonkin & Taylor Ltd. (T+T) Offer of Service, dated 22 May 2020.

This report provides the results of the high-level slope hazard assessment of the study area. The key tasks undertaken as part of this assessment are in line with T+T's Offer of Service, dated 22 May 2020, as follows:

- Undertake a desktop study of available information including:
  - Published geological documentation to understand the wider geological context and identify the location of previously mapped active or inactive faults;
  - Historic aerial photographs to identify locations of prior and active instability;
  - Land Information New Zealand (LINZ) Wellington LIDAR survey (2013) to identify slopes that are likely to pose the highest risk (for example, due to their height, angle, or distance from the road);
  - GNS slope hazard assessment study (we have assumed that GNS will be able to provide us with the study for Shelly Bay Road);
  - Relevant empirical information provided by WCC (for example, records of prior instability);
  - An initial inspections report undertaken by T+T along the road;
- Complete a site walkover with two engineering geologists. This will include a healthy and safety assessment prior to the site visit and preparation of required documentation; and
- Produce a Preliminary Slope Hazard Assessment Report based on the desktop study and site walkover in general accordance with the WCC Qualitative Risk Assessment Framework to determine current risk to the road. We note that this not a detailed geotechnical assessment and will be based primarily on available existing information and walkover observations, as outlined above.

2 Basis of assessment

2.1 Site walkover

Inspection of geological, geomorphic, and hydrological features was undertaken to develop an understanding of the current condition and possible slope hazards present at the site. This was completed by two T+T Engineering Geologists on 19 June 2020.

A discussion of the instability observed during this site walkover is included in **Section 3.1**. General observations are presented as part of the risk assessment in Table B1, **Appendix B**.

2.2 Desktop study

A desktop study of the following information has been undertaken to support the slope hazard assessment of slopes above Shelly Bay Road:

- Digital Elevation Model (DEM) using Light Detection and Ranging (LiDAR) data captured for Greater Wellington Regional Council by Aerial Surveys in 2013 and downloaded from Land Information New Zealand (LINZ);
- Published geological documentation:
  - Geological mapping of the Wellington region scale 1:50,000 (Begg & Mazengarb, 1996);
  - GNS Science Te Pū Ao (GNS) NZ active fault database, http://data.gns.cri.nz/af;
- Historic aerial photographs (c. 1939, 1951,1954, 1961, 1975, 1987 and 2017), http://retrolens.nz and licensed by LINZ; and
- T+T Geotechnical database.

2.2.1 Topographical setting

The site topography has been assessed using Blue Marble Geographics Global Mapper (v21.0.2). This software was used to identify locations of prior instability, and slopes with an elevated risk due to their slope angle, height, and distance from Shelly Bay Road. **Figure 2** presents the general slope angles between Chainage 1530 and 2290 m. In summary:

- Shelly Bay Road is located at the base of a west-facing coastal escarpment approximately 3 m above sea level and follows the coastline of Miramar Peninsular between Cobham Road and Shelly Bay;
- The coastal escarpment is naturally steep (40 to 50 degrees) and typically between 20 to 40 m high. The shallower slope above the escarpment is moderately steep (20 to 30 degrees);
- Earthworks cutting has locally steepened the escarpment to 60 degrees, and up to 4 high. The purpose of these cuttings was to form a desired road width during formation of the road;
- There are some localised areas of rock outcrop on the escarpment that exceeds 60 degrees;
- The existing road shoulder width is limited. The road generally less than 1 m from the base of the escarpment; and
- The crest of the escarpment is undulating, which is inferred to be the result of pre-historic retrogressive land sliding. The remnant features on the escarpment are narrow and wide gullies.

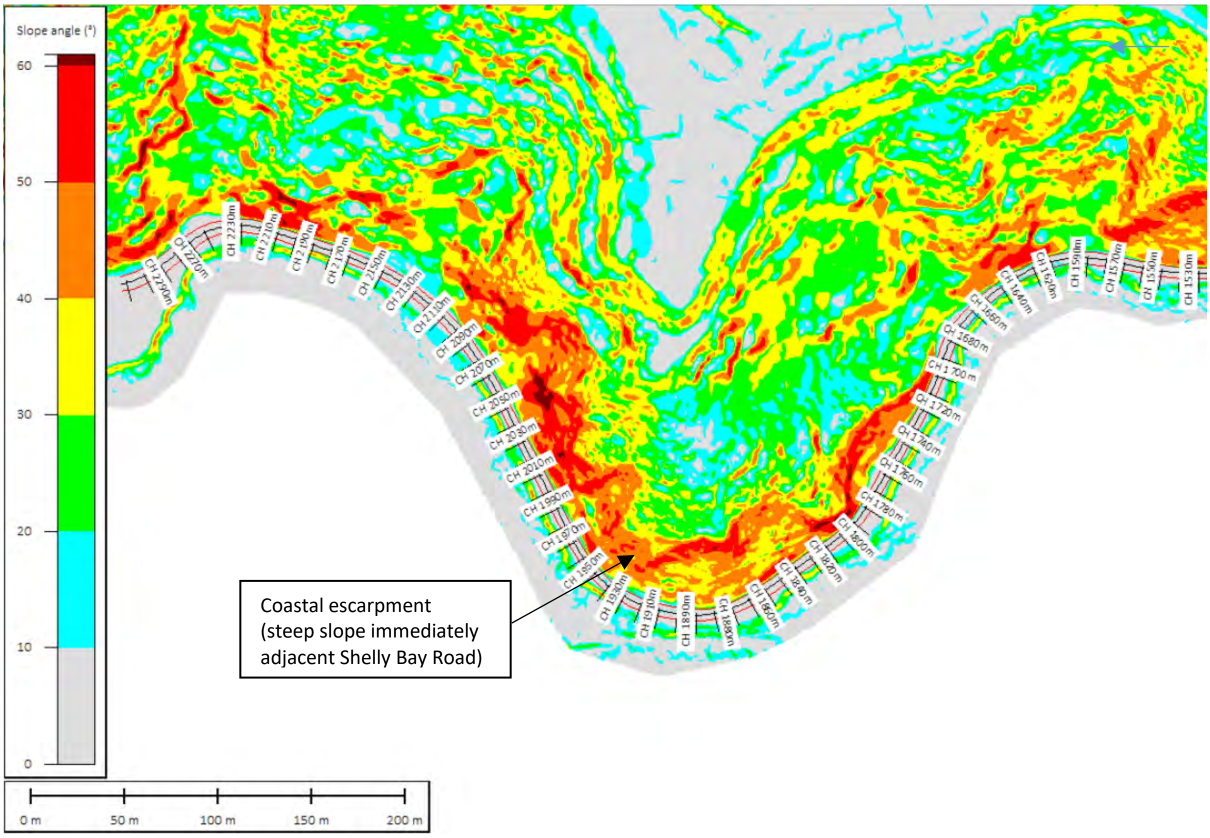

Figure 2: Extract from GIS software presenting slope angles as colours

2.2.2 Geological setting

Shelly Bay Road in the context of the regional geology is presented in **Figure 3** below. The geological map[1] indicates that the slopes are comprised of very steeply bedded, alternating sandstone/mudstone (known commonly as "Greywacke" rock) of the Rakaia Terrane (Late Triassic). A discrete block mapped separately as 'melange and broken' is located between approximately Chainage 660 and 810, and 980 and 1100 m. Greywacke rock is extensively fractured in multiple directions which is attributed to the rockfalls that are commonly observed on road cuts and natural rock slopes in the Wellington region, including Shelly Bay Road.

Although not mapped, a layer of colluvium soil overlies the rock in some areas across the slopes. The thickness of colluvium will likely be variable and predominantly thin or non-existent on steep slopes and ridges, and thicker in shallow slopes and gullies.

[1] Begg, J.G., Mazengarb, C., 1996. Geology of the Wellington area, scale 1:50 000. Institute of Geological & Nuclear Sciences geological map 22. 1 sheet + 128 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

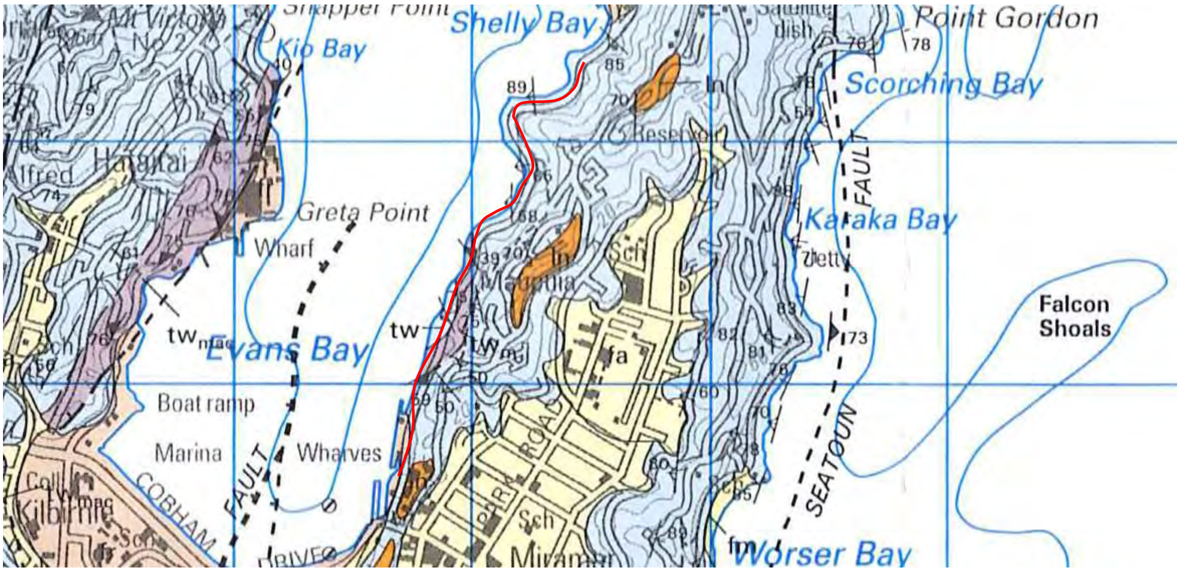

Figure 3: Geological setting and extent of study (red line). Note that this map only describes the general geology of the area and does not provide site-specific detail

The coastal escarpment has formed by the persistent erosion at the toe of the slope by the sea, in conjunction with the progressive tectonic uplift and tilting of the Miramar Peninsula. Maximum erosion by the sea is inferred to have occurred during the mid-Holocene Climatic Optimum from 7550 to 2000 BP where relative sea level was approximately 1 m higher than today Subsequent uplift of land attributed to the 1855 Wairarapa earthquake has resulted in the exposure of rock platform marginally above sea level, upon which Shelly Bay Road has been constructed.

Shelly Bay Road is near a number of significant active faults, capable of producing large-magnitude and surface-rupturing earthquakes (M≥7) that will generate strong ground-shaking throughout the Wellington region[2] and negatively impact slope stability. No significant faults have been identified beneath the project site therefore the risk of ground rupture is low. Any future slope design should consider the slopes' performance under seismic load.

A summary of these nearby active faults (those less than 5 km away) is presented in **Table 2.1**. Distances from the site are approximated with limited accuracy. We note that the Hikurangi Subduction Zone and other active faults greater than 5 km from the site can also generate strong ground-shaking.

Table 2.1: Nearby active faults (GNS Science Te Pū Ao, Active Fault Database)

Fault name	Distance from site	Direction from site	Recurrence interval
Evans Bay Fault	0.5 km	West	Unknown
Aotea Fault	2.5 km	West	2,200 to > 6,400 years2
Wellington Fault	4.6 km	West	500 to 1,000 years3

[2] Philip M. Barnes, Scott D. Nodder, Susi Woelz & Alan R. Orpin (2019) The structure and seismic potential of the Aotea and Evans Bay faults, Wellington, New Zealand, New Zealand Journal of Geology and Geophysics, 62:1, 46-71.
[3] Rhoades, D. A. et al., 2011. Re-Evaluation of Conditional Probability of Rupture of The Wellington-Hutt Valley Segment of The Wellington Fault. *Bulletin of The New Zealand Society for Earthquake Engineering,* June.44(2)

2.2.3 Historic aerial photographs

Table 2 presents a review of historic aerial photographs. Historic aerial photographs are available upon request.

Table 2: Summary of observations

Year	Observations
1939	• Numerous small to intermediate-scale landslides on slopes above the escarpment. • Slopes are grass-covered and free from vegetation. Terracettes (shallow soil slumping) are common. • Some side-cast fill is present on the side of the road (likely during construction) at the top of the slope – now Main Road, Akaroa Drive, Prison Road, and Maupuia Walkway. • Most of the escarpment is exposed and appears to be actively sloughing in some areas, particularly between Chainage 1930 to 2090 m. • Significant retrogressive landslide features in gully upslope from Chainage 2240 and 2260m (headscarp fully regressed). • A 20 m wide landslide appears to have occurred at approximately Chainage 2320 m (note that this has been removed by subsequent earthworks cutting). • Some local quarrying of rock may have occurred between Chainage 280 and 400. A dwelling is now located on the flat land in this area.
1951/1954	• Some establishment of vegetation generally on the south side of ridges. • Most of the escarpment remains exposed and appears to be actively sloughing. • Significant cutting made before c.1951 between Chainage 2290 and 2330 in the order of 4,000 m3. A bench appears to have been constructed and is likely to prevent rockfall from reaching the road.
1961	• Vegetation cover becoming more established. • Some areas of escarpment exposed, and no significant land instability identified.
1975	• Established vegetation cover. • Only minor areas of escarpment exposed, and no significant land instability identified.

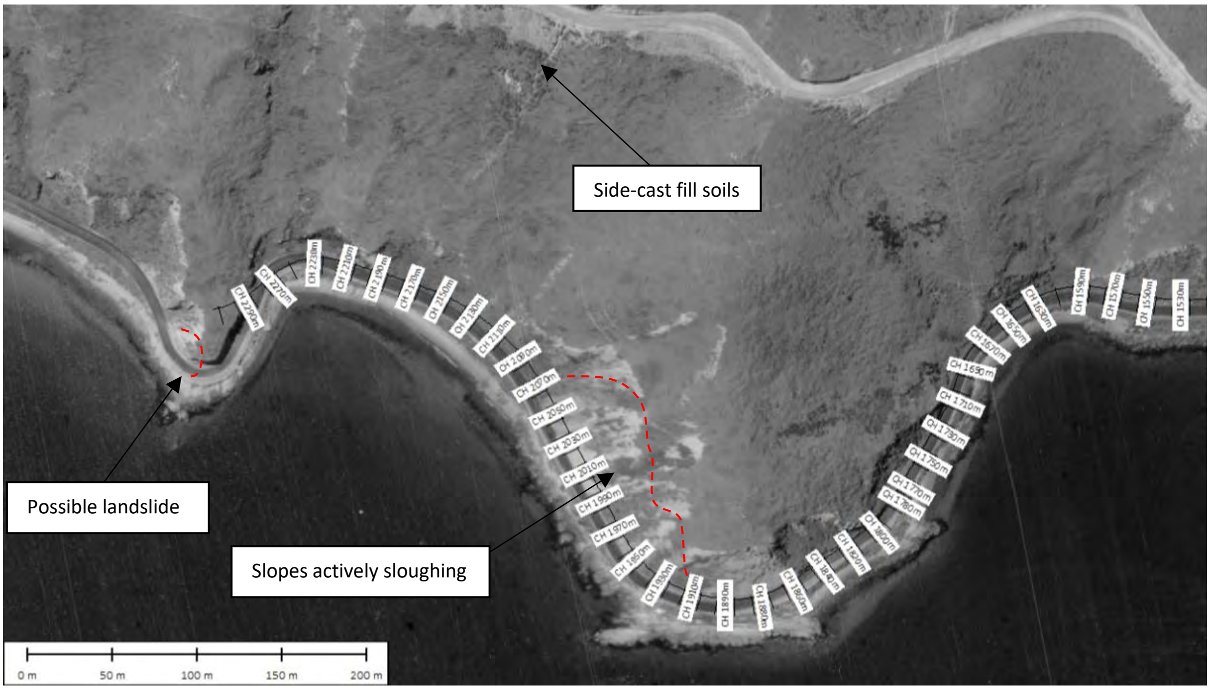

Figure 4: Historic aerial photograph c.1939

3 Slope hazard assessment

An assessment of the existing slopes has been carried out using a Qualitative Risk Assessment Framework in general accordance with AGS (2007c)[4] and has been adapted to suit WCC requirements i.e. consequence to private property, roads, and footpaths. This framework and adaptations have been used by WCC Transport & Infrastructure to assess slope hazard risks on other Wellington roads and slopes.

This framework measures risk based on Likelihood (annual probability of occurrence) and Consequence (damage) for a given landslide scenario. Generalised implications for risk management are provided in **Table 3**.

Table 3: Implications for risk management

Risk level		Implications for risk management
VH	Very High Risk	Detailed investigation, design, planning and implementation of treatment options to reduce risk to acceptable levels: May involve very high costs.
H	High Risk	Detailed investigation, design, planning and implementation of treatment options to reduce risk to acceptable levels.
M	Moderate Risk	Broadly tolerable provided treatment plan is implemented to maintain or reduce risks. May require investigation and planning of treatment options.
L	Low Risk	Acceptable. Treatment requirements to be defined to maintain or reduce risk.
VL	Very Low Risk	Acceptable. Manage by normal maintenance procedures.

