EASTERN BAYS SHARED PATH ALTERNATIVES ASSESSMENT

PREPARED FOR HUTT CITY COUNCIL

March 2018

Stantec

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Executive Summary

Throughout the development of the Project, alternatives and options associated with the design were investigated and recorded. Given the geography and terrain in the Eastern Bays area and the lack of any other alternative transport routes, the focus has been on alignments based on Marine Drive.

The Project has been developed on the seaward side of Marine Drive, following a detailed alternatives assessment. In summary, the key reasons for favouring a "coastal edge" option are:

- To avoid the steep hill slopes along large sections of the landward side of the road. Any widening on the landward side would require major earthworks and cuts, especially on the headlands, which would result in significant effects to the environment.
- To avoid adverse effects to properties and dwellings. Much of the landward side of Marine Drive is lined with residences and any road widening inland would bring the road closer to houses resulting in increased amenity effects. It would also require considerable property purchase.
- To reduce car and cycle/pedestrian conflicts. A shared path on the landward side of Marine Drive will both reduce visibility during egress and access of properties and connectivity to the coast while directing people to pass across all the street and property exits onto Marine Drive. Potentially the shared path could cross from inland to coastal options but this would also increase traffic and cycle/pedestrian conflicts.
- To enhance the connection to the coast and recreational benefits. Many areas have existing very poor access, especially at high tide. A coastal option enables public access to be enhanced. It also fits with the Great Harbour Way/Te Aranui O Pōneke which, apart from the section past the port, is designed to follow the coast.
- Ability to integrate with coastal hazard protection and climate change. A coastal location enables the efficient use of natural and physical resources by providing the shared path on an enhanced, consistent and fit-for-purpose seawall option, thereby reducing road closures and increasing the resilience of Marine Drive and the underground services.
- Ability to enhance environmental outcomes through providing a modern seawall and treatment options that respond to environmental effects such as fish passage, natural character, etc.
- Ensuring that the option is affordable and provides medium to long-term benefits.

The widening of the road on the seaward side to accommodate the shared path is therefore the preferred option.

As part of the assessment of alternatives, a number of design options for the shared path were investigated. The options development process undertaken during the Indicative Business case (IBC) identified two factors that principally dictated the form of the Project along the Eastern Bays foreshore. The first factor was the path width that safely accommodates pedestrians and cyclists along the route with the least amount of widening onto the coastal marine area (CMA). The second factor was the types of seawalls and methods that could be used to gain path width where there is currently insufficient width.

A multi-criteria analysis (MCA) process was used to assess options, where options were scored against a number of factors including safety, resilience, upgrade potential, consentability and beach impact. Two options for widening the road (2.5m and 3.5m path widths) were favoured through this process. Feedback through community consultation and alignment to the investment objectives also reinforced the two preferred options.

This report provides a summary of the various alternatives that have been considered and assessed throughout the development of the Eastern Bays Shared Path project. This includes assessments undertaken during the Indicative Business Case Phase, Detailed Business Case Phase, Community Engagement and Consenting Design.

The outcome is providing a seaward side shared path of varying width between 2.5m and 3.5m width, by using the existing shoulder where possible, reallocating road space where feasible, or by constructing a new seawall beyond the existing road pavement edge (or existing seawall edge) in order to provide additional width to create a new shared path.

Where a new seawall is being provided, it will be either a curved wall type for wave redirection (primarily double curve but with sections of both single and triple in response to the seawall height) or rock revetment.

Additional measures will also be provided with the new shared path to enhance the amenity of the new facility (such as beach accesses) as well as measures to mitigate the effects of the work (for example beach nourishment in certain locations and measures to support penguin access and fish passage).

Hutt City Council

Eastern Bays Shared Path Alternatives Assessment

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1. Introduction

The Alternatives Assessment is a report that outlines the various alternatives that have been investigated in preparing the design of the Eastern Bays Shared Path Project (the 'Project') for the purposes of the resource consent application. This report is part of a suite of technical reports in support of the application.

The Hutt City Council (HCC) proposes to construct a 4.4 km Shared Path (cycleway/walkway) along Marine Drive in two sections: between Point Howard and the northern end of Days Bay, and the southern end of Days Bay (Windy Point) to Eastbourne (Muritai Road / Marine Parade intersection). Approximately five thousand people live along the Eastern Bays, with Marine Drive providing the only road and infrastructure service connections.

Residents have identified that the completion of the Eastern Bays Shared Path, and concern about climate change, are the two most important issues facing the Eastbourne Community. The Project presents an opportunity to integrate an efficient response to both of these issues.

Eastern Bays include Sorrento Bay, Lowry Bay, York Bay, Mahina Bay, Sunshine Bay, Days Bay, Rona Bay, Eastbourne village and Robinson Bay. The Project area is shown on the map in Figure 1-1.