The road has been divided into zones that have similar ground conditions and geometry. The likelihood consequence of various potential landslide scenarios has been assessed for each zone and a risk level for each zone established based on the framework. Zones are presented in the drawings in **Appendix A**.

The results of the slope hazard assessment and the risk framework are presented in **Appendix B**. Potential landslide scenarios are discussed in detail in **Section 3.1**.

3.1 Potential landslide scenarios

3.1.1 Small-scale soil and rock failures

Shallow slides of surficial soils and vegetation are expected to occur on any slopes with a loose surficial soil cover.

Frittering and small-scale block dropouts are expected to occur on steep and exposed rock slopes due to ongoing physical weathering.

Such small-scale slope instability is expected to occur occasionally under normal rainfall conditions (<1 to 5-year return interval (0.2 to 1.0 annual probability of occurrence)).

[4] Australian Geomechanics Society Landslide Taskforce, Landslide Practice Note Working Group, Practice Note Guidelines for Landslide Risk Management (2007), Australian Geomechanics Journal and News of the Australian Geomechanics Society, Volume 42, No 1, March 2007

Debris (in the order of 1.0 m^3 or less) may accumulate locally on the road shoulder and part of a single lane requiring removal, but the road will remain usable. Some or all the debris may be captured by vegetation and not inundate the shoulder or road.

Several small-scale landslides were observed during the T+T site walkover, as shown in **Figure 5**.

Figure 5: Shallow slide of loose surficial soils and rock observed on 19 June 2020. Approximately 1 m^3 debris inundating road shoulder

3.1.2 Intermediate-scale soil and rockmass slides

Translational sliding of soils may occur where colluvium soil is found to be thicker whereby sliding occurs within the soil or along an interface with the underlying rock.

Rockmass-controlled plane or wedge failure may occur where discontinuity (bedding, fault, joint) orientation is unfavourable in relation to the slope orientation.

Such intermediate-scale slope instability is expected to occur under normal to adverse conditions (2 to 100-year return interval (0.01 to 0.5 annual probability of occurrence)) due to heavy rainfall and/or earthquake.

Debris (up to 100 m^3) including vegetation stripped from run-out is likely to inundate one or both lanes requiring removal. One or both lanes will be blocked until debris cleared (up to one day).

A rockmass slide occurred on the 19th June 2020 at Chainage 1100 m and was inspected by T+T as shown in **Figure 6**. The landslide inundated both lanes blocking the road. Approximately 50 m^3 of debris including boulders up to 1 m wide was removed over one day. One lane was open during that time.

We consider the landslide to be the direct result of the rainfall that occurred over the previous two days. Approximately 44 mm of rainfall measured by a nearby rain gauge[5] over 24 hours on 18 June

[5] Miramar at Miramar Bowling Club, Greater Wellington Regional Council Environmental Monitoring and Research (http://graphs.gw.govt.nz/)

2020 (this depth/rate of rainfall has a return interval of between 1 and 2 years[6], i.e. would be expected to occur every 1 to 2 years)).

Figure 6: Rockmass slide at CH 1100 m on 19 June 2020 blocking the road (photograph sourced from stuff.co.nz)

3.1.3 Major rockslide

A large-scale rockslide exploiting a significant unfavourable and persistent discontinuity may be possible, however no discernible surface features have been identified. Furthermore, no evidence historic or recent instability on this scale has been identified.

Instability of this nature could be expected to occur under high to extreme conditions (>100-year return interval (<0.1 annual probability of occurrence)) e.g. major rupture of a nearby active fault. We note that in the context of the wider Wellington area, numerous slopes would also be affected by instability.

For this scenario, debris could exceed 200 m^3, block both lanes and cause significant traffic delays.

3.2 Limitations slope hazards assessment

This preliminary assessment is based on the desktop review of existing documentation and visual observation of the geological, geomorphic, and hydrological features exposed at the ground surface. No subsurface investigation has been carried out to support this assessment. It must be appreciated that subsurface conditions may vary from those inferred in this report. As such, a more detailed assessment should be undertaken during design development.

This assessment considers risk to Shelly Bay Road and does not consider risk to life or private property. An increase in traffic volumes will increase the life risk due to the exposure to the slope hazard. The risk to life should be considered in any future slope design.

Field mapping was carried out from road level and only due to the steepness of the slope and dense cover of vegetation. Some areas of slope were therefore not visually inspected.

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[6] NIWA High Intensity Rainfall Design System V4 (https://hirds.niwa.co.nz/)

This assessment only considers the slope hazard from slopes above the road. Hazards affecting the stability of the road itself have not been considered as part of this assessment.

No risk mitigation options have been presented as part of this assessment.

In the context of the wider region, should a significant regional earthquake occur (e.g. rupture of a nearby active fault), numerous slopes could be affected by instability.

3.3 Summary of results

Table 4 presents a summary of the assessed highest risk levels for the existing 2.3 km of road assessed.

Some slopes above Shelly Bay Road have an elevated risk level i.e. 'Moderate to High'. We consider that this risk level, in the context of other slopes in the Wellington region are generally comparable. The elevated risk level can be attributed to the ongoing physical deterioration of rock, the steepness of slopes, and the limited road shoulder width whereby small-scale instability can affect the road.

Table 4: Summary of results

Zone	Chainage (m)	Zone Length (m)	Highest Risk Level
A	010 – 200	190	'Moderate'
B	200 – 390	190	'Very Low'
C	390 – 710	320	'Moderate'
D	710 – 790	80	'Very Low'
E	790 – 1320	530	'Moderate to High'
F	1320 – 1400	80	'Moderate'
G	1400 – 1580	180	'Moderate'
H	1580 – 1605	25	'Low'
I	1605 – 1660	55	'Moderate'
J	1660 – 1695	35	'Low'
K	1695 – 1715	20	'Moderate'
L	1715 – 1780	65	'Moderate'
M	1780 – 2080	300	'Moderate to High'
N	2080 – 2185	105	'Low'
O	2185 – 2235	50	'Moderate to High'
P	2235 – 2260	25	'Low'
Q	2260 – 2330	70	'Low to Moderate'
R	2330 – 2360	30	'Moderate to High'

4 Geotechnical considerations for road upgrades

Based on our slope hazard assessment, the following geotechnical issues should be considerations for future road design:

- The establishment of vegetation post c.1939 on the slopes has also improved the overall stability. Any future slope design should allow for appropriate erosion protection for exposed cut slopes e.g. hydroseed, erosion blanket and restorative planting;
- There are several nearby active faults. Seismic shaking will negatively impact the stability of all slopes. Any future slope design should consider the slopes performance under seismic loading;
- There is limited road shoulder width (often less than 1 m) for much of the road. Therefore, a landslide of any size will likely inundate portions of the carriageway. Road design should include rockfall analysis for both existing slopes and proposed cut slopes. Where possible, future road upgrades should allow for a minimum 3 m wide catch ditch and barrier to allow for the accumulation of debris and protection of the road and users. The catch ditch could also be a stormwater swale, however ongoing maintenance and removal of rock debris will be required to prevent ponding of stormwater;
- Any earthworks cuttings of the slope may result in instability. Therefore, design of such earthworks should be undertaken by a suitably qualified geotechnical professional.

  For the purpose of developing road upgrade options, the following preliminary slope angles are considered appropriate. Detailed investigation and mapping by an Engineering Geologist would be required to confirm that these slope angles are feasible;

  - Permanent slopes cut in highly weathered rock should not exceed an overall slope angle of 50 degrees. It is likely that for some slopes 50 degrees will result in very high rock cuts. Specific slope design based on the ground conditions may enable steeper cuts;
  - Permanent slopes cut in moderately weathered rock or better should not exceed an overall slope angle of 60 degrees; and
  - Permanent slope cut in colluvial soils should not exceed 40 degrees or 2 m in height without retaining support;

  We note that it may be possible to cut rock slopes with preferential defect orientations to be steeper. However, rock slopes with adverse defect orientations, or saturated slopes will likely require mitigation and drainage measures; and
- Instability could be mitigated by localised reduction of cut slope angles, providing catch benching (4 m wide), rock bolting, shotcrete and wire mesh stabilisation, passive downslope attenuation / protection, or a combination of these options.

5 Applicability

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

Recommendations and opinions in this report are based on desktop review of existing documentation and visual assessment during a site walkover. It must be appreciated that subsurface conditions may vary from those inferred in this report.

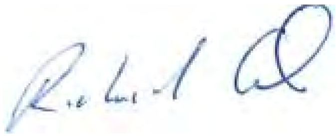
Tonkin & Taylor Ltd

Report prepared by:

....

Tim Haxell
Engineering Geologist

Authorised for Tonkin & Taylor Ltd by:



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Richard Cole
Project Director

Reviewed by:

....

Nick Peters
Senior Engineering Geologist

<u>Attachments:</u>

Appendix A: Slope Hazard Assessment Zones

Appendix B: Risk Assessment

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Appendix A: Slope Hazard Assessment Zones

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LEGEND

- EXISTING KERB
- 25 — GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LIDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500

0 5 10 15 20 25 (m)

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PROJECT No.	1014113	
DESIGNED	JASZ	Jun.20
DRAWN	JASZ	Jun.20
CHECKED		
APPROVED		DATE

CLIENT	WELLINGTON CITY COUNCIL
PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	SLOPE HAZARD ASSESSMENT SITE PLAN - SHEET 1 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F200
REV	1

UNDER REVISION

LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500
0 5 10 15 20 25 (m)

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DESIGNED	JASZ	Jun.20
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CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 2 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F201 REV 1

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F200_F212.dwg 2020-Jun-25 7:32:42 PM Plotted By: JANINE SZIKLASI

LEGEND

- EXISTING KERB
- 25 — GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
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A3 SCALE 1:500

0 5 10 15 20 25 (m)

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CLIENT	**WELLINGTON CITY COUNCIL**
PROJECT	**SHELLY BAY ROAD, MAUPUIA**
TITLE	SLOPE HAZARD ASSESSMENT SITE PLAN - SHEET 3 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F202
REV	1

UNDER REVISION

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F200_F212.dwg 2020-Jun-25 7:32:47 PM Plotted By: JANINE SZIKLASI

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CLIENT **WELLINGTON CITY COUNCIL**

PROJECT **SHELLY BAY ROAD, MAUPUIA**

TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 4 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F203 REV 1

LEGEND

- EXISTING KERB
- 25 — GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
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A3 SCALE 1:500
0 5 10 15 20 25 (m)

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DESIGNED	JASZ	Jun.20
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APPROVED		DATE

CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 5 OF 13
UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F204 REV 1

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F200_F212.dwg 2020-Jun-25 7:32:56 PM Plotted By: JANINE SZIKLASI

LEGEND

- EXISTING KERB
- 25 — GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
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A3 SCALE 1:500
0 5 10 15 20 25 (m)

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PROJECT **SHELLY BAY ROAD, MAUPUIA**
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 6 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F205 REV 1

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F200_F212.dwg 2020-Jun-25 7:32:59 PM Plotted By: JANINE SZIKLASI

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500
0 5 10 15 20 25 (m)

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PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 7 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F206 REV 1

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F200_F212.dwg 2020-Jun-25 7:33:03 PM Plotted By: JANINE SZIKLASI

LEGEND

- EXISTING KERB
- GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LIDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500
0 5 10 15 20 25 (m)

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CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 8 OF 13
FOR INFORMATION / UNDER REVISION
SCALE (A3) 1:500 FIG No. 1014113-F207 REV 1

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LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
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A3 SCALE 1:500
0 5 10 15 20 25 (m)

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PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 9 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F208 REV 1

LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
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3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500

0 5 10 15 20 25 (m)

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PROJECT **SHELLY BAY ROAD, MAUPUIA**

TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 10 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F209 REV 1

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LEGEND

- EXISTING KERB
- 25 GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500
0 5 10 15 20 25 (m)

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PROJECT **SHELLY BAY ROAD, MAUPUIA**
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 11 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F210 REV 1

T:\Wellington\TT Projects\1014113\WorkingMaterial\CAD\FIG\1014113-F200_F212.dwg 2020-Jun-25 7:33:16 PM Plotted By: JANINE SZIKLASI

LEGEND

- EXISTING KERB
- 25 — GROUND CONTOURS (25.0m)
- GROUND CONTOURS (5.0m)
- ASSET ID — SEA WALL LOCATIONS
- SLOPE HAZARD ASSESSMENT ZONES (REFER TO TABLE B1 IN THE SLOPE HAZARD ASSESSMENT REPORT FOR THE IDENTIFIED SLOPE HAZARDS AND QUALITATIVE RISK ASSESSMENT)

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
3. CONTOURS SOURCED FROM WELLINGTON LiDAR 1m DEM (2013) LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.

A3 SCALE 1:500
0 5 10 15 20 25 (m)

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PROJECT	SHELLY BAY ROAD, MAUPUIA
TITLE	SLOPE HAZARD ASSESSMENT SITE PLAN - SHEET 12 OF 13
SCALE (A3)	1:500
FIG No.	1014113-F211
REV	1

UNDER REVISION

NOTES:
1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM WELLINGTON 0.10m URBAN AERIAL PHOTOS (2017), LICENSED BY LINZ FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENCE (CC BY 4.0). ACCESSED 05/06/2020.
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A3 SCALE 1:500
0 5 10 15 20 25 (m)

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PROJECT SHELLY BAY ROAD, MAUPUIA
TITLE SLOPE HAZARD ASSESSMENT
SITE PLAN - SHEET 13 OF 13

UNDER REVISION

SCALE (A3) 1:500 FIG No. 1014113-F212 REV 1

Appendix B: Slope Hazard Assessment

- **Table B1 Shelly Bay Road preliminary slope hazard assessment (June 2020)**
- **Qualitative Risk Assessment Framework**

TABLE B1: SHELLY BAY ROAD PRELIMINARY SLOPE HAZARD ASSESSMENT (JUNE 2020)

1. This assessment has been carried out to identify the level of risk to the road to support a long list assessment of road upgrade options. No risk mitigation options have been presented as part of this assessment.
2. This assessment has been carried out using a Qualitative Risk Assessment Framework in general accordance with Appendix C of AGS (2007): Landslide Risk Management Concepts and Guidelines. Refer to this framework when reviewing the assessed risk. This assessment considers risk to the road only and does not consider risk to life. A quantitative assessment of the risk to life should form part of any future slope design.
3. The extent of study has been separated into zones with similar geometrical (slope angle, height, and distance from road), geological (subsurface), geomorphic (surface) and hydrological (subsurface and surface water) conditions. Refer drawings in Appendix A for road layout.

Zone	Approximate chainage (m)	Identified slope hazard	Consequence	Likelihood	Assessed risk	Observations / Notes
A	**010 – 200**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• No evidence of significant previous/existing instability • Limited road shoulder width (<1m between toe of slope and road) • Escarpment up to 25m above road • Exposed rock steeper than 60° up to 20m above the road at CH 070m • Wastewater pipe (150mm dia.) and manholes sidling the slope • Immediately adjacent upslope private property
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely	**Moderate**	
		Major rockslide (greater than 200m^3)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
B	**200 – 390**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Cannot occur due to distance from slope	N/A	**N/A**	• Evidence of prior instability of rock slope and rock anchor mesh stabilisation • Increased shoulder width (typically 5m between slope and road) • Escarpment up to 20m above road • Walkway sidling track to Aranui Street acts as a bench and will prevent some debris from upper slopes reaching the road • Wastewater pipe (150mm dia.) and manholes sidling the slope • Storm and mains waterpipe intersect slope at approximately CH 260 • Immediately adjacent upslope and downslope private property
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Minor: Debris unlikely to inundate road shoulder or road due to distance from slope. Road remains usable.	Possible	**Very Low**	
		Major rockslide (greater than 200m^3)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
C	**390 – 710**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 2 – 3m high cut immediately adjacent road • Moderately weathered greywacke subvertical bedded, very closely spaced • > 2m gravelly colluvium soil exposed at CH 620 • Limited road shoulder width (<1m between toe of slope and road) • Escarpment up to 35m above road • Numerous exposures of very steep rock up to 25 m above the road • Immediately adjacent upslope private property
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely	**Moderate**	
		Major rockslide (greater than 200m^3)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
D	**710 – 790**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Cannot occur due to distance from slope	N/A	**N/A**	• Slope set back approximately 20m from road behind private property. • Concentration of surface water discharge down slope
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Cannot occur due to distance from slope	N/A	**N/A**	
		Major rockslide (greater than 200m^3)	Minor: Debris unlikely to inundate road shoulder or road due to distance from slope. Road remains usable.	Rare	**Very Low**	
E	**790 – 1320**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• Evidence of prior instability including small block dropouts and rockfall at CH 970 and 1150 inundating shoulder and part of one lane (Google Street View, July 2019) • Rockmass failure at CH 1100 on 19 June 2020, approximately 50m^3 debris blocking both lanes • Concentration of surface water discharge down slope at CH 910, 950, 1085, 1145, 1170 • Moderately weathered sandstone subvertical bedded, very closely spaced • Limited road shoulder width (<1m between toe of slope and road) • Escarpment up to 40m above road. Exposed rock steeper than 60° up to 35m above road along the majority of this section
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely to Very Likely	**Moderate to High**	
		Major rockslide (greater than 200m^3)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Unlikely	**Very Low to Low**	
F	**1320 – 1400**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 2 m high cut in colluvium immediately adjacent road • No evidence of significant previous/existing instability • > 2m gravelly colluvium soil exposed at CH 1370 • Concentration of surface water discharge down slope • Limited road shoulder width (<1m between toe of slope and road) • Slope in this section generally shallower at approximately 30 – 40° • Predominantly colluvium soil observed at road level
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely to Possible	**Low to Moderate**	
		Major rockslide (greater than 200m^3)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	

TABLE B1: SHELLY BAY ROAD PRELIMINARY SLOPE HAZARD ASSESSMENT (JUNE 2020)

1. This assessment has been carried out to identify the level of risk to the road to support a long list assessment of road upgrade options. No risk mitigation options have been presented as part of this assessment.
2. This assessment has been carried out using a Qualitative Risk Assessment Framework in general accordance with Appendix C of AGS (2007): Landslide Risk Management Concepts and Guidelines. Refer to this framework when reviewing the assessed risk. This assessment considers risk to the road only and does not consider risk to life. A quantitative assessment of the risk to life should form part of any future slope design.
3. The extent of study has been separated into zones with similar geometrical (slope angle, height, and distance from road), geological (subsurface), geomorphic (surface) and hydrological (subsurface and surface water) conditions. Refer drawings in Appendix A for road layout.