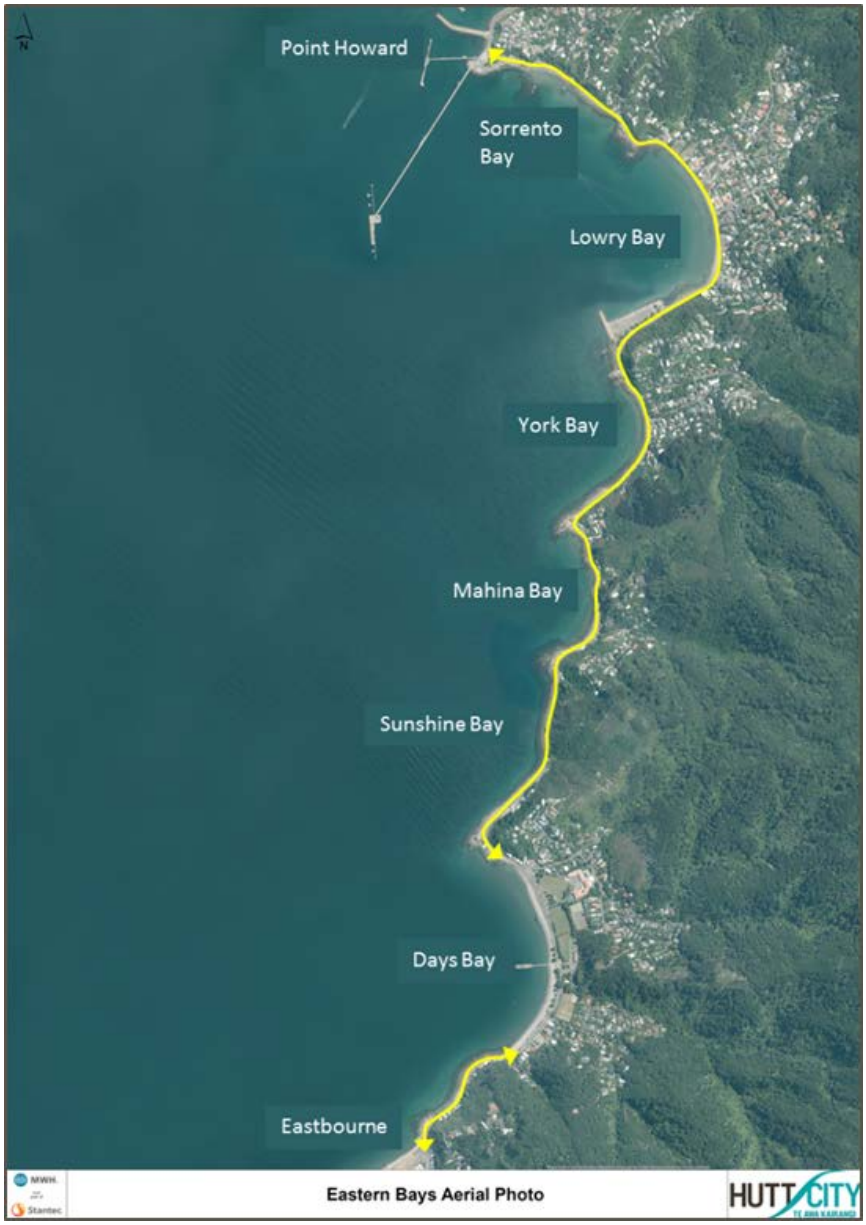

Figure 1-1: Map of Project Area

2. Legal Context

The assessment of options is required to demonstrate that alternatives associated with location and methods have been adequately assessed against planning provisions. The following planning provisions set out requirements for the assessment of alternatives.

An assessment of the proposed project works against these planning provisions is provided in the Statutory Assessment (Appendix S of the application).

2.1 RMA requirements

Schedule 4 to the RMA requires, if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity.

Schedule 4

6. Information required in assessment of environmental effects

(1) An assessment of the activity's effects on the environment must include the following information:

a) if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity:....

2.2 New Zealand Coastal Policy Statement

The New Zealand Coastal Policy Statement (NZCPS) 2010 states that reclamation of land in the coastal marine area should be avoided unless there are no practicable alternative methods of providing the activity. Policy 10 states that:

'Avoid reclamation of land in the coastal marine area, unless:

a. land outside the coastal marine area is not available for the proposed activity

b. the activity which requires reclamation can only occur in or adjacent to the coastal marine area;

c. there are no practicable alternative methods of providing the activity; and

d. the reclamation will provide significant regional or national benefit.'

2.3 Proposed Natural Resources Plan for the Wellington Region

The proposed Natural Resources Plan for the Wellington Region states under Policy P139: Seawalls

'The construction of a new seawall is inappropriate except where the seawall is required to protect:

(a) existing, or upgrades to, infrastructure, or

(b) new regionally significant infrastructure, and in respect of (a) and (b):

(c) there is no reasonable or practicable alternative means, and

(d) suitably located, designed and certified by a qualified, professional engineer, and

(e) designed to incorporate the use of soft engineering options where appropriate.'

3. Overview of Alternatives

Investigations were carried out at two stages of the Project – the Indicative Business Case (IBC) stage and the Detailed Business Case (DBC) stage. These stages are aligned with the Business Case Approach (BCA) followed by the NZ Transport Agency and its investment partners to guide planning, investment and project development processes.

In addition to the requirements under the BCA, alternatives were also assessed to meet the requirements of the RMA.

Underpinning the investigation around the alternatives is having an understanding of the shared path widths and level of safety and user level of service performance that the project aims to achieve. Section 7.2 below reviews the path width and outlines the guidance and standards pertaining to path width.

Alternatives investigated for this project are summarised in Table 3-1 below.

Table 3-1: Summary of Alternatives

Option		Applicable to seawalls	Applicable to shared path	Addressed in options assessment (MCA)
1	Do minimum	Ongoing limited maintenance of seawall	No shared path proposed	Rejected after assessment
2	Shared Path location along Marine Drive			
2a	• Landward side Shared Path	Excluding seawall upgrades	Shared path proposed	Rejected after assessment
2b	• Partial landward/partial seaward side shared path	Including limited seawall upgrades	Shared path proposed	Rejected after assessment
2c	• Carriageway allocation for Shared Path,	Including limited seawall upgrades	Shared path proposed	Made some design changes to the carriageway at York Bay
2d	• **Seaward side Shared Path**	**Including seawall upgrades**	**Shared path proposed**	✓
3	Inland shared path route	Excluding seawall upgrades	Only a shared path, or could be combined with "Do minimum" or "staged seawall upgrades"	Rejected after assessment
4	Design Options			
4a	• Path widths	Including seawall upgrades	Shared path proposed	✓
4b	• Treatment options (wall types)	Including seawall upgrades	Shared path proposed	✓

Option		Applicable to seawalls	Applicable to shared path	Addressed in options assessment (MCA)
4c	• Site specific alternatives	Including seawall upgrades	Shared path proposed	Considered during preliminary design stage
4d	• Design features	Including seawall upgrades	Shared path proposed	Considered during preliminary design stage
5	Construction methodologies (alternative methods)	Including seawall upgrades	Shared path proposed	Considered during preliminary design stage

The alternatives are discussed in detail in sections 4 to 9 below.