G	**1400 – 1580**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m³)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 2 m high cut in rock immediately adjacent road • Frittering of rock at CH 1550m • Limited road shoulder width (<1m between toe of slope and road) • Escarpment up to 50m above road • Exposed rock steeper than 60° up to 50m above road at CH 1400 - 1430m • Exposed rock steeper than 60° up to 20m above road at CH 1475m
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m³)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely	**Moderate**	
		Major rockslide (greater than 200m³)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
H	**1580 – 1605**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m³)	Minor: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Low**	• Slope in this section generally shallower at approximately 20 – 30° • No cut immediately adjacent the road • Concentration of surface water discharge • Limited road shoulder width (<1m between toe of slope and road) • Stormwater pipe intersects slope at approximately CH 1590
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m³)	Low: Inundation of debris may block one or lane requiring removal that takes up to 1 day	Likely	**Low**	
		Major rockslide (greater than 200m³)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
I	**1605 – 1660**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m³)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 2 m high cut in colluvium immediately adjacent road • Loosely packed surface soils • No evidence of significant previous/existing instability • Limited road shoulder width (<1m between slope and road) • Escarpment up to 25m above road
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m³)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely	**Moderate**	
		Major rockslide (greater than 200m³)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
J	**1660 – 1695**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m³)	Minor: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Low**	• Slope in this zone generally shallower than other zones at approximately 20 – 30° • Increased shoulder width (typically 5m between slope and road) • No cut immediately adjacent the road • No evidence of significant previous/existing instability • Concentration of surface water discharge down slope
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m³)	Low: Inundation of debris may block one or lane requiring removal that takes up to 1 day	Likely	**Low**	
		Major rockslide (greater than 200m³)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
K	**1695 – 1715**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m³)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 2 – 3m high rock cut immediately adjacent road steeper than 60° • No evidence of significant previous/existing instability • Limited road shoulder width (typically <1m between toe of slope and road)
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m³)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely	**Moderate**	
		Major rockslide (greater than 200m³)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
L	**1715 – 1780**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m³)	Minor: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Low**	• Evidence of historic instability within gully but >20m from the road. Mechanism inferred to be shallow translational sliding of soils. • Increased shoulder width (typically 5m between slope and road) • Slope in this section generally shallower at approximately 20 – 30°
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m³)	Medium: Inundation of debris may block one lane requiring removal that takes up to 1 day	Likely	**Moderate**	
		Major rockslide (greater than 200m³)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	

TABLE B1: SHELLY BAY ROAD PRELIMINARY SLOPE HAZARD ASSESSMENT (JUNE 2020)

1. This assessment has been carried out to identify the level of risk to the road to support a long list assessment of road upgrade options. No risk mitigation options have been presented as part of this assessment.
2. This assessment has been carried out using a Qualitative Risk Assessment Framework in general accordance with Appendix C of AGS (2007): Landslide Risk Management Concepts and Guidelines. Refer to this framework when reviewing the assessed risk. This assessment considers risk to the road only and does not consider risk to life. A quantitative assessment of the risk to life should form part of any future slope design.
3. The extent of study has been separated into zones with similar geometrical (slope angle, height, and distance from road), geological (subsurface), geomorphic (surface) and hydrological (subsurface and surface water) conditions. Refer drawings in Appendix A for road layout.

M	**1780 – 2080**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 3m high rock cut immediately adjacent road steeper than 60° • Interbedded sandstone and mudstone, subvertical bedding 100mm wide • Dilation of rock defects in cut at CH 1800 and 1955m • Evidence of prior instability – frittering and root jacking of rock CH 1930 • Escarpment up to 30m above road • Limited road shoulder width (typically <1m between toe of slope and road) • Exposed rock steeper than 60° up to 30m immediately above the road at CH 1790 and 2050m
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely to Very Likely	**Moderate to High**	
		Major rockslide (greater than 200m^3)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Unlikely	**Very Low to Low**	
N	**2080 – 2185**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Minor: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Low**	• Slope in this section generally shallower at approximately 20 – 30° • Increased shoulder width (typically 5m between slope and road) • No cut immediately adjacent the road • No evidence of significant previous/existing instability • Concentration of surface water discharge down slope
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Low: Inundation of debris may block one or lane requiring removal that takes up to 1 day	Likely	**Low**	
		Major rockslide (greater than 200m^3)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
O	**2185 – 2235**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• Evidence of historic landslip at CH 2190m – 2m wide rockmass failure • Limited road shoulder width (typically <1m between toe of slope and road) • Exposed rock steeper than 60° up to 20m immediately above the road at CH 2210m
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely to Very Likely	**Moderate to High**	
		Major rockslide (greater than 200m^3)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Unlikely	**Very Low to Low**	
P	**2235 – 2260**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Minor: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Low**	• Evidence of prior instability within gully. Mechanism inferred to be shallow translational sliding of soils but at distance from the road • Concentration of surface water discharge • Slope in this section generally shallower at approximately 30 – 40° • Increased shoulder width (typically 5m between slope and road) • Stormwater pipe intersects slope at approximately CH 2250
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Low: Inundation of debris may block one lane requiring removal that takes up to 1 day	Likely	**Low**	
		Major rockslide (greater than 200m^3)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
Q	**2260 – 2330**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Minor: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Low**	• Location of a significant cutting of ridge prior to c.1951. Slope cut at approximately 50° with a bench • Increased shoulder width (typically 5m between slope and road) • No cut immediately adjacent the road • No evidence of significant previous/existing instability
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Low – Medium: Inundation of debris may block one lane requiring removal that takes up to 1 day	Likely	**Low to Moderate**	
		Major rockslide (greater than 200m^3)	Medium: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Rare	**Very Low**	
R	**2330 – 2360**	Shallow slide of surficial soils and vegetation; or, Small scale rock failures including frittering and small block dropouts (less than 1.0m^3)	Low: Inundation of debris in road shoulder or part of one lane requiring removal. Road remains usable.	Very Likely	**Moderate**	• 3m high rock cut immediately adjacent road steeper than 60° • Highly weathered to moderately weathered sandstone • Evidence of recent instability including small block dropouts and rockfall at CH 2340 inundating shoulder of road including boulders up to 0.5m wide • Evidence of historic instability approximately 4m wide rockslide. Debris likely inundated road in the order of 20m^3 • Limited road shoulder width (typically <1m between toe of slope and road) • Escarpment up to 40m above the road
		Translational slides of colluvium soil; or, Rockmass slides / falls (up to 100m^3)	Medium: Inundation of debris blocking one or both lanes requiring removal that takes up to 1 day	Likely to Very Likely	**Moderate to High**	
		Major rockslide (greater than 200m^3)	Medium – Major: Inundation of debris blocking both lanes causing major delays. Debris clearance takes up to two days	Unlikely	**Very Low to Low**	

Tonkin+Taylor

Wellington City Council

Qualitative Risk Assessment Framework

Collectors/Sub-collectors and Local/Residential Route

Absolutely POSITIVELY Wellington

Measures of likelihood

Level	Descriptor	Description	Annual Probability of Occurrence	
A	Almost Certain	The event is on-going, or is expected to occur during the next year	100%	< 1 year
B	Very Likely	The event is expected to occur.	20% to 100%	1-5 years
C	Likely	The event is expected to occur under somewhat adverse conditions	5% to 20%	5-20 years
D	Possible	The event is expected to occur under adverse conditions	1 to 5%	20-100 years
E	Unlikely	The event is expected to occur under high to extreme conditions	0.2 to 1%	100-500 years
F	Rare	The event could occur under extreme conditions	Less than 0.2%	>500 years

Measures of consequence (see notes below)

Level	Descriptor	Collectors/Sub Collectors and Local/Residential Route		Damage to Footpaths
		Upslope	Downslope	
1	Catastrophic	Cannot occur	Cannot occur	Cannot occur
2	Disastrous	Cannot occur	Total evacuation of both lanes of road. Major remedial works with serious traffic delays over several weeks	Cannot occur
3	Major	Road blocked for an extended period causing major and extended delays to traffic; clean up /remedial works operation over several days to weeks	Half of road evacuated by underslippage; significant remedial works with serious traffic delays over one to two weeks	Cannot occur
4	Medium	Half of road inundated by overslip; clean up/remedial works operation takes one or two days	Shoulder of road evacuated to the edge of the outside lane; trafficable area of road narrowed to avoid region immediately above headscarp causing significant traffic delays or footpath destroyed over several metres	Several metres of footpath destroyed; no alternative access available
5	Low	Shoulder of road/footpath inundated; remedial works limited to clean up only and takes about one day	Insignificant damage	Footpath destroyed over several metres; alternative access is available
6	Minor	Insignificant damage	Insignificant damage	Footpath locally undermined but still usable; reinstatement works can be delayed

Risk matrix

		Consequences to Property/Assets					
		1: Catastrophic	2: Disastrous	3: Major	4: Medium	5: Low	6: Minor
Likelihood	A – Almost Certain	VH	VH	VH	H	H	M
	B – Very Likely	VH	VH	H	H	M	L
	C – Likely	VH	H	H	M	L	L
	D – Possible	VH	H	M	L	L	VL
	E – Unlikely	H	M	L	VL	VL	VL
	F – Rare	M	L	VL	VL	VL	VL

Risk level implications

Risk Level		Implications for Risk Management
VH	Very High Risk	Detailed investigation, design, planning and implementation of treatment options to reduce risk to acceptable levels: May involve very high costs.
H	High Risk	Detailed investigation, design, planning and implementation of treatment options to reduce risk to acceptable levels.
M	Moderate Risk	Broadly tolerable provided treatment plan is implemented to maintain or reduce risks, May require investigation and planning of treatment options.
L	Low Risk	Acceptable. Treatment requirements to be defined to maintain or reduce risk
VL	Very Low Risk	Acceptable. Manage by normal maintenance procedures

Notes:

1 The examples of consequence given should only be used as a general guide. The implications for a particular situation may be required to be specifically determined.

2 The risk matrices above are based on those given in Appendix C of AGS (2007): *Landslide Risk Management Concepts and Guidelines*

3 "Insignificant damage" – comprise small scale failures (e.g. minor rockfall or surficial sliding)

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Appendix F: Planning review

- **Shelly Bay Road upgrades: Planning review (T+T letter, February 2022)**

Tonkin+Taylor

Job No: 1014113.1000
22 February 2022

Wellington City Council
PO Box 2199
Wellington 6140

Attention: Daniel Cairncross

Dear Daniel

Shelly Bay Road upgrades: Planning review

1 Introduction

Wellington City Council (WCC) are investigating options to upgrade the transport facilities on Shelly Bay Road.

This planning scoping report sets out a preliminary assessment of the likely resource consent requirements for the potential upgrades based on information currently available. It also identifies key directive objectives and policies within the relevant planning documents that may support or hinder the potential upgrades.

This report has been prepared in accordance with Tonkin & Taylor Ltd's (T+T) letter of engagement dated 8 July 2021.

1.1 Site location and description

The project site (herein referred to as 'the site') is a 2.3 km length of Shelly Bay Road, extending from the intersection of Shelly Bay Road and Miramar Avenue in the south to Shelly Bay in the north (refer to Figure 1.1). The Wellington Harbour is to the west of the site and the coastline is characterised by rocky outcrops and small beaches. The area is frequently used for coastal recreation (e.g. fishing, swimming).

The width of the formed road varies between approximately 6 m and 7 m, with two traffic lanes (one in each direction) and short sections of narrow shoulder. The average daily traffic flow is approximately 2,500 vehicles per day.

There is a footpath on the western side of the road from the intersection with Miramar Avenue/Cobham Drive for a length of approximately 450m. Beyond this, there are no provisions for pedestrians or cyclists. The road is constrained by the existing topography, with the coast located immediately to the west and steep slopes to the east.

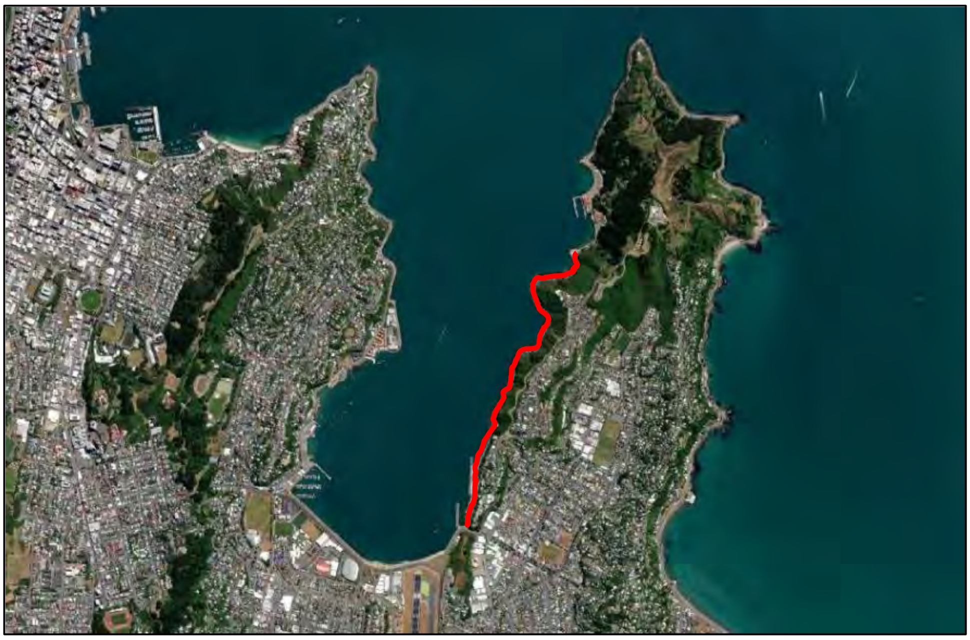

Figure 1.1: Site location (red line) *Source: TTMapViewer*

1.2 Proposed works

WCC are investigating options to upgrade transport facilities on Shelly Bay Road. The primary objective of this project is to create an environment on Shelly Bay Road that provides a safer and more inviting setting for pedestrians, cyclists and other road users. The project is proposed in anticipation of increased road usage with the proposed development at Shelly Bay.

A long list of design options was prepared in July 2020 by T+T and included various road layout options. In summary, these were different combinations of a shared cycle and pedestrian path, individual cycle and pedestrian paths and two, one or no vehicle lanes. It was noted that widening of the corridor would be required for several of the options. The corridor could be widened towards the coast requiring seawalls, reclamation or boardwalks, towards the embankment slope requiring excavation of the hillside, or a combination of these two.

It is now proposed to prepare a short list of options that will be used by WCC for consultation. A Multi Criteria Analysis (MCA) process will be used to identify the short list options. This planning assessment will inform the MCA.

2 Regulatory framework

The sections below set out a preliminary analysis of the statutory planning provisions that could be considered relevant to the consenting of the Shelly Bay Road upgrades.

Further detailed statutory analysis of the proposed activities will be required as part of the resource consent and Assessment of Effects on the Environment (AEE) preparation process, as more detailed information becomes available.

2.1 Relevant RMA statutory documents

The following statutory planning documents are relevant to the proposed works:

- GWRC Natural Resources Plan (NRP);
- GWRC Regional Coastal Plan (RCP);
- GWRC Regional Soil Plan (RSP);

- Wellington City Council (WCC) District Plan;
- National Policy Coastal Policy Statement (NZCPS); and
- National Environmental Standards for Freshwater (NESF).

The following zoning and planning notations apply to the site.

Table 2.1: Zoning and planning notations

Zoning/planning notation	Comment
GWRC NRP	
Schedule B – Nga Taonga Nui a Kiwa	Applies to the Wellington Harbour, including the Coastal Marine Area adjacent to Shelly Bay Road.
Schedule D – Statutory Acknowledgements	The Wellington Harbour is statutory area for Taranaki Whānui ki Te Upoko o Te Ika and Ngati Toa Rangatira.
Schedule F2 – Indigenous Bird Habitat	Applies to the Wellington Harbour and the foreshore adjacent to Shelly Bay Road.
Schedule F5 – Habitats with significant indigenous biodiversity values in the CMA	Schedule F5 habitats are not mapped. However, an initial desktop ecological review has been undertaken. From their review they have confirmed that the site along the coastal edge likely contains some of the habitats listed in Schedule F5. These potentially include Adamsiella beds, sub tidal rocky reefs and potentially kelp beds and seal haul outs.
Groundwater - Wellington Harbour Aquifer Zone	Applies to the Wellington harbour, including the CMA adjacent to Shelly Bay Road.
Hutt Aquifer Protection Zone	
Wellington Airport Height Restriction Areas	This extends over the entire road corridor. Given the proposed works are limited to transportation upgrades rather than the erection of large structures, the height restrictions are unlikely to be of significance.
Commercial Port Area	Burnham Wharf at the southern extent of the site is identified as a Commercial Port Area.
GWRC Regional Coastal Plan	
Contact Recreation	The Wellington Harbour is identified as for contact recreation.
Commercial Port Area	Burnham Wharf at the southern extent of the site is identified as a Commercial Port Area.
GWRC Regional Soil Plan	
Area 2	The site is within Area 2. This influences the rules that apply to earthworks.
WCC District Plan[1]	
Note: the road itself is not zoned in the District Plan, only the adjoining land. The relevant zone which applies to the road corridor is the adjacent zone. If there are two different zones on either side of the road, the division between the zones is the centreline.	
Outer residential zone	Applies to multiple residential properties adjacent to Shelly Bay Road near the southern end of the site.
Business 1 zone	Applies to multiple properties adjacent to Shelly Bay Road at the southern extent of the site.
Business zone 2	Applies to the Burnham wharf area at the southern extent of the site.
Open Space B zone	Applies to the majority of hillside above the road corridor

[1] Refer to Figure 2.1 for a map of the District Plan zones.

Zoning/planning notation	Comment
Character Area - Operational Port Area	Applies to the Burnham wharf area at the southern extent of the site.
Map 62 – Urban Coastal Edge	Applies to the area to the east of, and above, the road corridor for the length of the site (refer to Figure 2.2). Earthworks rule 30.1.2 applies to this area.
Section 23.3 - Appendix 1: Coastal Roads subject to rules 23.3.1 and 23.4.1	A map which identifies land on the seaward side of coastal roads where particular focus will be given to the adverse effects from utility structures on the character of the coastal environment and visual amenity. This applies to Shelly Bay Road and WCC will seek to protect these areas.

Table 2.2: Key plan definitions

<table>
<tr><th>Definition</th><th>Comment</th></tr>
<tr><td colspan="2">GWRC NRP</td></tr>
<tr><td>Regionally significant infrastructure – includes:
[…]
· the Strategic Transport Network (including ancillary structures required to operate, maintain, upgrade and develop that network);
[…]</td><td rowspan="2">The proposed road upgrades to include a cycleway and/or shared path meet the definition of the strategic transport network. They are therefore considered to be regionally significant infrastructure.</td></tr>
<tr><td>Strategic transport network – includes the following parts of the Wellington Region's transport network:
[…]
(f) Any other existing and proposed cycleway and/or shared paths for which the New Zealand Transport Agency and/or a local authority is/was the requiring authority or is otherwise responsible.</td></tr>
<tr><td>High risk areas - all areas in the coastal marine area and the beds of lakes and rivers are high risk areas.</td><td>Applies to the CMA.</td></tr>
<tr><td colspan="2">WCC District Plan</td></tr>
<tr><td>Network Utility - means network utility operations as defined in Section 166 of the Act […]</td><td>Includes roads and proposed roads.</td></tr>
</table>

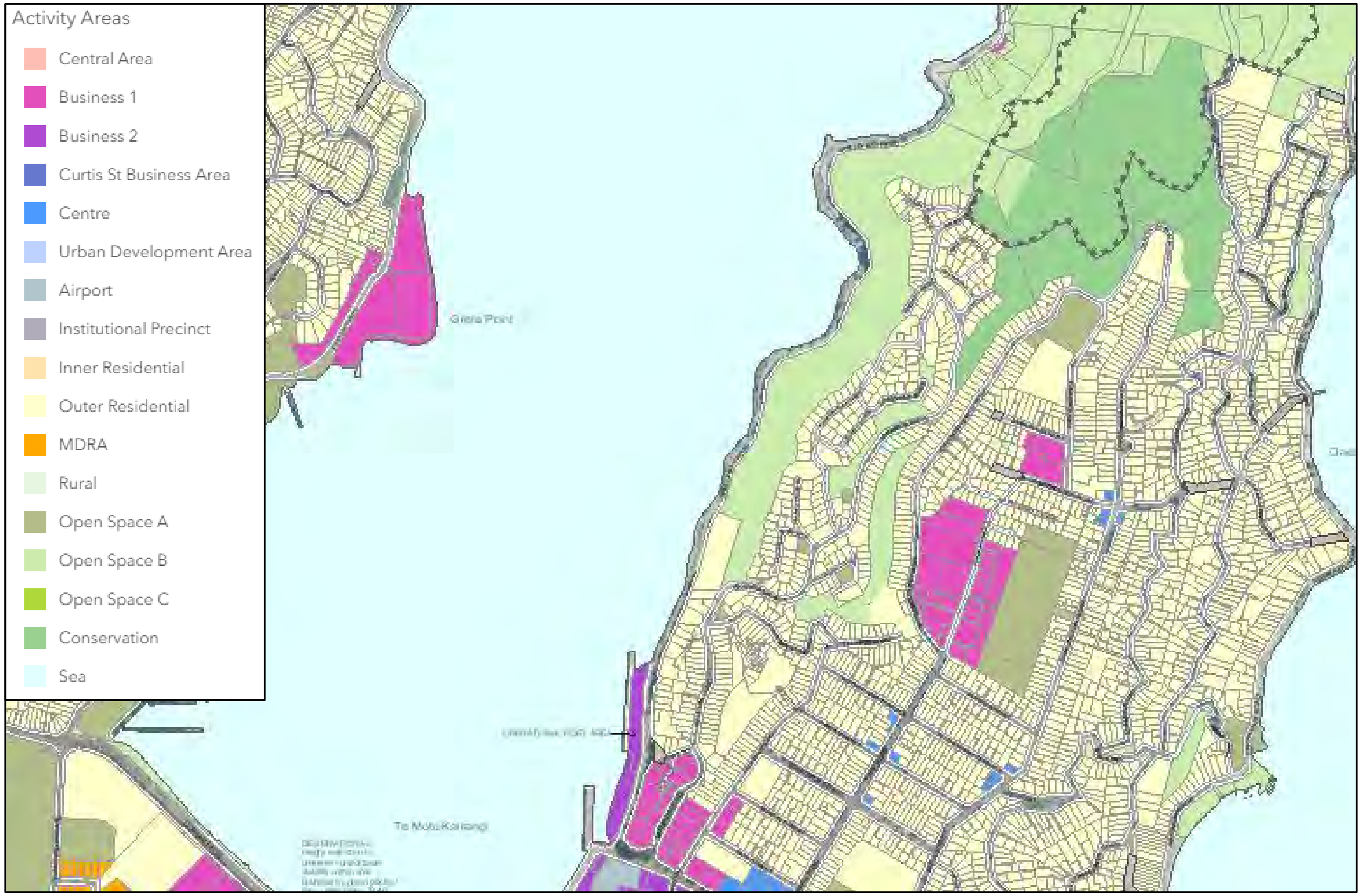

Figure 2.1: WCC District Plan zones *Source: WCC District Plan online*

Figure 2.2: Urban Coastal Edge *Source WCC District Plan Map 62*

2.2 Existing resource consents

We are not aware of any existing resource consents held by WCC that would support the proposed road upgrades.

2.3 Key potential resource consent requirements

A summary of the potential resource consent triggers under the Regional and District Plans is set out in section 2.3.1 below. Also, a summary of the potential resource consent triggers under the NESF is set out in section 2.3.2 below. These are preliminary assessments of the resource consent requirements. The resource consent requirements will be confirmed once a preferred transport upgrade option(s) is selected and at the time of preparing the relevant resource consent applications.

In summary:

- There are no relevant 'prohibited' activities within the GWRC NRP, operative Regional Coastal Plan, operative Regional Soil Plan or WCC District Plan that would prevent resource consents being applied for (i.e. a fatal flaw);
- Resource consent will be required from GWRC if seawall upgrades, new seawalls and/or reclamations are proposed. These will be a discretionary or non-complying activity if they are within coastal sites or habitats of significance;
- Resource consent will likely be required from GWRC for earthworks and vegetation clearance;
- Resource consent will likely be required from WCC for earthworks and vegetation clearance and may be required for structures on land if they are proposed;
- The upgrade and maintenance of the formed road and installation of traffic management control structures can likely be permitted (no resource consent required);

- Vegetation clearance, earthworks or the taking, damming, diversion and discharge of water within a wetland, including a coastal wetland, that is for the purpose of a cycleway and/or shared path is a discretionary activity under NESF regulation 45;
- Any other earthworks or the taking, damming, diversion and discharge of water, not associated with a cycleway and/or shared path:
  - within a wetland, including a coastal wetland, is prohibited activity under NESF regulation 53 (i.e. a fatal flaw);
  - within 100 m but outside of a wetland, including a coastal wetland, require resource consent as a non-complying activity under NESF regulation 52; and
- The construction of wetland utility structures (e.g. jetties and boardwalks) is a restricted discretionary activity under NESF regulation 42.

Note: We are not aware of any rivers or streams on the eastern side of Shelly Bay road. Therefore, a complete review of the regional rules relating to activities in the bed of a river has not been undertaken other than to confirm that there are no relevant prohibited activities (i.e. a fatal flaw). The presence of streams will need to be confirmed during a site walkover. If streams are found to be present the resource consent requirements of any activities proposed within streams will need confirmed.

2.3.1 Regional and District Plans

Table 2.2: Key potential resource consent requirements

Activity	Rule	Comment	Status
GWRC Natural Resources Plan			
Construction of structures (e.g. timber boardwalk) outside sites of significance within the Coastal Marine Area (CMA)	R161	Resource consent required.	Discretionary
Construction of structures (e.g. timber boardwalk) inside sites or habitats of significance within the CMA (i.e. Schedule F5 sites).	R162	Resource consent required. The activity will either need to have no more than minor adverse effects on the environment or demonstrate consistency with the objectives and policies in the plan.	Non-complying
Minor additions, alterations or replacement of seawalls in the CMA	R165[2]	Resource consent required, but it must be granted.	Controlled
Construction of seawalls outside sites of significance within the Coastal Marine Area (CMA)	R166	Resource consent required.	Discretionary
Construction of seawalls inside sites or habitats of significance within the CMA (i.e. Schedule F5 sites).	R167	As above for rule R162. Resource consent required.	Non-complying
Reclamation of the CMA for regionally significant infrastructure and outside sites of significance	R214	Resource consent required. If it can be demonstrated that any reclamation is required for a proposed cycleway and/or	Discretionary

[2] Rule subject to an unresolved appeal. Therefore, the RCP rule 6 is also applicable.

Activity	Rule	Comment	Status
		shared path the works will be considered as for regionally significant infrastructure.	
Reclamation inside sites or habitats of significance within the CMA (i.e. Schedule F5 sites).	R215	As above for rule R162. Resource consent required.	Non-complying
Earthworks and vegetation clearance, including associated sediment discharges to water.	R101[3]	Resource consent required for earthworks and vegetation that exceed 3000 m^2 per 12-month period.	Discretionary
GWRC operative Regional Coastal Plan			
Maintenance and minor extensions to seawalls	6	Further assessment required against the permitted activity conditions to confirm activity status. If not permitted, the works default to Controlled rule 13 or Discretionary rule 25.	Permitted
GWRC operative Regional Soil Plan			
Earthworks associated with roading	1	Resource consent required if the works would result in a batter exceeding 200 m in length and 2 m in height.	Restricted Discretionary
WCC District Plan			
Any activity relating to the upgrade and maintenance of existing formed public roads, including associated earthworks.	5.1.5, 17.1.14, 34.1.4	These rules provide for activities within the formed road corridor, including earthworks. However, large scale earthworks outside of the road corridor such as cutting the hillside are unlikely to be permitted under this rule.	Permitted
Earthworks in the Urban Coastal Edge and Open Space B	30.1.2/ 30.2	Applies to the area to the east of, and above, the road corridor for the length of the site. This permitted activity rule limits cuts to 1.5 m in height and 100 m^2 among others. It is unlikely the earthworks can comply with these restrictions and restricted discretionary rule 30.2 will likely be triggered.	Permitted/ Restricted Discretionary
Vegetation clearance in the Open Space B zone	17.1.15/ 17.2.4	This rule requires <100 m^2 of vegetation clearance over a five-year period. This is unlikely to be met if the hillside is to be excavated and cleared. Resource consent is likely to be required and restricted discretionary rule 17.2.4 applies.	Permitted/ Restricted Discretionary
Construction and operation of traffic management and control structures on legal roads.	23.1.7	Resource consent is not required.	Permitted
Above ground network utility structures in the residential and business zone and outside of the formed road *Note: the construction and operation of roads is a network*	23.2.1A	Resource consent required for above ground structures outside of the formed road. A matter of assessment for any consent application under this rule is the extent to which the structure will affect the character of the coastal environment	Controlled

[3] Rule is subject to appeal. Therefore, RSP rule 1 is also applicable.

Activity	Rule	Comment	Status
utility as defined under the District Plan. Therefore, any structures associated with the road are considered to be network utility structures.		and visual amenity of Shelly Bay Road (standard 23.2.1A.8).	
Network utility structures in the Open Space B zone.	23.4.1	Resource consent required for structures associated with the road in the Open Space B zone.	Discretionary
Buildings and structures for recreation purposes less than 30 m^2 in area and 4m in height in Open Space B	17.1.10/ 17.3.2	Some structures associated with road upgrades may be able to be permitted under this rule provided the limits are met. If not, resource consent is required as a discretionary activity under rule 17.3.2.	Permitted/ Discretionary

2.3.2 National Environmental Standards for Freshwater

The NESF includes national regulations which restrict and prohibit certain activities near or within natural wetlands. A recent High Court judgement[4] has established that the NESF applies to natural wetlands in the coastal marine area (CMA). The presence of wetlands, including coastal wetlands, will need to be determined through an ecological review of the site. Notwithstanding this, the potential planning implications are outlined below.

To widen the road corridor reclamations of the CMA may be required. Regulation 45 requires a discretionary activity resource consent for vegetation clearance, earthworks and the taking, use, damming, diversion or discharge of water within or within a 100 m setback of a natural wetland if it is for the purpose of constructing 'specified infrastructure'. Specified infrastructure includes regionally significant infrastructure identified as such in a regional policy statement or plan, which as outlined above, will include a cycleway and/or shared path. Therefore, there is a consenting pathway for the construction of a cycleway and/or shared path within, or near, a coastal wetland.

However, if the earthworks or the taking, damming, diverting, or discharging of water within a coastal wetland is not for the purpose of constructing specified infrastructure, and it results or is likely to result in the complete or partial drainage of the coastal wetland, the activity is prohibited under regulation 53 and no resource consent can be applied for. This would be a fatal flaw in the design. If the earthworks or the taking, damming, diverting, or discharging of water are within 100 m but outside of a wetland, resource consent would be required as a non-complying activity.

Notwithstanding the above, regulation 42 provides for the construction of wetland utility structures as a restricted discretionary activity. Wetland utility structures include jetties, boardwalks and walking tracks. Therefore, if these structures are proposed within a wetland, including a coastal wetland, there is a consent pathway which will be less complex than that for the reclamation of a coastal wetland.

2.4 Key plan policies

This section provides a discussion on the key policies within the GWRC PNRP and WCC District Plan that will be considered during the assessment of resource consent applications. It outlines which policies are likely to weigh against or in favour of the proposed upgrades and associated activities.

[4] Minister of Conservation v Mangawhai Harbour Restoration Society Incorporated [2021] NZHC 3113 [18 November 2021].

2.4.1 GWRC Proposed Natural Resources Plan

Reclamations

The PNRP provides clear direction that reclamations shall be avoided except where the reclamation is associated with regionally significant infrastructure (e.g. cycleway and/or shared path), there are no alternative locations for the activity outside of the CMA, and there are no other practicable alternative methods of providing for the activity (policy P146). Provided it can be demonstrated that any reclamations can meet all three matters this policy is unlikely to weigh against the proposal. Notwithstanding this, the space occupied by any reclamations must also be minimised (policy P133).

Seawalls and coastal structures

Provided there are no practicable alternative means to protect the cycleway and/or shared path, new seawalls in the CMA are unlikely to be considered inappropriate as they will be associated with new regionally significant infrastructure. This is consistent with policy P140. Also, new structures associated with regionally significant infrastructure do not need to be avoided in Schedule F5 (coastal habitats) sites (Policy 139). However, it will be critical to demonstrate that there are not practicable alternative locations or methods of providing for the activity. In that regard, some information will be required to explain the challenges/impracticality of widening the road to the landward side of the corridor.

Natural character

While the policies discussed in sections 2.5.1 and 2.5.2 above will enable reclamations or structures within the CMA, if these structures result in significant adverse effects on natural character, policy P24 and P52 will weigh against any resource consent application. Specifically, these policies provide direction that significant adverse effects on natural character are to be avoided and other adverse effects are to be avoided, remedied and mitigated.

Therefore, particular consideration will need to be given to avoiding areas with a high value of natural character (e.g. unmodified sandy beaches) and mitigation will need to be incorporated into designs to mitigate adverse effects on natural character.