4. Option 1: Do minimum

The "Do minimum" option was considered as part of the IBC (Option 1, refer to section 7.2.2). This option would involve only replacing the seawall with less than 5 years remaining life[1]. This option was considered more of a comparison than a realistic option for the delivery of a shared path as it would leave in place sections of the route where there is insufficient width for the passage of a pedestrian or cyclist. While it would benefit the short term structural integrity of the seawall, there would be no or limited benefits[2] to:

- Improving safety for pedestrians and cyclists;
- Increasing the numbers of pedestrians and cyclists;
- Improving access to the beaches;
- Increasing the availability of the route; and
- Provide a first phase of an adaptable solution for climate change and sea level rise.

On the basis of these factors, this option was rejected following MCA analysis.

5. Option 2: Shared Path location along Marine Drive

Currently Marine Drive road provides a single lane in each direction, with intermittent shoulders of varying widths that are generally narrow. In some locations a formalised footpath exists in sporadic sections on the landward side, while a shoulder of varying width is available for most of the seaward side, but which reduces to almost no width in some sections.

Any options to provide a shared path in the Marine Drive corridor required careful consideration of the spatial availability and effects. There were four main options for share path located along Marine Drive:

- Landward side option
- Partial landward / partial seaward option
- Carriageway allocation
- Seaward side option

These options are discussed below:

[1] Based on the seawall assessment indicated in the Base Information Plans (Appendix M of the Resource consent Application).
[2] Indicative Business Case investment objectives (Eastern Bays Shared Path Indicative Business Case, Stantec, January 2017).

5.1 Option 2a: Landward side option

5.1.1 Landward side assessment

A landward side path option for the full extent (Point Howard to Eastbourne) would mean path users accessing the facility and staying on the landward side for the full extent. The location of a 3.5m wide shared path on the landward side of Marine Drive is shown on plans in Appendix A (Drawing Nos: 80509137-01-001-C300 – C307 Rev A).

In some locations the opportunity for a landward side path appears positive due to the cadastral property boundaries being set back from the carriageway – with the benefit of this being property acquisition could be minimised or avoided in these areas[3].

Furthermore, a landward side option could use some of the sporadic landward side footpath already in place and provide for a more continuous facility. A further benefit of a landward side option could be that the existing seaward side parking could be maintained with no loss of parking places, while also avoiding any encroachment into the coastal area.

On this basis an initial option was developed which considered a landward side path . There are various ways that a landward side path could be developed and for the concept work a path width of 3.5m was used offset from the landward side white edge line to allow a concept option to be developed.

In developing a landward side concept option it is apparent that there are some major challenges to be considered. While in some parts of the corridor the cadastral boundary is set back from the carriageway, this is not the case throughout. There are locations where the property boundaries are very close to the existing traffic lanes, meaning that property acquisition is required from multiple properties. There is also another significant factor to consider in terms of topography. In numerous locations, the landward side path will require extensive earthwork cuts to provide space for the path. This is most frequent at the headland points between the bays where the landform tends to be quite severe with close to vertical escarpment faces close up to the edge of the road.

The following table indicates the approximate extent of land take and earthwork cuts that will be needed to construct a shared path on the landward side. Refer to the plans in Appendix A of this report.

Table 5-1: Land take and earthworks cuttings

Street Name	House No.	Extent of Cut on private land (m^2)	Extent of land take (m^2)	Structure potentially affected on property
Westhill Road	14	54		
Marine Parade	115	36		
Marine Parade	117	26		
Marine Parade	119	41		
Marine Parade	121	17		✓
Marine Parade	141	227		
Marine Parade	143	294		
Marine Parade	201	175		
Wilmore way	1		28	✓
Marine Parade	208		14	✓
Marine Parade	211		13	✓
Marine Parade	212		9	✓
Marine Parade	214		214	✓
Marine Parade	215		34	✓

[3] In many locations where the cadastral boundaries are set back from the road and space is theoretically available, the terrain is quite challenging and in many cases adjacent residents have taken to using this area and managing the vegetation (generally the areas are not sealed but heavily vegetated).

Street Name	House No.	Extent of Cut on private land (m^2)	Extent of land take (m^2)	Structure potentially affected on property
Dillon Street	15a		5	✓
Dillon Street	13b		50	✓
Marine Parade	217		52	✓
Marine Parade	219		69	✓
Marine Parade	222		75	✓
Marine Parade	224		10	✓
Marine Parade	225		75	✓
Marine Parade	226		83	✓
Marine Parade	227		14	✓
Marine Parade	228		100	✓
Cheviot Road	1a		72	✓
Cheviot Road	2		112	✓
Marine Parade	231		63	✓
Marine Parade	232		50	✓
Marine Parade	234		65	✓
Marine Parade	235		66	✓
Marine Parade	237		26	✓
Marine Parade	238		33	✓
Marine Parade	239		31	✓
Taumaru Ave	1		60	✓
Taumaru Ave	1-2/2		52	✓
Gill Road	4		76	✓
Gill Road	6a		11	
Gill Road	7a		11	
Gill Road	8a		11	
Marine Parade	249	232		
Waitohu Road	53	96		
Waitohu Road	39	6		
Waitohu Road	31	184		
Waitohu Road	29	138		
Waitohu Road	25	41		
Marine Parade	332-Lot7	46		
Marine Parade	332-Lot8	88		
Rangiuru Road	5	79		
Rangiuru Road	4	30		
Marine Parade	409	115		
Marine Parade	411	82		