Biodiversity and habitats

The policy provides direction that adverse effects on threatened or at-risk species are to be avoided (policy P38), significant adverse effects are avoided, minimised, remedied or offset (policy P31) and habitats for indigenous birds are to be protected and restored (P42). Notwithstanding this, policy P39 is enabling towards the development of regionally significant infrastructure (e.g. cycleways/walkways) within significant habitats. However, the need to locate there must be justified and the activity shall provide for the maintenance, and where practicable, the enhancement or restoration of the affected significant indigenous biodiversity values and attributes.

The degree of adverse ecological effects is currently unknown. However, the works are unlikely to be entirely consistent with the policy direction which will weigh against the proposal. Therefore, consideration will need to be given to avoiding and or minimising adverse effects through design where possible and ecological restoration or offsets may be required.

Coastal wetlands

Policy P30 and P34 provides direction that wetlands, their natural flow regime, natural and values shall be maintained and restored where practicable. Also, adverse effects must be avoided if they are on indigenous biodiversity values that meet the criteria in Policy 11(a) of the NZCPS (policy 38) and if not, significant adverse effects must be avoided, minimised, remedied or offset (policy P31). If coastal wetlands are present and their damage or drainage is proposed, these polices are unlikely to be met.

Also, policy P104 provides direction that the loss of extent and values of natural wetlands is to be avoided, except where for specified infrastructure, and it will provide significant regional benefit, and there is a functional need for the specified infrastructure in that location. The definition of functional need[5] is very limiting and it is unlikely the cycleway and/or shared path can meet the definition as the activity is not dependent on having its location in the CMA.

Recreation

Maintenance and enhancement of public access to and along the CMA is supported by the policy direction (policy P8). As the project is to improve cycling and pedestrian access along the road this policy will weigh in favour of the proposal.

Regionally significant infrastructure

There is policy direction that supports the provision of regionally significant infrastructure in appropriate places and ways (policy P13). Additionally, the benefits of regionally significant infrastructure will be a consideration during a resource consent process and will weigh in favour of the proposal (policy P11).

Hazards and resilience

Policy P25 discourages use and development in the CMA as it is a high risk area. However, provided the development (e.g. boardwalk, seawalls) has a functional or operational requirement to be located there, the residual risk is low, hazards are not exacerbated and adverse effects on natural processes are avoided, remedied or mitigated, the policy is unlikely to prohibitive towards development within the CMA.

The use of hard hazard engineering protection is to be avoided except where it is necessary to protect existing development from unacceptable risk and any adverse effects are no more than minor (policy P27). The restoration of natural buffers is favoured and opportunities for this should be sought through design (policy P29).

Particular regard must be given to the potential for climate change to exacerbate natural hazards over at least the next 100 years that could affect use and development (policy P28). Therefore, either resilience will need to be incorporated into the design of coastal structures, or a robust discussion will be required as to why resilience has not been incorporated into the design and/or how it will be implemented over time (e.g. staged approach or creating a design that can easily accommodate future resilience upgrades).

2.4.2 WCC District Plan

Natural character and ecosystems

The policy provides direction that the character and purpose of the Open Space B zone, being the natural environment, is to be maintained (policy 16.5.1.1). Also, landscape elements that are significant in the Wellington context, such as the Miramar Urban Coastal Edge, are to be protected (policy 16.5.2.1 and policy 29.2.1.9).

Therefore, earthworks, vegetation clearance and structures that will have significant adverse effects on the natural character and visual amenity of the area will weigh against the proposal. The extent of earthworks and vegetation clearance will need to be minimised as far as practicable and revegetation at the completion of construction is likely to be required (policy 16.5.2.3 and 29.2.1.7).

[5] PNRP definition of 'functional need': When an activity is dependent on having its location in the coastal marine area.

Hazards and resilience

The policy provides direction to ensure that utility structures are not at risk from hazards (policy 22.2.1.5). This policy is unlikely to weigh against the road upgrades as the road is not a structure, and any ancillary structures (e.g. signage, lights) that are inconsistent with this policy are unlikely to be of significance as their damage is of low consequence. The earthworks will need to be designed to minimise the risk of slope instability (policy 29.2.1.3).

Network utilities

Network utilities in the Open Space zone are generally discouraged, but may be appropriate where there is no practicable alternative and visual effects can be mitigated (policy 22.2.1.1B). Therefore, provided there is no alternative, or the alternative is coastal structures, and the adverse effects can be remedied or mitigated (policy 22.2.1.1) the policy direction is unlikely to prevent a resource consent from being granted. Policy 22.2.1.2 also requires that regard be had to the operational requirements of network utilities which will weigh in favour of the proposed road upgrades.

2.5 NZCPS

Policy 10 provides clear direction that reclamations should be avoided unless there is no land available outside the CMA, the activity can only occur adjacent to the CMA, there are no practicable alternatives and the reclamation will provide significant regional or national benefit. Consistency with all of these matters will need to be demonstrated for this policy to not weigh against the proposal. Policy 25 discourages the use of hard protection structures, such as seawalls, in favour of more natural defences.

Policy 11 provides clear direction that adverse effects on threatened or at risked species and rare habitats is to be avoided. Policy 13 and 15 provide direction that significant adverse effects on the natural character of the coastal environment, natural features and natural landscapes shall be avoided and other adverse effects avoided, remedied or mitigated.

Notwithstanding the above, policy 6 recognises that the provision of infrastructure is important to the social, economic and cultural well-being of people and communities. More specifically, policy 18 and 19 recognise the need for public open space, including active recreation and walking access. These policies will weigh in favour of the development of a cycling path/shared path within or adjacent to the CMA.

Overall, the NZCPS is not prohibitive towards the potential activities within or adjacent to the CMA and there are policies which support the enhancement of public access to the CMA. However, reclamations will be challenging to obtain resource consent for and it is clear that these need to be avoided unless there is no alternative. Throughout the option selection and design process careful consideration will need to be given to those designs that avoid or minimise adverse effects on indigenous biodiversity, rare coastal habitats and also natural character, landscapes and features.

3 Conclusions

A single fatal flaw (i.e. prohibited activity) has been identified that could prevent certain aspects of the proposed road upgrades from occurring. Under the NESF, earthworks and damming, taking, diversion or discharge of water within a coastal wetland (e.g. for a reclamation) is a prohibited activity unless it is for the purpose of constructing specified infrastructure, which includes cycleways and/or shared paths. Therefore, this will be a key factor when preparing the shortlist of design options.

Any proposed seawalls, boardwalks and reclamations may be within Schedule F5 (coastal habitats) and therefore a non-complying activity status under the PNRP. For a non-complying resource consent to be granted either the reclamation must not be contrary to the objectives and policies of the PNRP or the effects must be no more than minor.

Should reclamations and seawalls be proposed within the CMA it will increase the complexity of the resource consent applications to GWRC. Policy direction in the PNRP and NZCPS requires reclamations to be avoided unless it can be demonstrated that there is no land available outside the CMA for the proposed activity, the activity that requires the reclamation can only occur in or adjacent to the CMA, there are no practicable alternatives, and the reclamation will provide significant regional or national benefit. The PNRP also provides direction that the loss of the extent and values of coastal wetlands is also to be avoided. Similarly, policy direction in the PNRP for seawalls outlines that they are inappropriate unless there are no practicable alternative means to protect the cycleway and/or shared path.

Given the likely ecological sensitivity and values of the coastal environment adjacent to Shelly Bay Road, opportunities to avoid and minimise adverse effects on coastal biodiversity, habitats and the natural character of the area through design should be sought.

The main risk to obtaining resource consent from WCC is if substantial earthworks and vegetation clearance are proposed within the Urban Coastal Edge. The policy provides direction that the natural character and visual amenity of this area is to be protected. Therefore, the works extent will need to be minimised and remedial landscaping incorporated into any proposal.

The following will need to be confirmed during Phase 2 of the project and to inform the multi-criteria analysis:

- The presence of wetlands and streams and the ecological values with the site area;
- Landscape and visual values of the project area;
- Geotechnical risks (slope stability); and
- The coastal processes and hazards that will inform design.

4 Applicability

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

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
....	....
Alex Gifford	Chris Purchas
Senior Planner	Project Director

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Appendix G: Ecological desktop assessment

- **Shelly Bay Road: Ecology inputs to MCA and options selection for public consultation (T+T letter, April 2022)**

Job No: 1014113.1000
26 April 2022

Wellington City Council
PO Box 2199
Wellington 6140

Attention: Karyn Stillwell

Dear Karyn

Shelly Bay Road: Ecology inputs to MCA and options selection for public consultation

1 Background and scope

Wellington City Council (WCC) is considering upgrades to Shelly Bay Road (the road) to support a proposed housing development at Shelly Bay. The project area comprises a 2.3 km length of Shelly Bay Road between Miramar Avenue and Shelly Bay. Tonkin + Taylor (T+T) previously prepared a long list of upgrade options. Objectives included achieving better alignment with Waka Kotahi guidance and the Great Harbour Way plan for pedestrians, cyclists, and other road users.

T+T have undertaken further work to refine the long list of upgrade options to a short list to inform WCC's Officer's recommendation to the Council Meeting of 30 June 2022. Ecological inputs have been provided to inform the short list refinement and Multi-Criteria Assessment (MCA) workshops.

This letter report provides a high-level summary of the ecological inputs, including methods and results, that were used to inform the short list refinement and MCA workshops (including scoring), plus recommendations for next steps. This work has been undertaken in accordance with our signed Variation Order 1 (VO1), dated 15 February 2022.

2 Methods

Ecological inputs were provided based on a desktop assessment only; for future stages of work, ecological values should be verified via site visits and surveys. The desktop assessment referred to:

- Google maps and street view.
- Data layers sourced from GWRC and the Proposed Natural Resources Plan (PNRP); Schedule F Ecosystems and habitats with significant indigenous biodiversity values.
- Citizen science platforms (E-bird and iNaturalist).

Ecological values were spatially represented in ArcGIS.

3 Shelly Bay Road ecological characteristics

Ecological values for species and habitat types are provided in Table 3.1 and associated maps in Appendix A. Table 3.1 further identifies potential approaches to manage effects on specific habitats or species.

Terrestrial ecological values within and surrounding the project footprint (the road) include indigenous scrubland vegetation, which extends down to the road edge. This has a high ecological value due to being potential habitat for regionally threatened lizards (such as copper and ornate skink and Wellington green gecko) and threatened bird species which spill over from Zealandia (such as falcon and kaka plus spread of others like tui and kereru) as well as the potential for threatened plant species to be present.

Wellington City Council has classified the Shark Bay coastal escarpment forest as a Significant Natural Area due to this forest being a rare example for the area. It provides an important seed source for nearby regenerating areas and connectivity along the western side of Miramar Peninsula. It is home to several bird species, including the kororā / little penguin and variable oystercatcher. Vegetation includes ngaio, kawakawa, *Coprosma propinqua* and cabbage tree. It also includes flaxes, hebes, karo, and pohutukawa. Lizards and birds may also use the tree, shrub and grass areas mapped.

Marine ecological values within and surrounding the project footprint (the road) are wide ranging and include rocky reef, intertidal, subtidal and gravel beach habitats, which are likely to support diverse species assemblages that include algae (seaweeds), bivalves, chitons, barnacles and echinoderms. Several threatened coastal bird species are known to be resident or regular visitors to this habitat, including fluttering shearwater, red-billed gull, little black shag and white-fronted tern. Coastal birds are likely to use the marine habitat both for roosting and foraging. The rocky reef and gravel beaches are used as haul out areas by New Zealand fur seals, and kororā / little penguins potentially use the rocky habitat (natural and artificial) for burrows during the breeding and moulting season. Marine fish are also expected to utilise the intertidal rock pools and subtidal areas.

Table 3.1: Shelly Bay Road ecological values and expected management approach

Habitat or species type	Value	Expected management approach
Terrestrial		
Vegetation: Indigenous scrublands	High-Very high · Significant Natural area (Shark Bay) · Threatened Environment classification >30% indigenous cover left and <10% protected · Threatened Environment classification <10% indigenous cover left · Potential habitat for regionally Threatened and At Risk bird species · Potential habitat for regionally Threatened and At Risk lizards Plant species potentially present: · *Veronica speciosa*: Purple hebe (At Risk-Declining) · *Peraxilla tetrapetala*: Red Mistletoe (Threatened-Regionally Critical)	Vegetation Management Plan i.e. rules around vegetation clearance in SNA.

Habitat or species type	Value	Expected management approach
	· Potentially *Atriplex cinerea*: Grey Saltbush (Threatened- Nationally Critical, regionally extinct but observation made in Wellington region) · *Muehlenbeckia astonii*: shrubby tororaro (Threatened-Regionally Critical) · *Brachyglottis perdicioides*: Raukumara (Nationally Threatened-Critical, Regionally At Risk-Uncommon) · *Drymoanthus flavus*: Spotted fleshy tree orchid (At Risk-Declining)	
Lizards	Low - High - depending on the species (For example, copper skink- Regionally Threatened-Critical and barking gecko- Regionally Threatened-Vulnerable have high value. Northern grass skink- Not Threatened have low value)	Lizard Management Plan i.e. Timing restrictions around vegetation clearance Salvage and relocation
Birds	High - regionally critical (falcon), regionally endangered (black shag) and regionally vulnerable (red-billed gull, little shag) species found around Project area	Avifauna Management Plan i.e. Timing restrictions around vegetation clearance
Marine		
Rocky reef habitat, intertidal and subtidal (Shallow, sheltered)	Moderate – high (dependent on species assemblage). Likely to support algal species, bivalves, chitons, barnacles, echinoderms. Evans Bay supports soft sediment *Adamsiella* algal beds Roosting and foraging sites for coastal birds	Avoid where practicable
Gravel beach habitat	Moderate. Roosting for coastal birds	Avoid where practicable
Rock revetment (artificial habitat)	High. Artificial habitat with the potential for kororā / little penguin burrows	Kororā Management Plan seasonal restrictions around breeding and moult
Seawall (artificial habitat)	Low. Species diversity and abundance potentially low in comparison to surrounding natural reef habitat.	-
Coastal birds (waders and seabirds)	High. Six threatened or at-risk indigenous bird species are known to be resident or regular visitors to this habitat: fluttering shearwater, variable oystercatcher, red-billed gull, little black shag, pied shag and white-fronted tern. Point Jenningham to Point Halswell. Wellington Source: PNRP	Avoid where practicable and Avifauna Management Plan i.e. seasonal restrictions around works

Habitat or species type	Value	Expected management approach
Penguins	High. At-Risk -declining conservation status for kororā / little penguins	Kororā Management Plan seasonal restrictions around breeding and moult
Fish (Intertidal rock pools and subtidal)	Unknown. Likely to be moderate – high based on iNaturalist records and available habitat.	Construction management measures
Marine mammals	High. Rocky reef / gravel beaches haul out areas for NZ fur seal, classified as 'Not threatened' (iNaturalist records).	Avoid where practicable and construction management measures

4 Recommendations

Following further refinement of the Shelly Bay Road short list options or the selection of a preferred option, ecological values should be verified through site visits or surveys. We understand that a lizard survey is currently being undertaken prior to the end of the 2021/2022 field season; the results from this survey should be included in any further assessment of the site.

Prior to an application for Resource Consent for the preferred upgrade to the road, an Ecological Impact Assessment (EcIA) should be undertaken to inform an Assessment of Environmental Effects (AEE). The EcIA and any subsequent management plans should provide additional detail on effects management measures to avoid, remedy or mitigate effects on ecological values as a result of the road upgrade, or to offset or compensate for residual ecological effects following best practice guidance.

5 Applicability

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

We understand and agree that this report will be used by Wellington City Council in undertaking its regulatory functions in connection with the Shelly Bay Road options assessment.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

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Susan Jackson
Senior Marine Ecologist

Authorised for Tonkin & Taylor Ltd by:

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Chris Purchas
Project Director

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Tarryn Wyman
Terrestrial Ecologist

Technical review by Josh Markham, Senior Ecologist

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Appendix A: Ecology constraints mapping

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LEGEND

Tidal Levels

- MLWS Line
- MHWS Line

Terrestrial Ecology

- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Marine Features

- Gravel Beach
- Rock Revetment (Artifical)
- Rocky Reef
- Seawall

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NOTES:
Basemaps: Land Information New Zealand, Eagle Technology, OpenStreetMap contributors
Data from Wellington City Council, Ecology data from T+T.

REV	DESCRIPTION	GIS	CHK	DATE
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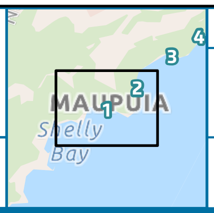

LOCATION PLAN

PROJECT No.	1014113.1000	
DESIGNED	ANDO	MAR.22
DRAWN	ANDO	MAR.22
CHECKED	JORB	MAR.22
APPROVED		DATE

CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD UPGRADES
TITLE CONSTRAINTS MAPPING - ECOLOGY
MAP 1 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 1. REV 0

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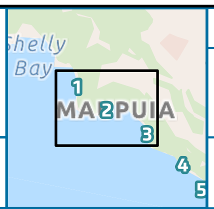

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PROJECT SHELLY BAY ROAD UPGRADES
TITLE CONSTRAINTS MAPPING - ECOLOGY
MAP 2 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 2. REV 0

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PROJECT SHELLY BAY ROAD UPGRADES
TITLE CONSTRAINTS MAPPING - ECOLOGY
MAP 3 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 3. REV 0

LEGEND

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CLIENT **WELLINGTON CITY COUNCIL**

PROJECT **SHELLY BAY ROAD UPGRADES**

TITLE CONSTRAINTS MAPPING - ECOLOGY
MAP 4 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 4. REV 0

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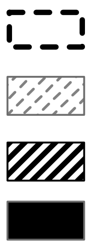

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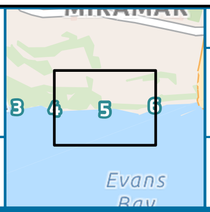
LOCATION PLAN



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CLIENT **WELLINGTON CITY COUNCIL**
PROJECT **SHELLY BAY ROAD UPGRADES**
TITLE CONSTRAINTS MAPPING - ECOLOGY
MAP 5 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 5. REV 0

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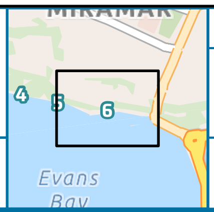


LOCATION PLAN

PROJECT No.	1014113.1000	
DESIGNED	ANDO	MAR.22
DRAWN	ANDO	MAR.22
CHECKED	JORB	MAR.22
APPROVED		DATE

CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD UPGRADES
TITLE CONSTRAINTS MAPPING - ECOLOGY
MAP 6 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 6. REV 0

Appendix H: Constraints mapping

- **Shelly Bay Road upgrades: Constraints mapping, Figures 1 to 6 (March 2022)**

\\ttgroup.local\corporate\Wellington\TT Projects\1014113\1014113.1000\WorkingMaterial\Constraints Model\MapFigures\ShellyBayCyclewayConstraintFigures.aprx Layout: Shelly Bay Cycleway Constraints 2022-Mar-17 3:45 pm Drawn by ANDO

LEGEND (TOP)

Earthquake Induced Slope Failure Risk
- 1 Low
- 2
- 3 Moderate
- 4

Liquefaction Potential
- High
- Moderate
- Low

Three Waters
- Wastewater Pipe
- Stormwater Pipe/ Channel
- Potable Water Pipe
- Wastewater Feature
- Stormwater Feature
- Potable Water Feature

Tidal Levels
- MHWS Line
- MLWS Line

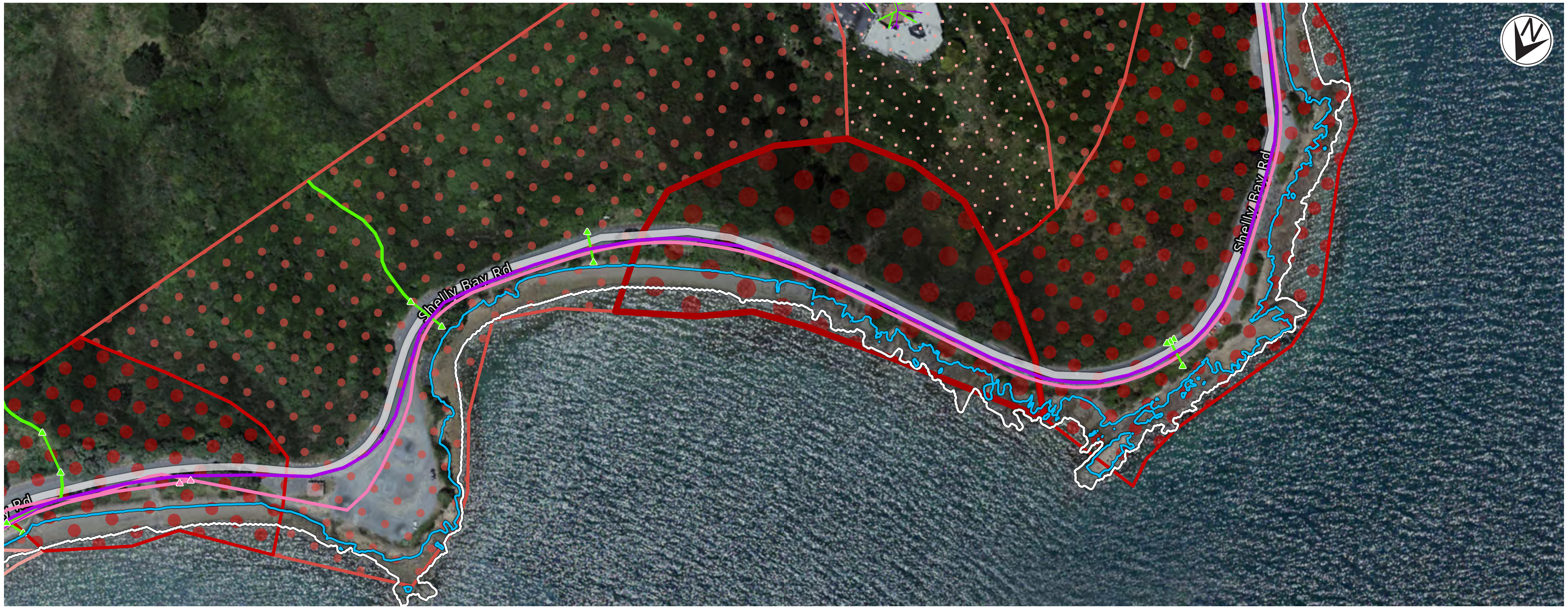
LEGEND (BOTTOM)

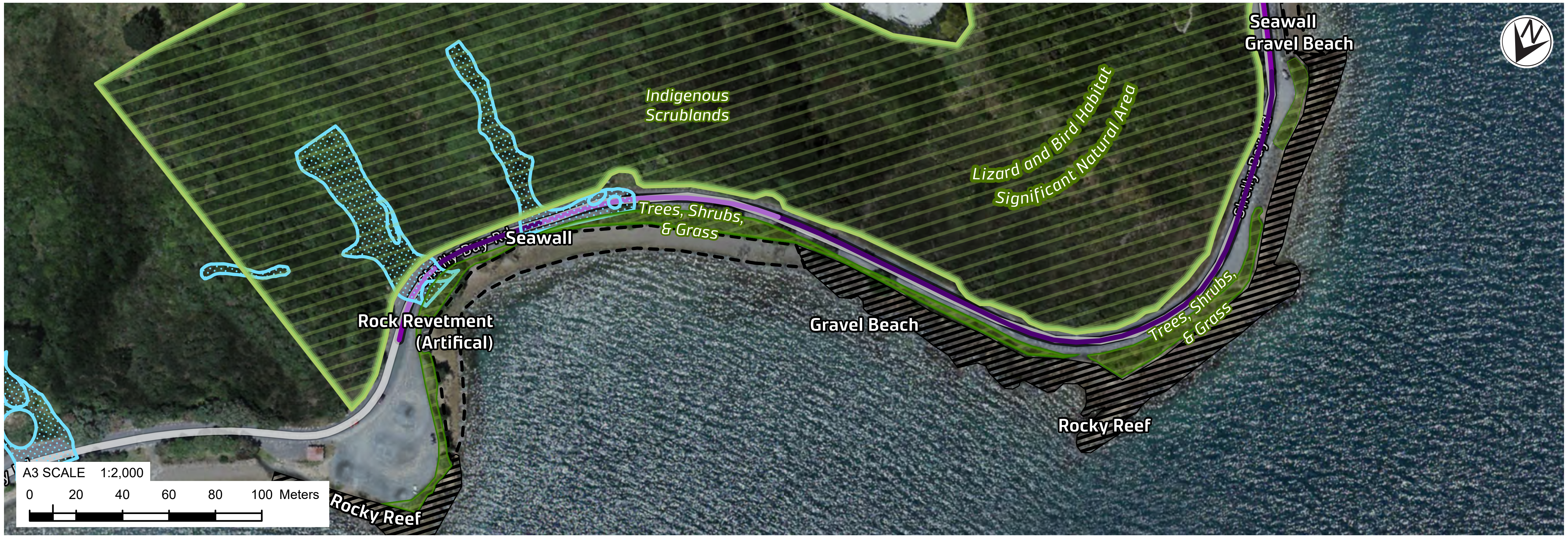
Flood Zone Depth
- 0.01 - 0.10m
- 0.10 - 0.50m
- > 0.50m

Marine Features
- Gravel Beach
- Rock Revetment (Artifical)
- Rocky Reef
- Seawall

Terrestrial Ecology
- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Slope Classification
- High Risk 'H'
- Moderate Risk 'M'
- Low Risk 'L'
- Very Low Risk 'VL'





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NOTES:
Basemaps: Land Information New Zealand, Eagle Technology, OpenStreetMap contributors
Data from Wellington City Council, Ecology data from T+T.

REV	DESCRIPTION	GIS	CHK	DATE
0	First version	ANDO	JORB	17/3/22

LOCATION PLAN: MAUPUIA, Shelly Bay

PROJECT No.	1014113.1000	
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DRAWN	ANDO	MAR.22
CHECKED	JORB	MAR.22
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CLIENT: WELLINGTON CITY COUNCIL
PROJECT: SHELLY BAY ROAD UPGRADES
TITLE: CONSTRAINTS MAPPING
MAP 1 OF 6
SCALE (A3): 1:2,000 FIG No. FIGURE 1. REV 0

LEGEND (TOP)

Earthquake Induced Slope Failure Risk
- 1 Low
- 2
- 3 Moderate
- 4

Liquefaction Potential
- High
- Moderate
- Low

Three Waters
- Wastewater Pipe
- Stormwater Pipe/ Channel
- Potable Water Pipe
- Wastewater Feature
- Stormwater Feature
- Potable Water Feature

Tidal Levels
- MHWS Line
- MLWS Line

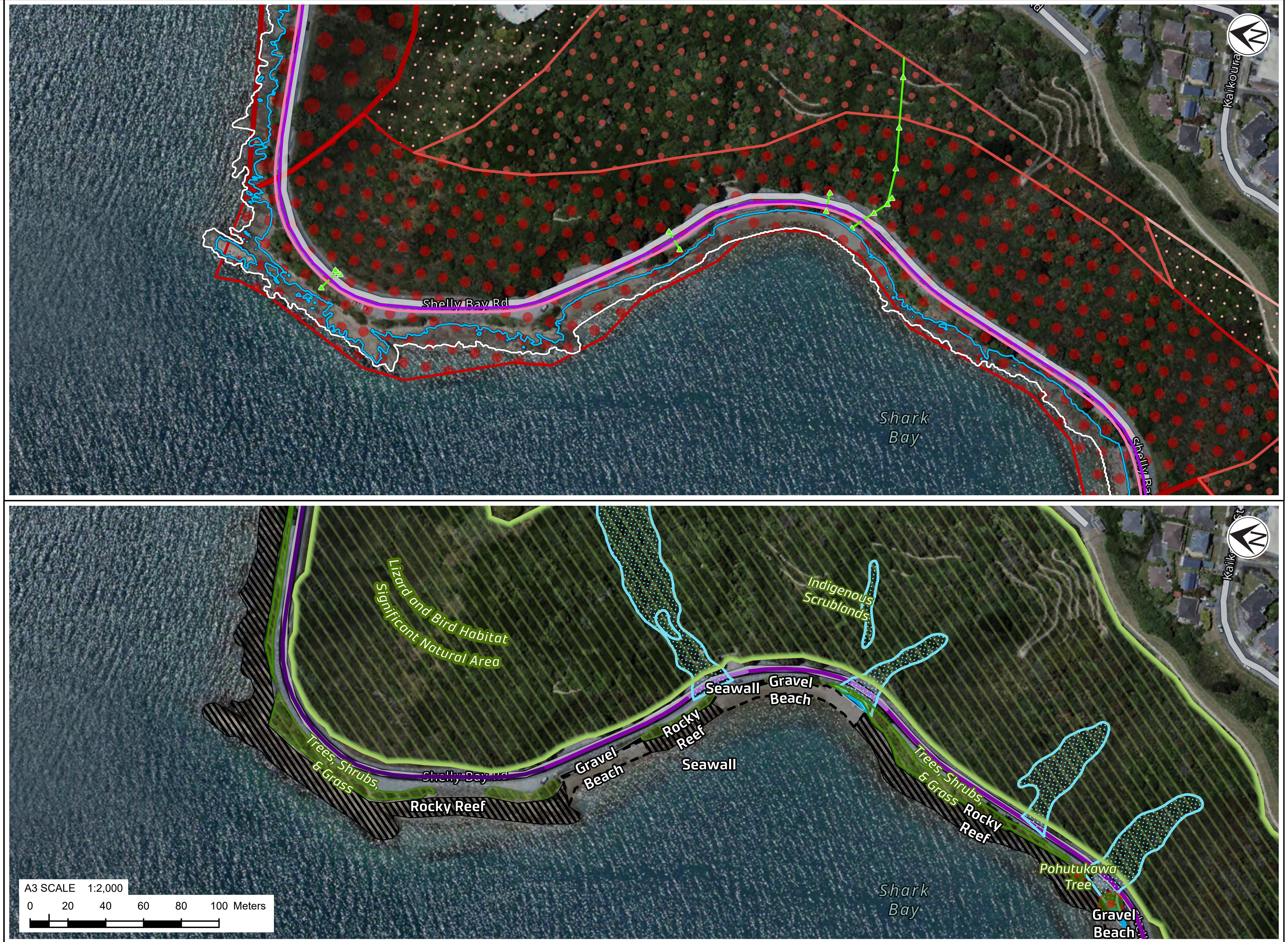
LEGEND (BOTTOM)

Flood Zone Depth
- 0.01 - 0.10m
- 0.10 - 0.50m
- > 0.50m

Marine Features
- Gravel Beach
- Rock Revetment (Artificial)
- Rocky Reef
- Seawall

Terrestrial Ecology
- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Slope Classification
- High Risk 'H'
- Moderate Risk 'M'
- Low Risk 'L'
- Very Low Risk 'VL'



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REV	DESCRIPTION	GIS	CHK	DATE
0	First version	ANDO	JORB	17/3/22

LOCATION PLAN: Shelly Bay, MAUPUIA, 1, 2, 3, 4, 5

PROJECT No.	1014113.1000	
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DRAWN	ANDO	MAR.22
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CLIENT: WELLINGTON CITY COUNCIL
PROJECT: SHELLY BAY ROAD UPGRADES
TITLE: CONSTRAINTS MAPPING MAP 2 OF 6
SCALE (A3): 1:2,000 FIG No. FIGURE 2. REV 0

\\ttgroup.local\corporate\Wellington\TT Projects\1014113\1014113.1000\WorkingMaterial\Constraints Model\MapFigures\ShellyBayCyclewayConstraintFigures.aprx Layout: Shelly Bay Cycleway Constraints 2022-Mar-17 3:45 pm Drawn by ANDO

LEGEND (TOP)

Earthquake Induced Slope Failure Risk

- 1 Low
- 2
- 3 Moderate
- 4

Liquefaction Potential

- High
- Moderate
- Low

Three Waters

- Wastewater Pipe
- Stormwater Pipe/ Channel
- Potable Water Pipe
- Wastewater Feature
- Stormwater Feature
- Potable Water Feature

Tidal Levels

- MHWS Line
- MLWS Line

LEGEND (BOTTOM)

Flood Zone Depth

- 0.01 - 0.10m
- 0.10 - 0.50m
- > 0.50m

Marine Features

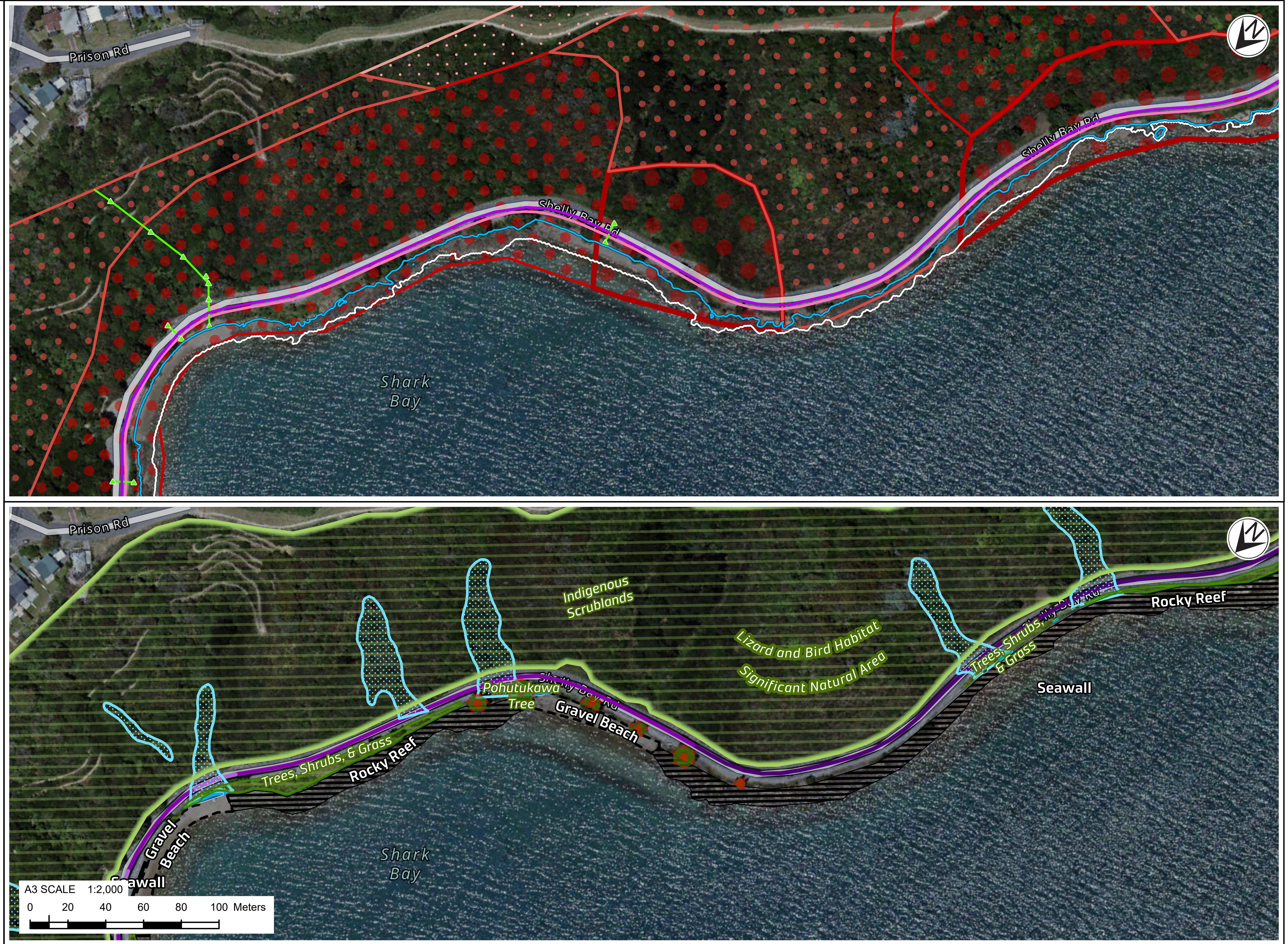
- Gravel Beach
- Rock Revetment (Artifical)
- Rocky Reef
- Seawall