Street Name	House No.	Extent of Cut on private land (m^2)	Extent of land take (m^2)	Structure potentially affected on property
Marine Parade	419	177		
Marine Parade	415	51		
Marine Parade	417		49	✓
Marine Parade	419-421		35	✓
Marine Parade	427		98	✓
Marine Parade	425		17	✓
Marine Parade	445		88	✓
Mahina Road	1		7	✓
Mahina Road	2		78	✓
Marine Parade	417		98	✓
Marine Parade	455		89	✓
Marine Parade	501	55		
Marine Parade	502	117		
Mahina Road	38	21		
Mahina Road	507a	68		
Mahina Road	507	31		
Marine Parade	605	10		
Marine Parade	623		52	✓
Marine Parade	624		20	✓
Marine Parade	625		10	✓
Marine Parade	627		15	✓
Marine Parade	628		111	✓
Marine Parade	705		23	✓
Marine Parade	729		22	✓
Marine Parade	731		20	✓
Marine Parade	735		16	✓
TOTAL		**2537**	**2432**	

5.1.2 Land acquisition

Initial investigation work suggests property acquisition (including land required for cut) for a landward side option would be required in over 80 property parcels. In some locations where acquisition is needed then just the land required could be purchased (i.e. a partial purchase of a wide frontage strip). In other locations, dwellings are close to the road edge and therefore acquisition would require the purchase and removal of the entire dwelling to make space for the shared path. It is estimated that at least five of the property acquisitions would require full purchase and removal of a dwelling.

A very rough order costing of the property acquisition has been undertaken based up a cost of \$1,000/m^2 of acquisition and with approximately 5,000m^2 of acquisition being required.

In addition, five properties are estimated to require full acquisition. The value of these homes has been estimated at $800,000 each[4] . An overall property acquisition cost of $9M is estimated to supply the land for the shared path.

Irrespective of the costs and affordability of the land acquisition, the acquisition process from this number of properties is expected to be resisted by the local community.

5.1.3 Earthworks cuttings

To continue the path through these sections would require extensive cuttings that extend back some distance. While no geotechnical investigation or assessment of these cuts has been undertaken, experience in the Wellington region suggests such materials could be moderately to highly weathered greywacke rock, potentially necessitating cut angles of 45 degrees which extend back into the escarpment laterally by some distance. Approximately 2800m^2 of cut will be required (on private properties as well as within the road corridor). There is a cost, stability and visual effect of such works that require consideration. Major earthworks would result in significant risks to the environment. These risks include the potential for landslips due to land disturbance and the runoff of sediment laden water during excavation.

The visualisation below illustrates the earthworks cuttings for a landward side option.

Figure 5-1: Visualisation of landward side option

Concept plans and visualisations of the landward side path have been developed which include approximate footprints of the headland cuts that could be required. These are included in Appendix A and Appendix B of this Alternatives Assessment report.

5.1.4 Conflict points

A further drawback of the landward side path is the frequency of private accessways and side roads that the path must cross. This interrupts the continuation of the path and introduces a greater number of conflicts with vehicles. These conflicts are manageable and could be designed so as to limit the safety risk but this does break up the continuity of the path and introduces a level of conflict that would be preferable to avoid and which could reduce the level of attractiveness for road users. This solution would not create the high quality facility that is being sought.

On the basis of these factors, a full landward side option was rejected.

[4] Based upon the August 2018 data supplied by homes.co.nz https://blog.homes.co.nz/wellington-median-house-price-by-suburb/ which lists house prices in Lowry Bay averaging $1.1M and Eastbourne being $0.8M. Therefore a figure of $0.8M is considered conservative given these are coastal frontage properties and therefore could be expected to be of higher value than the overall Eastbourne average.

5.2 Option 2b: Partial landward / partial seaward option

Another path option for consideration was a path that is split between partially landward and partially seaward; such an option could be used to maximise the use of the available space possibly without major road reconstruction costs or property acquisition.

With such an option, the path would need to switch from side to side as its travelled longitudinally along Marine Drive. This could allow sensitive and highly valued existing locations to be avoided or the effects of the path reduced.

This option would however necessitate the provision of multiple crossing points to get path users from one side of the road to the other. Crossing facilities would likely need to be fairly formalised to ensure crossing safety.

This option has been rejected for a number of reasons:

- It provides very poor continuity for path users;
- It introduces (potentially) a very high number of conflict points in a high volume environment (and in some locations also a high speed environment);
- In some locations insufficient width exists to provide a facility either on the landward side or the seaward side so would still require either encroachment or property acquisition, somewhat defeating the purpose of the option;
- This option introduces some significant delay effect to road vehicular traffic in terms of stop / start requirements at controlled crossing points which is not desirable on the only road corridor into and out of Eastbourne;
- It does not provide the high quality and safe active modes facility that is being sought by HCC; and
- Does not provide a first phase of an adaptable solution for climate change and sea level rise.

5.3 Option 2c: Carriageway allocation

An assessment of the current carriageway width including the road width and shoulder width was undertaken as part of the options development process. It also included an assessment of the condition of the seawalls. This information is shown on a series of plans (see Base Information Plans, Appendix M) using a colour coding system to represent the different shoulder widths/conditions along the entire length of the project. The road and shoulder widths vary considerably over the road corridor.

5.3.1 Principles

A number of general principles associated with carriageway reallocation were considered:

- Limited or no property acquisition would be undertaken as it was not considered economically viable or desirable by HCC (refer to findings in section 5.1.2).
- In the HCC district plan, Marine Drive is classified as a 'Minor District Distributor' which has an associated minimum carriageway width in the plan rules of 16m. Given this is an existing situation that does not meet the road hierarchy requirements, we have assumed Austroads standards for traffic lane widths of 3.5m are required generally.
- Marine Drive is the only access road along this coastal area of Eastbourne.
- The 3.5m width is an urban arterial width and Austroads does not recommend widths below this unless they are low speed roads with low truck volumes. Given the speeds of traffic on this route, along with high volumes and high bus numbers, any width below 3.5m is not recommended.
- Austroads also recommends an absolute minimum of 0.5m sealed shoulder in addition to these lane widths. In many locations this is also not provided along Marine Drive.
- The desirable minimum width of a footpath is 1.2m (Austroads Guide to Road Design Part 3: Geometric Design Section 4.11.3).
- Curve widening is also recommended in Austroads for tight radius curves as is the case on Marine Drive with widening of between 0.2m and 0.8m (per lane) recommended depending on the individual radius of the horizontal curve.
- On this basis, reduction in lane widths along Marine Drive is not considered a viable option (in terms of safety and operation) as lane widths are almost entirely 3.5m or less throughout i.e. already at or below

the minimum standard described in Austroads, and do not include sufficient curve widening, and in many instances the absolute minimum road shoulder.

- Where a landward side footpath or shoulder does exist, Stantec are not supportive of the removal/reduction of this if it will create problems for driveway access (i.e. drivers nosing out to aid visibility) (refer to findings in section 5.1.4).

5.3.2 Assessment

The following table shows a station by station assessment for using the landward side shoulder/footpath (within the existing carriageway) in order to limit widening the road on the seaward side. The table records comments for each location and whether road space reallocation can be included in the preliminary design.

Table 5-2: Carriageway Reallocation Assessment

Station		Length (m)	Location	Comments	Landward side widening (within existing carriageway) proposed?
Start	End				
580	700	120	Point Howard	Wide landward shoulder but no beach encroachment	No
700	760	60	Point Howard	Wide landward side shoulder but narrowing at Stn 760 means realignment not possible (design sketches have been undertaken here)	No
760	850	90	Point Howard	Narrow landward side shoulder of 0.5m - insufficient room to reallocate space	No
850	1020	170	Point Howard	Narrow landward side shoulder of zero to 0.5m - insufficient room to reallocate space	No
1020	1080	60	Sorrento	Reallocation of road space currently proposed to reduce beach encroachment	Yes (included in preliminary design)
1080	1180	100	Headland	Narrow landward side shoulder of 0.5m - insufficient room to reallocate space	No
1180	1230	50	Lowry	Short section on curve, geometric challenges and significant concern regarding wave overtopping	No
1230	1800	570	Lowry	Narrow footpath (<1m) on landward side required to facilitate driveway access, no reduction to this deemed acceptable	No
1800	1950	150	Lowry	Narrow landward shoulder, and steep escarpment on landward side, not feasible to widen landward side	No
1950	2180	230	Reserve	No seawall works	No
2180	2350	170	Headland	Narrow landward shoulder, heavily vegetated and steep bank on landward side, not feasible to widen landward side	No
2350	2475	125	York	Narrow footpath (<1m) on landward side required to facilitate driveway access, no reduction to this deemed acceptable	No
2475	2570	95	York	Reallocation of road currently proposed to reduce beach encroachment	Yes (included in preliminary design)

Station		Length (m)	Location	Comments	Landward side widening (within existing carriageway) proposed?
Start	End				
2570	2910	340	York	No wall works here (already completed)	No
2910	2990	80	Mahina	Could possibly realign road here to avoid encroachment over length of 20-30m - would result in loss of landward side street parking. Not progressed given non-beach location and limited extent achievable	No
2990	3200	210	Mahina	Narrow shoulder (approx <0.5m) and bank on landward side. Shoulder width required for driveway access	No
3200	3280	80	Mahina	Shoulder/path widens to approx. 0.5-1m around curve. Amount of width gain over short length is negligible (estimated at 100-200mm)	No
3280	3950	670	Mahina/ Sunshine	Narrow shoulder (generally around 0 .5m but with some localised fluctuation) not feasible to widen to landward side	No
3950	4020	70	Sunshine	Possible to move road over and remove shoulder outside service station. However, would 'kink' road alignment over a short length. Estimate could save up to 0.5m over 50m length. Not proposed as limited encroachment on beach at this location (and existing revetment in place along part)	No
4020	4980	960	Days Bay	No works	N/A
4980	5370	390	Windy Point	Narrow footpath (generally approx. 1m in HCC road corridor) on landward side required to facilitate driveway access, no reduction to this deemed acceptable	No
5370	5500	130	Windy Point	Wider footpath on landward side but sufficient space on seaward side to provide path plus parking with no encroachment	No

Based on the above information, carriageway reallocation was deemed unsuitable as a major treatment strategy due to there not being sufficient road width/space available in many locations. Reallocation was considered for localised sections where there is sufficient width to do so, provided that it does not result in unacceptable consequences (such as the tightening of road curvature or creating driveway access difficulties for residents). Examples of where this has been carried out is in York Bay where the preliminary design was amended (further details outlined in section 8.4).

5.4 Option 2d: Seaward side option

A shared path option on the seaward side of Marine Drive has a number of challenges in terms of limited space and the interface with the coastal area (beaches and rocky outcrops). For some of the route there is sufficient width in the road shoulder or the headland areas to provide a path without extensive widening, but in places this drops to virtually nothing beyond the seaward side white edge line (for example in parts of Lowry Bay).

In many places, a seaward side shared path would necessitate a new seawall being constructed and to provide the width needed would result in the new seawall being pushed further out towards the tidal area than is currently the case.

A positive aspect of a seaward side path is that it has very few accessways or side road interruptions and can provide an almost continuous path with no vehicle crossing conflicts (though there are some exceptions to this). Conversely, a seaward side path would necessitate the removal of a number of areas currently used for car parking and which are already in short supply.

Furthermore, this seaward side option improves, and provides a basis for future opportunities for protecting the resilience of the road and underground services by upgrading the supporting seawalls. Marine Drive provides the only road access to the Eastern Bay suburbs and is therefore a key transport route for the region.[5] Key infrastructure services including the main outfall sewer pipeline (MOP) are located within the road corridor.[6] The MOP is an 18km long pipeline that conveys secondary treated wastewater from the Seaview Wastewater Treatment Plant (which services 146,000 residents and a large number of local industries) to the outfall at Bluff Point, near Pencarrow Head.[7] The MOP is regionally significant infrastructure, and along with the road access and other services are important lifeline utilities for the wider community.