Terrestrial Ecology

- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Slope Classification

- High Risk 'H'
- Moderate Risk 'M'
- Low Risk 'L'
- Very Low Risk 'VL'



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REV	DESCRIPTION	GIS	CHK	DATE
0	First version	ANDO	JORB	17/3/22

LOCATION PLAN

PROJECT No.	1014113.1000	
DESIGNED	ANDO	MAR.22
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CHECKED	JORB	MAR.22
APPROVED		DATE

CLIENT **WELLINGTON CITY COUNCIL**
PROJECT **SHELLY BAY ROAD UPGRADES**
TITLE CONSTRAINTS MAPPING
MAP 3 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 3. REV 0

\\ttgroup.local\corporate\Wellington\TT Projects\1014113\1014113.1000\WorkingMaterial\Constraints Model\MapFigures\ShellyBayCyclewayConstraintFigures.aprx Layout: Shelly Bay Cycleway Constraints 2022-Mar-17 3:45 pm Drawn by ANDO

LEGEND (TOP)

Earthquake Induced Slope Failure Risk

- 1 Low
- 2
- 3 Moderate
- 4

Liquefaction Potential

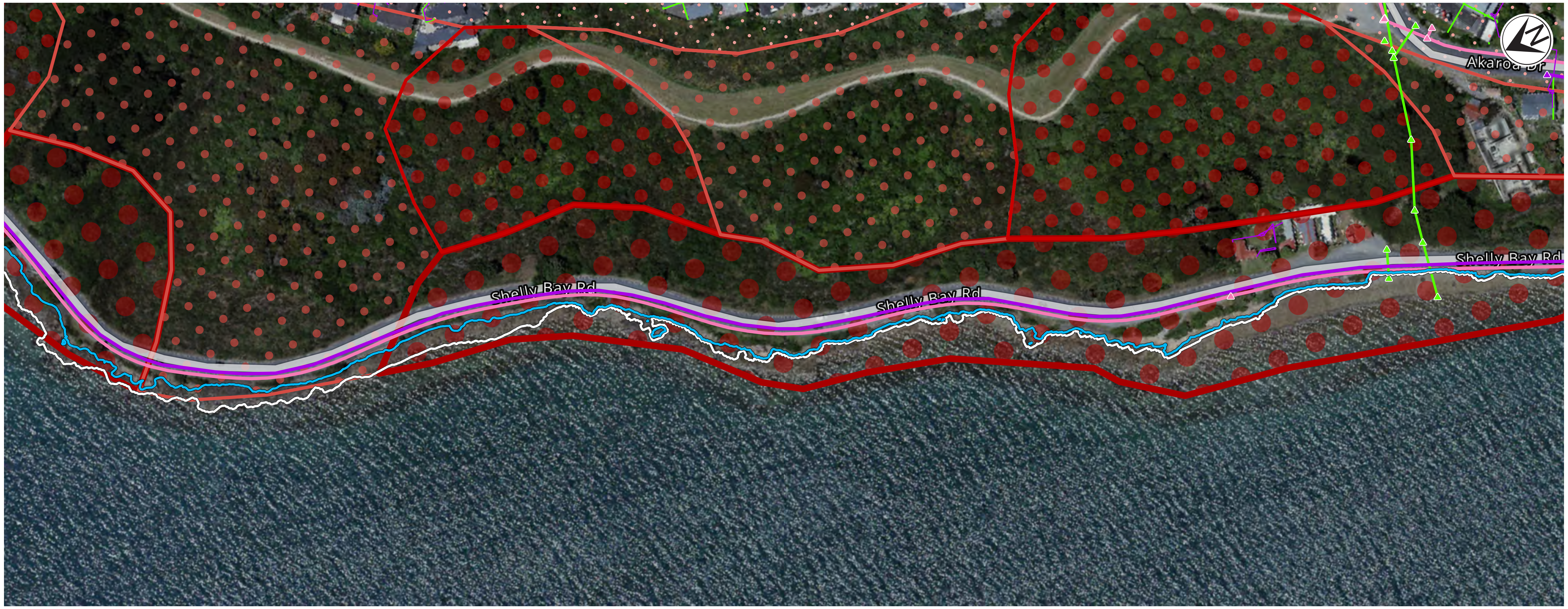
- High
- Moderate
- Low

Three Waters

- Wastewater Pipe
- Stormwater Pipe/ Channel
- Potable Water Pipe
- Wastewater Feature
- Stormwater Feature
- Potable Water Feature

Tidal Levels

- MHWS Line
- MLWS Line



LEGEND (BOTTOM)

Flood Zone Depth

- 0.01 - 0.10m
- 0.10 - 0.50m
- > 0.50m

Marine Features

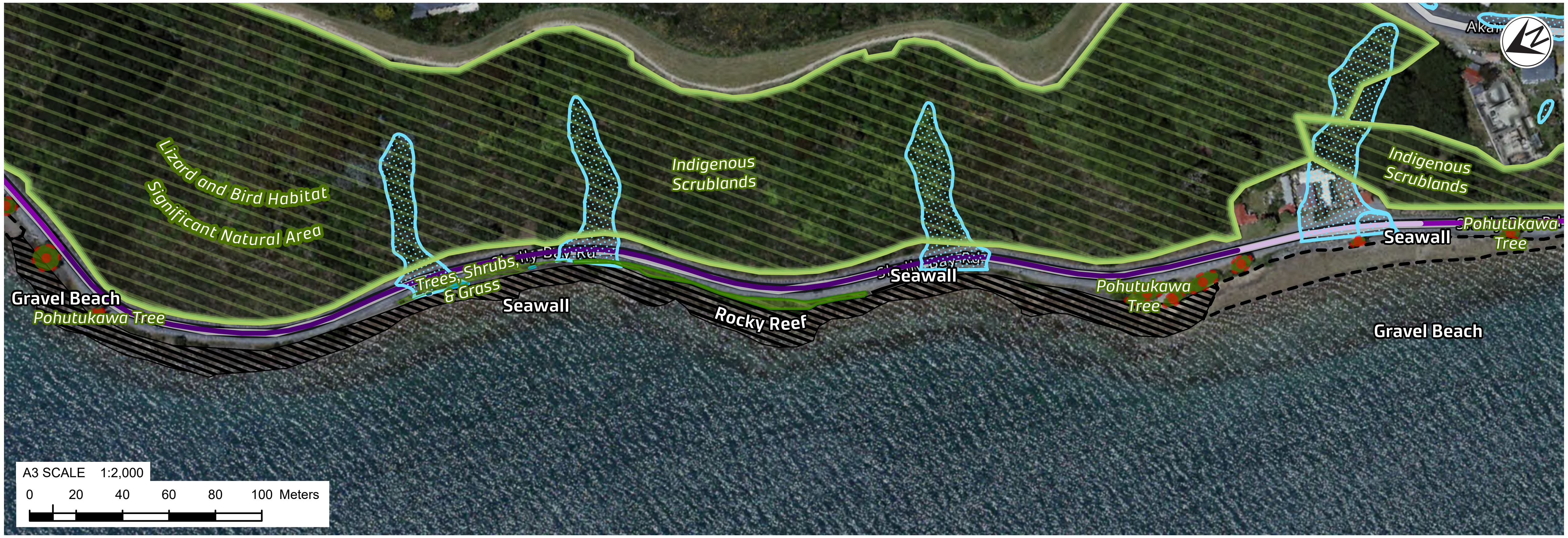
- Gravel Beach
- Rock Revetment (Artifical)
- Rocky Reef
- Seawall

Terrestrial Ecology

- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Slope Classification

- High Risk 'H'
- Moderate Risk 'M'
- Low Risk 'L'
- Very Low Risk 'VL'



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LOCATION PLAN

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CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD UPGRADES
TITLE CONSTRAINTS MAPPING
MAP 4 OF 6
SCALE (A3) 1:2,000 FIG No. FIGURE 4. REV 0

\\ttgroup.local\corporate\Wellington\TT Projects\1014113\1014113.1000\WorkingMaterial\Constraints Model\MapFigures\ShellyBayCyclewayConstraintFigures.aprx Layout: Shelly Bay Cycleway Constraints 2022-Mar-17 3:45 pm Drawn by ANDO

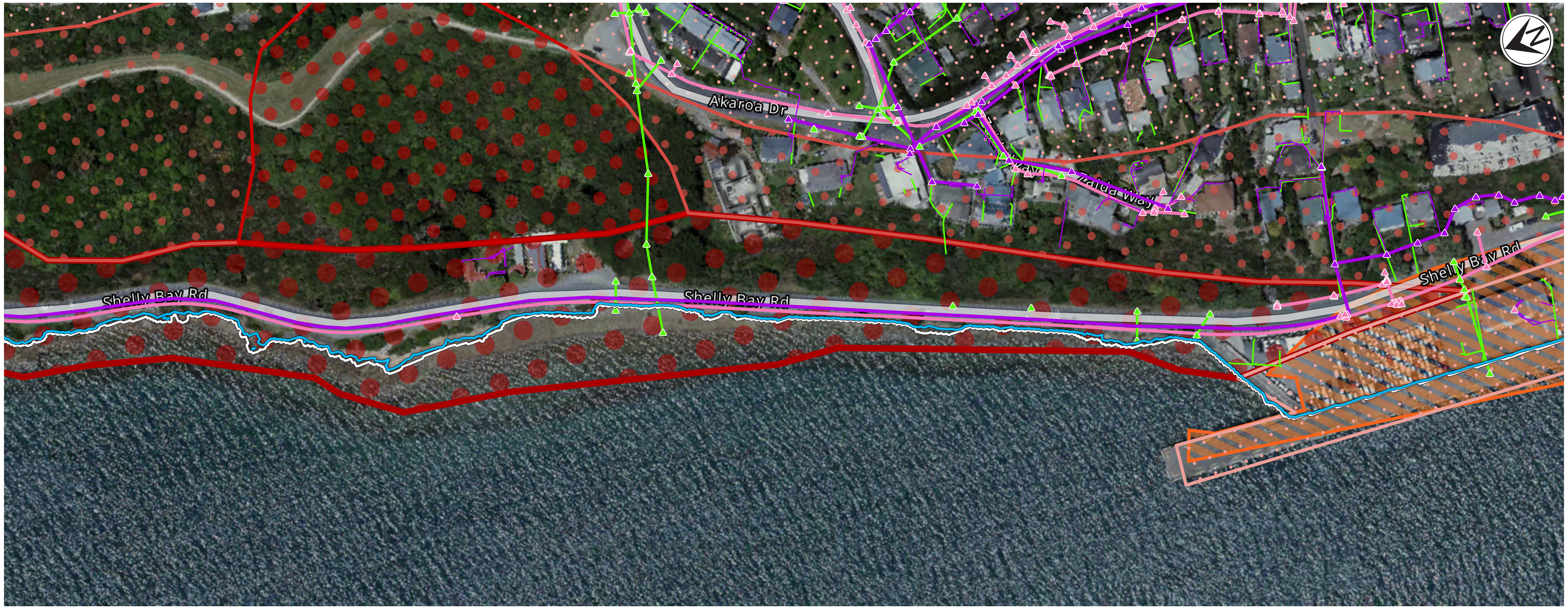
LEGEND (TOP)

Earthquake Induced Slope Failure Risk
- 1 Low
- 2
- 3 Moderate
- 4

Liquefaction Potential
- High
- Moderate
- Low

Three Waters
- Wastewater Pipe
- Stormwater Pipe/ Channel
- Potable Water Pipe
- Wastewater Feature
- Stormwater Feature
- Potable Water Feature

Tidal Levels
- MHWS Line
- MLWS Line



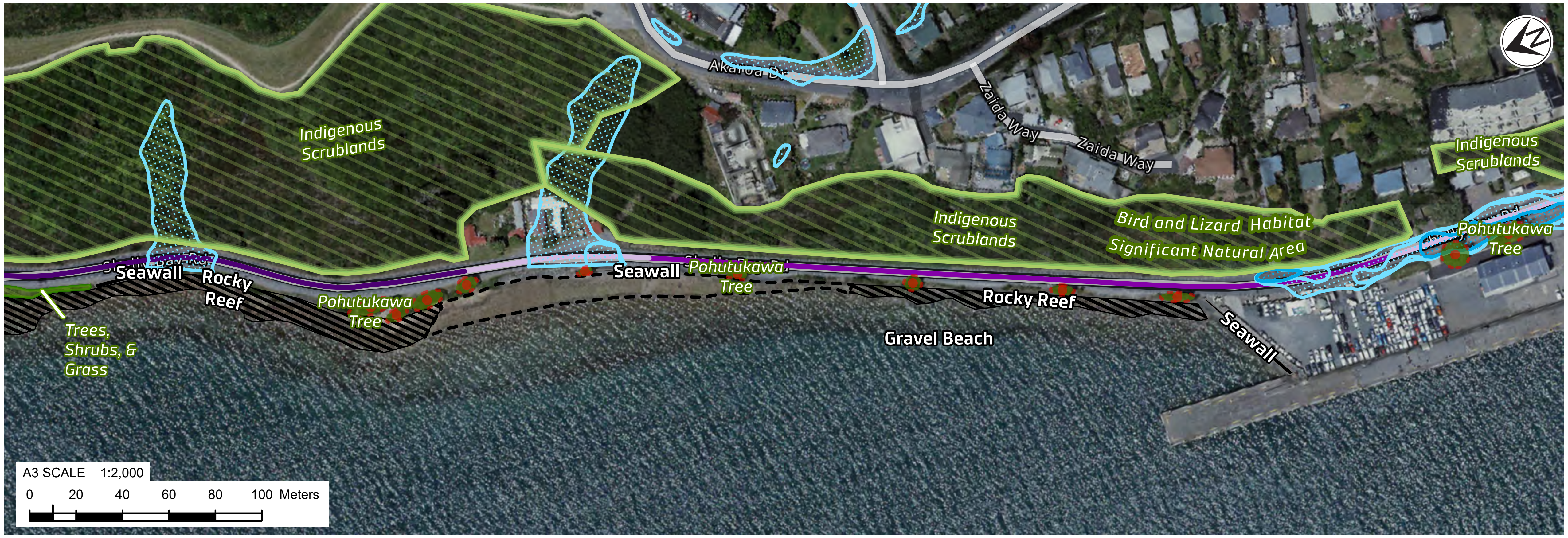
LEGEND (BOTTOM)

Flood Zone Depth
- 0.01 - 0.10m
- 0.10 - 0.50m
- > 0.50m

Marine Features
- Gravel Beach
- Rock Revetment (Artifical)
- Rocky Reef
- Seawall

Terrestrial Ecology
- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Slope Classification
- High Risk 'H'
- Moderate Risk 'M'
- Low Risk 'L'
- Very Low Risk 'VL'



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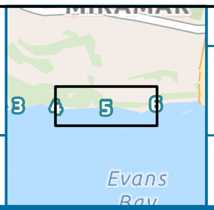
LOCATION PLAN



PROJECT No.	1014113.1000	
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PROJECT: SHELLY BAY ROAD UPGRADES
TITLE: CONSTRAINTS MAPPING
MAP 5 OF 6

SCALE (A3): 1:2,000 FIG No. FIGURE 5. REV 0

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LEGEND (TOP)

Earthquake Induced Slope Failure Risk
- 1 Low
- 2
- 3 Moderate
- 4

Liquefaction Potential
- High
- Moderate
- Low

Three Waters
- Wastewater Pipe
- Stormwater Pipe/ Channel
- Potable Water Pipe
- Wastewater Feature
- Stormwater Feature
- Potable Water Feature