The road is currently vulnerable to closure, and/or reduced operation, in part due to wave overtopping because of the current state of coastal edge. The existing seawall in places has a residual life of less than 5 years and, as it has been built on an ad hoc nature over time, is vulnerable to failure and does not provide consistent, nor effective, storm mitigation. Over time sea levels will rise, aggravating the situation. MfE(2017) projections[8] forecast a 16 cm sea level rise by between 2030 and 2040 (depending on global emissions trajectories). Further sea level rise will increase the frequency of all coastal inundation with sea level rise of 0.5 m forecast to be reached sometime between ~2070 and ~2110 and sea level rise of 1.0 m sometime after ~2115.

The seaward side option recognises the ongoing processes of managing coastal values in the face of climate change and sea level rise and related pressures faced by Greater Wellington Regional Council and HCC. While the proposal is not a solution to the effects of sea level rise, this seaward side option enables a first step in a potential series of incremental upgrades that will assist in providing protection to the road (and underground services) and is an adaptation option in addressing the effects of sea level rise along this section of the coast. It does not preclude future options and has been designed to enable additional protection to be added onto the top of it in the future if that is considered appropriate (i.e. building up the outer edge of the wall). By increasing resilience now it also provides some time for the community to decide how best to respond to sea level rise.

Based on the assessment of the various alternatives for a shared path location along Marine Drive, the seaward option is considered to be the most practicable alternative.

6. Inland shared path route

An inland shared path was not considered as an option for this project given that the key drivers for the project is to develop a safe and integrated walking and cycling facility along Marine Drive by providing enhanced connections:

- within the individual bays (for recreation and access);
- between different bays (to shops, schools, recreation, etc.); and
- to and from Lower Hutt and beyond (to work, school or for recreation etc.).

Due to the terrain and geographical constraints around the Eastern Bays, options for providing a shared path route between Point Howard and Eastbourne are very limited. Possible route options are extremely constrained due to the harbour location on the western side of Marine Drive and then the terrain on the eastern side (East Harbour Regional Park) characterised by native bush forest and steeply sloping topography. If an inland route was proceeded with, irrespective of all of the environmental implications and challenges, the attractiveness for use is highly questionable due to the steep grades and lack of

[5] Marine Drive is classified as a "Primary Collector" under the One Network Road Classification (ONRC) with traffic volumes up to 8,000 vehicles per day.

[6] It is currently believed the MOP is in good working order, and under existing conditions will remain so for the foreseeable future. There is allowance in long term budgets for replacement or renewal of the pipeline insitu. (Seaview Wastewater Treatment Plant, Main Outfall Pipeline, Condition Report dated August 2016, MWH).

[7] Any damage to the MOP will result in emergency overflows into the Hutt River via the Waiwhetu Stream.

[8] Ministry for the Environment Coastal Hazards and Climate Change Guidelines, 2017. http://www.mfe.govt.nz/publications/climate-change/coastal-hazards-and-climate-change-guidance-local-government

proximity to the coastline. On the basis of these significant constraints, the only feasible option for a shared path is to utilise the existing transport corridor of Marine Drive.

An additional driver for the shared path is to provide the basis for future opportunities for protecting the resilience of the road and underground services by upgrading the supporting seawalls, as discussed in section 5 above. An inland route would not offer these opportunities.

7. Design Options

During the IBC stage, as part of the assessment of alternatives, a number of design options were investigated following the premise that the path would follow the seaward side of Marine Drive. The options development process undertaken during the IBC stage identified two factors that principally dictated the form of the shared path along the Eastern Bays foreshore. The first factor was the path width that would accommodate pedestrians and cyclists along the route with the least amount of encroachment into the coastal marine area. The second factor was the types of seawalls and reclamation methods that could be used to gain width where there is currently insufficient road width.

7.1 Guiding Principles of Options Development

As part of the options development, the wider project team, including community group representatives, were asked to provide recommendations on key or desirable characteristics that a shared path should endeavour to provide.

The following high level design principles were discussed, but it was recognised that it would be challenging for any option to meet all the principles identified. Nevertheless, the identification of these features assisted in option identification and assessment:

- Consistency in width and surface throughout
- York Bay solution is a good starting point (existing seawall)
- Minimum width should cater for two cyclists going in opposite directions
- A shared path (cycleway and walkway) is desired
- Single side contraflow shared path, rather than unidirectional on each side of the road
- Parking to cater for the wider community, but lesser priority than the path itself
- Avoid encroachment on the beaches, if possible
- Consider realigning the centre line on the roads to gain additional space
- Retain trees along the route as much as possible
- Avoid legal speed reductions on road – it has been considered previously
- Fencing is undesirable on the seaward side
- Consider options for separating path from traffic lanes
- Avoid point obstacles
- Consider crossing points for accessing the path
- Accessible for all wheels (e.g. skateboards, scooters, wheelchairs)

It is noted that while the focus of the Project is to construct a shared path, the design includes elements that incorporates iterative long term management principles to address sea level rise.

7.2 Path widths

A key output of the IBC was to identify the most suitable width for the shared path. From this the specific treatment options to achieve this width were considered.

7.2.1 Path Width Guidance and Standards

Throughout the business case process a variety of path widths were considered and subject to local community and wider public consultation. A review was undertaken in relation to the final width of the shared path that will be constructed relative to various standards available, to determine the alignment.

The path is a separated (or protected) shared path, which can be used by pedestrians, cyclists and users of mobility devices and wheeled recreational vehicles. On this basis it is necessary to consider the guidance provided for both protected cycle paths and also for shared paths. The NZTA National Cycle Network Design Guidance - Stage 1 Report - Best Practice Review (2015) (https://www.nzta.govt.nz/assets/Walking-Cycling-and-Public-Transport/docs/national-cycle-network-design-guidance-stage-1-report-best-practice-review.pdf) is helpful in documenting the various standards and guidance that exist for these paths. A number of tables relating to the multitude of guidance available is reproduced in Table 7-1, Table 7-2 and Table 7-3 in the following pages of this report.

Table 7-1: Guidance for shared paths (reproduced from Table 5.17, NZTA/Abley/ViaStrada, 2015)

	National	NZ Local Guidance	International
Width	**Austroads: GTR6A (Section 7.5.3)** • Local Access path: 2.5m-3.0m • Commuter path: 2.5m-4.0m • Recreational paths: 3.0m-4.0m NB. Lesser/wider widths may be required if cyclist volumes and operational speeds are low or if the number of cyclists and pedestrians are very high **NZTA Pedestrian Planning and Design Guide (Table 14.13)** • Local Access Path: 2.0-2.5m (2.5m desirable) • Commuter Path: 2.0-3.5m(3.5m desirable) • Recreational Path: 3.0-4.0m (3.5m desirable) • Where use uncertain, provide 3.0m **Bridging the Gap Urban Design Guidelines** • No less than 3.0m	**ATCOP (13.4.2)** • 3.0m desirable minimum. • 2.5m absolute minimum • Providing less than 2.5m should be done in exceptional circumstances only and for a short distance only (e.g. 10m). • Where a high number of users (including pedestrians) are expected wider paths should be considered. **The Nelson Land Development Manual (Table 4.15)** • Local Access (travel between local roads): 2.0m • Community Access (travel from road to community facility e.g. shops or school): 3.0m	**Making Space for Cycling (London)** • 3.0m minimum width in parks, 2.5m minimum width on key routes between major areas or in rural areas. **VicRoads Cycle Notes 21** • A graph is available for determining the width of shared paths (2.0m-3.0m) or whether separated facilities are required – the graph uses peak hour pedestrian and cyclist volumes **London Cycling Design Standards** • 2.0m (low flow*) • 3.0m (medium flow*) *flow categories are defined based on volumes at peak hr/6am-8pm or 24hr periods

Table 7-2: Guidance for protected cycle lanes (reproduced from Table 5.13, NZTA/Abley/ViaStrada, 2015)

	National	NZ Local Guidance	International
Width (two way)	No Guidance Provided	**CCC MCR Design Guide (Table 6.2)** • Desirable: 3.5m • Desirable Minimum: 3.0m **ATCOP (13.2.2.7)** • 2.3m (island separator) • 2.0m (bollard separator)	**NACTO Guide** • Desired width: 3.7m • Minimum width: 2.4m **London Cycling Design Standards** • 2.0m (low flow*) • 3.0m (medium flow*) • 4.0m (high flow*) *flow categories are defined based on volumes at peak hr/6am-8pm or 24hr periods **TMR Separated Cycleways** • Widths range from 3.0m to 4.0m depending on peak hour cyclist volume (minimum 2.4m for low volumes).

Table 7-3: Austroads Shared Path Widths (reproduced from Table 7.6 of Austroads: Cycling Aspects of Austroads Guides – AP-G88-14)

	Path width (m)		
	Local access path	Commuter path	Recreational path
Desirable minimum width	2.5	3.0	3.5
Minimum width – typical maximum	2.5[1]–3.0[2]	2.5[1]–4.0[2]	3.0[1]–4.0[2]

1 A lesser width should only to be adopted where cyclist volumes and operational speeds will remain low.
2 A greater width may be required where the numbers of cyclists and pedestrians are very high or there is a high probability of conflict between users (e.g. people walking dogs, roller bladers and skaters etc.).

Source: Austroads (2009f) Figure 7.4.

7.2.2 Options

The IBC identified five potential options:

- Option 1 – only replace seawall with less than five years remaining life. This was the 'do-minimum' option and was considered as a baseline for assessment only.
- Option 2 – 1.5 metre wide path. This was considered as the lowest standard path and an 'absolute minimum' option.
- Option 3 – 2.0 metre wide path. This option was slightly wider than the minimum consideration but still less than providing the ideal level of service for users.
- Option 4 – 2.5 metre wide path. Achieved the minimum standard for a shared path.
- Option 5 – 3.5 metre wide path. A wider path that achieved the desirable minimum requirement for a recreational shared path.

A multi-criteria analysis (MCA) was undertaken on the five path width options in a workshop setting on 7 November 2016. The attendees included the core project team, plus specialist consultant advisors including a structural engineer, urban designer, landscape architect, ecologists (intertidal, vegetation, avifauna), planning and consenting expert, client representatives, NZ Transport Agency representatives (Planning and Investment and cycleway specialist), as well as community group representatives. Options were scored against a number of factors including safety, resilience, upgrade potential, consentability and beach impact. Options 4 and 5 were favoured through this process. Feedback through community consultation and alignment to the investment objectives also reinforced the two preferred options.

While it was desirable to only assess one option during the next stage of the project (through a DBC), there was no clear distinction between the two options. As a result, both options were considered, allowing a combination of widths to be applied. Constructing a path of consistent width along the corridor is generally preferred. However, the two options provided the opportunity to alter the width of the path at beaches and sensitive locations, or where there were expected to be a higher number of pedestrians.