Tidal Levels
- MHWS Line
- MLWS Line

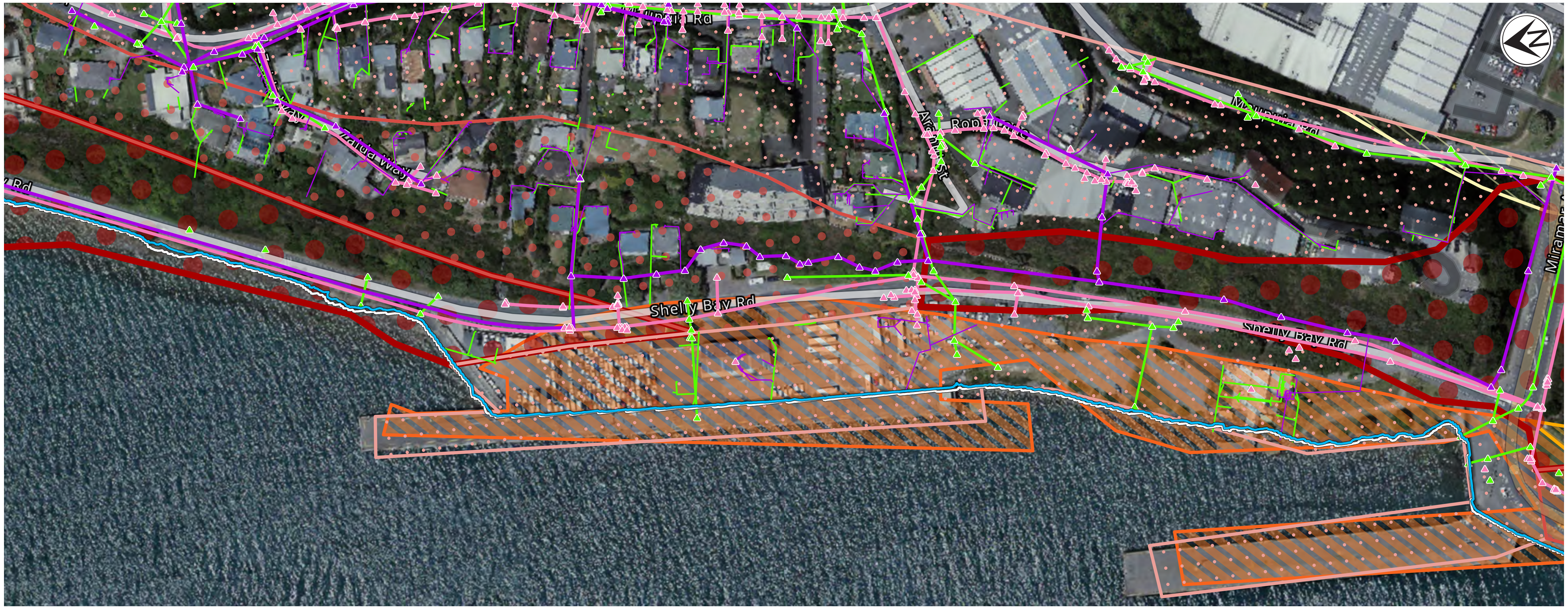
LEGEND (BOTTOM)

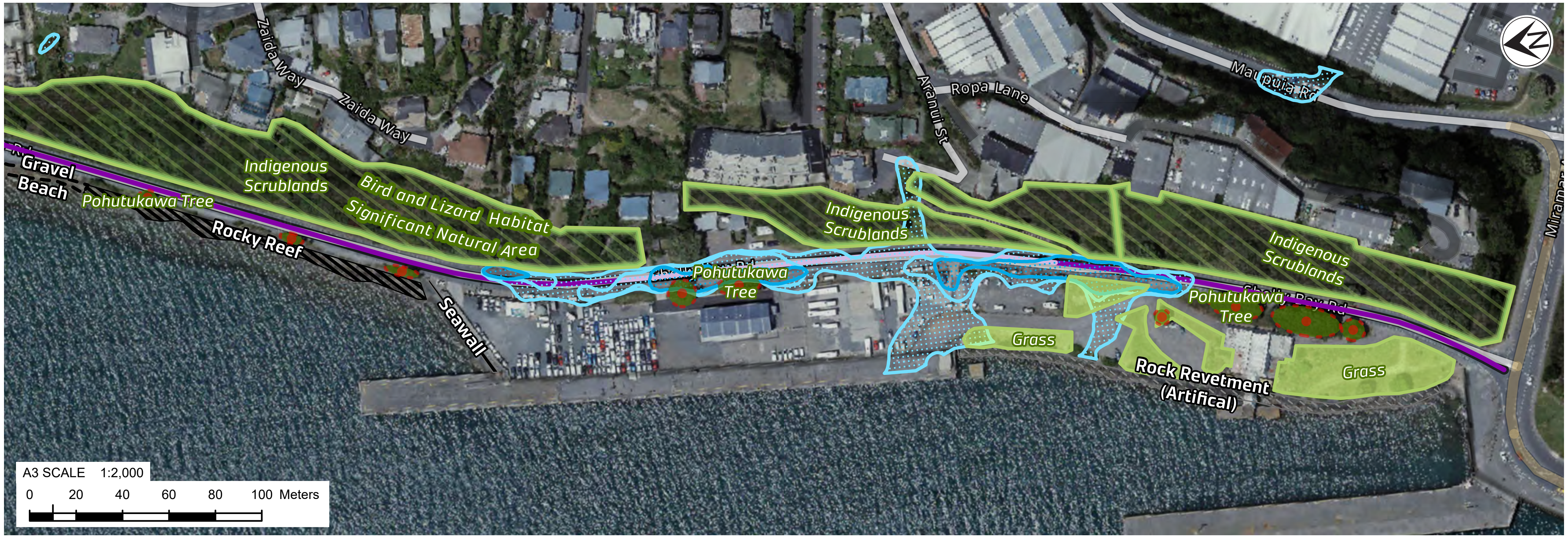
Flood Zone Depth
- 0.01 - 0.10m
- 0.10 - 0.50m
- > 0.50m

Marine Features
- Gravel Beach
- Rock Revetment (Artifical)
- Rocky Reef
- Seawall

Terrestrial Ecology
- Pohutukawa Tree
- Trees, Shrubs, & Grass
- Indigenous Scrublands
- Grass

Slope Classification
- High Risk 'H'
- Moderate Risk 'M'
- Low Risk 'L'
- Very Low Risk 'VL'





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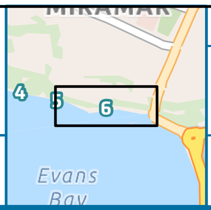
REV	DESCRIPTION	GIS	CHK	DATE
0	First version	ANDO	JORB	17/3/22

LOCATION PLAN



PROJECT No.	1014113.1000	
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CLIENT WELLINGTON CITY COUNCIL
PROJECT SHELLY BAY ROAD UPGRADES
TITLE CONSTRAINTS MAPPING
MAP 6 OF 6

SCALE (A3) 1:2,000 FIG No. FIGURE 6. REV 0

Appendix I: Multi-criteria analysis results

- **Scoring scales**
- **Objectives assessments**
- **Effects and implementation assessments**

Multi-criteria analysis: Scoring scales

	Not evaluated

Objectives

	Highly contributes to achieving the desired outcome
	Contributes to achieving the desired outcome
	Partially contributes to achieving the desired outcome
	Neutral/could detract from achieving the desired outcome but can be managed through design
	Partially detracts from achieving the desired outcome
	Detracts from achieving the desired outcome
	Significantly detracts from achieving the desired outcome

Effects

	Significant positive effect
	Moderate positive effect
	Slight positive effect
	Neutral/no effect
	Slight negative effect
	Moderate negative effect
	Significant negative effect

Implementation

	Neutral/no risk
	Slight negative effect/risk
	Moderate negative effect/risk
	Significant negative effect/risk

Multi-criteria analysis: Objectives assessments

Option	Consented works[1]	Footpath and cycle lanes						Separated path								Shared path								Footpath only							
		1A/1C		1D		1E		2A/2C		2D		2E		2F		3A/3C		3D		3E		3F		4A/4C		4B		4D		4E	
Option description	*1.0-1.5m "shared path" and two traffic lanes*	*Footpath, cycle lanes, and two traffic lanes (Option 1C for local pinch points)*		*Footpath, cycle lanes, and one traffic lane (one-way flow)*		*Footpath, cycle lanes, and one traffic lane (tidal flow)*		*Separated path and two traffic lanes (Option 2C for local pinch points)*		*Separated path and one traffic lane (one-way flow)*		*Separated path and one traffic lane (tidal flow)*		*Separated path with no traffic lanes*		*Shared path and two traffic lanes (Option 3C for local pinch points)*		*Shared path and one traffic lane (one-way flow)*		*Shared path and one traffic lane (tidal flow)*		*Shared path with no traffic lanes*		*Footpath and two shared traffic lanes (Option 4C for local pinch points)*		*Footpath and two shared traffic lanes (time-restricted)*		*Footpath and one shared traffic lane (one-way flow)*		*Footpath and one shared traffic lane (tidal flow)*	
Corridor widening option	As consented	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward	Seaward	Landward
CORRIDOR WIDTH																															
Minimum	*7.0 m*	*11.0 m*		*8.0 m*		*8.0 m*		*10.0 m*		*7.0 m*		*7.0 m*		*6.0 m*		*9.5 m*		*6.5 m*		*6.5 m*		*6.0 m*		*10.0 m*		*10.0 m*		*6.0 m*		*6.0 m*	
Maximum	*7.5 m*	*15.0 m*		*11.5 m*		*11.5 m*		*14.0 m*		*10.5 m*		*10.5 m*		*7.0 m*		*12.0 m*		*8.5 m*		*8.5 m*		*7.0 m*		*12.0 m*		*12.0 m*		*8.0 m*		*8.0 m*	
PROJECT PURPOSE																															
Aligns with Waka Kotahi minimum guidance	×	✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓		✓	
Aligns with the Great Harbour Way – Te Aranui o Pōneke vision	×	✓		✓		✓		✓✓✓		✓✓✓		✓✓✓		✓✓✓		✓✓		✓✓		✓✓		✓✓		×		×		×		×	
PROJECT OBJECTIVES																															
Provide a safe and accessible environment for walking																															
Provide a safe and accessible environment for cycling and micro-mobility																															
Provide access and a safe environment for motor vehicles																															
Achieve a net benefit of ecological values[2]																															
Maintain or improve the public space amenity and the natural aesthetic of the coastal environment																															
Highlight the cultural and historical values of mana whenua and other communities[2]																															
Enhance knowledge and awareness of Motu Kairangi through interpretation, storytelling, art and creativity[2]																															
DOES THE OPTION PASS THE PROJECT OBJECTIVES SCREEN?		✓	✓	✓	✓	×	×	✓	✓	✓	✓	×	×	×	×	✓	✓	✓	✓	×	×	×	×	✓	✓	×	×	×	×	×	×
RELEVANT POLICY OBJECTIVES																															
Great Harbour Way - Te Aranui o Pōneke: guiding principles/ objectives — Provide a safe continuous walking and cycling route for both transport and recreation movement around the perimeter of the harbour between Pencarrow Head and Red Rocks						Not evaluated						Not evaluated		Not evaluated						Not evaluated		Not evaluated				Not evaluated		Not evaluated		Not evaluated	
Be predominantly designed to accommodate a continuous 2-way path																															
Provide a safe cycling commuter route between the communities along the route																															
Be located immediately beside the harbour edge as far as is practicable																															
Be planned and designed in such away as to avoid adverse effects on environmentally sensitive areas																															
Highlight Māori cultural history and values and other historical values[2]																															
Recognise the opportunities of this route to act as a catalyst for new ancillary or development opportunities within the corridor of land it traverses[3]																															
Enhance knowledge and awareness of the Wellington Harbour environment and immediate environs through interpretation, storytelling and art[2]																															
Become a nationally recognised cycleway/walkway, and a key part of the National Cycleway project promoted by the Government																															
Be developed and upgraded over time and in stages as resources allow; the initial focus is on providing at least a basic level of access along the entire length[3]																															
WCC Paneke Pōneke – Bike Network Plan (2021-2031): performance measures — Lower carbon emissions from transport																															
More people choosing to cycle																															
Fewer deaths and serious injury crashes involving people on bikes																															
Lower crash rate per kilometre of travel by bike																															
Improved perception of safe infrastructure for riding bikes[3]																															
The quality of public space that have been improved[2]																															
The extent of the completed bike network																															
Te Atakura – First to Zero: Transport key considerations — Enhancing opportunities for active transport throughout Wellington																															
Raising the quality, capacity, and affordability of public transport across the city[3]																															
Develop targets to strongly increase public transport and active transport use by 2025[3]																															
Sending signals about road use																															
Enhancing development around public transport routes[3]																															
Decarbonise the vehicle fleet[3]																															
LGWM: investment objectives — A transport system that enhances urban amenity and enables urban development outcomes																															
A transport system that provides more efficient and reliable access for users[3]																															
A transport system that reduces carbon emissions and increases mode shift by reducing reliance on private vehicles																															
A transport system that improves safety for all users																															
A transport system that is adaptable to disruption and future uncertainty																															

1 - This option represents the minimum works required under the resource consent for the Shelly Bay development. It is not an option on the long list. Howevever, since these works will be going ahead, it represents the "do-minimum" scenario. It has been included in the MCA for reference. The assessment has been based on publicly available documents about the Shelly Bay development.
2 - The objective was not assessed because the long list options are not at a level of detail that allows for the objective to be evaluated/there is no distinction between the options at this stage that would impact the objective. The objective will be important to consider and assess at a more detailed stage of the project.
3 - The objective was not assessed because it is not relevant to the project.

Multi-criteria analysis: Effects and implementation assessments

Option		**Consented works[1]**	**Footpath and cycle lanes**				**Separated path**				**Shared path**				**Footpath only**	
			1A/1C		**1D**		**2A/2C**		**2D**		**3A/3C**		**3D**		**4A/4C**	
Option description		*1.0-1.5m shared path and two traffic lanes*	*Footpath, cycle lanes, and two traffic lanes (Option 1C for local pinch points)*		*Footpath, cycle lanes, and one traffic lane (one-way flow)*		*Separated path and two traffic lanes (Option 2C for local pinch points)*		*Separated path and one traffic lane (one-way flow)*		*Shared path and two traffic lanes (Option 3C for local pinch points)*		*Shared path and one traffic lane (one-way flow)*		*Footpath and two shared traffic lanes (Option 4C for local pinch points)*	
Corridor widening option		**As consented**	**Seaward**	**Landward**	**Seaward**	**Landward**	**Seaward**	**Landward**	**Seaward**	**Landward**	**Seaward**	**Landward**	**Seaward**	**Landward**	**Seaward**	**Landward**
CORRIDOR WIDTH																
Minimum		*7.0 m*	*11.0 m*		*8.0 m*		*10.0 m*		*7.0 m*		*9.5 m*		*6.5 m*		*10.0 m*	
Maximum		*7.5 m*	*15.0 m*		*11.5 m*		*14.0 m*		*10.5 m*		*12.0 m*		*8.5 m*		*12.0 m*	
EFFECTS																
Transportation	Connection to the adjacent transport infrastructure															
	Effect on pedestrians (LOS, safety, and experience)															
	Effect on cycling and other micro-mobility (LOS, safety, and experience)															
	Effect on motor traffic (LOS, safety, and experience)															
	Effect on public transport (opportunity to future-proof for public transport)															
	Effect on parking capacity and location															
Environmental	Loss of coastal habitat, coastal wetlands, disturbance															
	Loss of terrestrial habitat (indigenous scrubland)															
	Permanent occupation of the CMA															
	Effect on coastal processes															
	Temporary disturbance of foreshore or seabed															
	Discharge of contaminants to water															
Resilience	Ability to withstand the impacts of climate change/adapt to the effects of climate change															
	Natural hazards - slope hazards (landslips)															
	Natural hazards - coastal erosion and edge stability (assumes coastal edge is armoured where needed)															
	Natural hazards - wave overtopping and coastal flooding (assumes no raising of coastal edge)															
Carbon emissions	Embodied carbon															
	Enabled emissions															
Urban design	Public access to the waterfront/ opportunity to experience the CMA															
	Effect on the natural character of the coastline and urban coastal edge															
	Priority for active modes															
	Legibility (clear and simple layout that is easily understood)															
Cultural	Effect on historical and archaeological sites															
Property	Requirement for privately held adjacent land															
	Impact on adjacent land use															
DOES THE OPTION PASS THE EFFECTS ASSESSMENT SCREEN?			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IMPLEMENTATION																
Planning feasibility	Resource consent requirements															
	Consent complexity and approvals risk															
	Consenting timeframe for decision															
	Consenting cost															
Delivery feasibility	Complexity of construction															
	Transportation disruption during construction															
	Delivery timeframe															

1 - This option represents the minimum works required under the resource consent for the Shelly Bay development. It is not an option on the long list. However, since these works will be going ahead, it represents the "do-minimum" scenario. It has been included in the MCA for reference. It provides a benchmark against which the effects and implementation critera for the other options have been assessed. The assessment has been based on publicly available documents about the Shelly Bay development.
2 - Parking effects have been evaluated as neutral because no option allows for parking consistently along the whole length of the corridor. Across all options, additional corridor widening would be required to accommodate parking at most locations along the corridor.

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