7.2.3 Conclusion

During the IBC the path widths were assessed. The following path width options were rejected because of the following:

- Less than 1.5m wide: No path less than 1.5m was considered, such as providing a minimum of 1.0m throughout, on the basis that 1.5m is already substandard (and arguably unsuitable/inappropriate), and so adequately covers off the consideration of alternatives at the lower end of the spectrum. The cost outlay for a 1.0m facility would not be expected to generate many benefits and would be unlikely to meet project objectives.
- 3.0m wide: Initially this was considered as an option to be investigated and assessed. Ultimately it was discounted and not considered further. Working through the options there appeared little difference between 3.0m and 3.5m in terms of locations where physical works were required i.e. there were very few sections where 3.0m was already achievable and would require no physical work – so costs for the options were very similar, and so there was little to differentiate.
- Greater than 3.5m width: This option was not considered given that 3.5m satisfies the desirable width for a recreational shared path. Additional width would require more widening of the road into the coastal marine area and would also result in cost increases that may inhibit affordability. Similarly, the recently completed section of shared path at York Bay would become out of context if the path was much wider than 3.5m, and there is no intention to provide further upgrade to the improved York Bay section. Nonetheless, it is recognised that there could be a desire to provide some specific sections at greater than 3.5m width, where there may be a need for additional width for congregating, bus shelters or for enhanced urban design and movement functions (such as between Days Bay and Eastbourne).

Early in the preliminary design process (and following public consultation on the IBC), based on the above assessment, the decision was made to proceed with a path of 3.5m width in the non-beach areas, and a 2.5m width path in beach locations to limit encroachment onto the beaches. There was reasonably broad agreement throughout the individual bays following 2017 consultation with this approach.

There has been general support for a 3.5m path outside of the beaches, but a reduced width at beach locations. This is to limit encroachment to the beaches which are already limited in extent and considered to be of high amenity value to the community[9].

The decision to reduce the path width at certain beach locations is a compromise to maintain a continuous path (northern Lowry Bay, Mahina Bay and Sunshine Bay) but also limit the impact to a highly valued public asset. Reducing the path width however does impact on the paths functionality and reduces the level of service for path users.

For the non-beach sections, the 3.5m path width falls between the recreational shared path width recommendations of 3.0m-4.0m wide provided in Austroads. Further, the 3.5m provided meets the 3.5m 'desirable' width as stated in the NZTA Pedestrian Planning Guide.

Providing a continuous 3.5m facility throughout would be the design teams preferred approach, however spatial constraints are such around Eastern Bays that this could result in significantly greater beach encroachment to already limited beach areas.

The beach sections of 2.5m width are clearly below the preferred width requirements. However, The Project team have selected this width based on the feedback from the community and in trying to seek a balance between community acceptance, achieving a continuous path and limiting beach encroachment while also providing a safe and serviceable facility. It is noted that other NZ standards, such as the ATCOP do permit a minimum of 2.5m width, as do other reputable international standards from Australia and the United Kingdom. Further, the number of sections and overall length of the narrower 2.5m width have been reduced following the introduction of beach nourishment in key locations.

On this basis and given that users of the path are not expected to be doing so at high speeds during busy periods, the 2.5m minimum width at certain beach locations is considered to be an acceptable compromise given the spatial challenges that exist. The path still provides a usable facility that broadly can achieve a consensus of community support because it does not result in beach loss to an unacceptable extent.

7.3 Treatment Options

The project team identified twelve potential seawall options that would provide additional corridor width to accommodate a shared path. Four of these options were rejected during the initial assessment, mostly due to limited scope for application along the corridor or lacking durability within a coastal environment.

The four options excluded were:

- Timber walkway with limited applications due to design life/durability concerns (this option was included in the community consultation but there was little support from the community for a boardwalk solution anywhere along the corridor, hence it was removed).
- Gabions/reno mattress because of its very poor durability in marine environment and that it does not reflect wave energy.
- Sheet piles also because of its poor durability in marine environment; high cost and that it does not reflect wave energy.
- Timber pole wall because of its poor durability in marine environment and that it does not reflect wave energy.

The eight remaining feasible options for further consideration were:

- Carriageway Reallocation (discussed under section 5.3)
- Placed Rock Revetment
- Double Curved Seawall
- Single Curved Seawall
- Vertical Cantilevered Concrete Wall
- Concrete Blocks

[9] The Recreation Assessment carried out at a later stage of the project recommended the use of beach nourishment as mitigation for loss of beach amenity at the three main high usage beaches – Point Howard, Lowry Bay and York Bay. As a result of this assessment and the potential for these areas to attract more visitors, it was decided to propose a 3.5m path along these beaches, given the associated loss of beach can be managed and replaced via beach nourishment.

- Mass Concrete to Existing Pitched Seawall
- Dwarf Mass Concrete Wall

These options were assessed during the DBC stage as discussed in section 8 below.

8. Preferred Project Option

8.1 Assessment

Through the DBC, both path width options were considered (2.5m and 3.5m widths), allowing a combination of path widths to be applied. The two options provided the opportunity to alter the width of the path at beaches and sensitive locations. This flexibility in design also enabled the shared path to respond to the constraints unique to the various bay environments and mitigate environmental effects on the environment.

An assessment of the seawall treatment options was undertaken through workshops with the project team on 22 June and 6 July 2017. Workshop participants developed and agreed on the criteria and weighting of the criteria to assess each of the options. These criteria included factors that related to the RMA, as well as the social, environmental, cultural and economic impacts of the project. It was agreed that assessments be undertaken separately for beach and non-beach locations, as the preferred treatment options for the two locations are likely to differ.

An MCA process was used to assess the various options for beach (6 wall type options) and non-beach (8 wall type options), where options were scored against a number of factors including safety, resilience, cultural, natural character, ecology, coastal processes, upgrade potential, consentability and beach impact.

Once scoring was completed by the group and agreed, a number of different weighting systems for the different criteria were applied which resulted in the following preferred treatments being identified for beach and non-beach locations:

- Beach location: curved seawall, dwarf wall, mass concrete wall
- Non-beach location: curved seawall, dwarf wall, placed rock revetment

It was also noted that in some specific locations carriageway reallocation could still be used in conjunction with the above treatments to reduce encroachment into beach areas.

Using the preferred treatment options (outlined in 7.3) and recommended path widths, the project team systematically worked through each section of the corridor, as a group in a workshop environment, and agreed on an option that optimised the outcomes sought whilst minimising impacts.

This was an organic process that was undertaken through group discussion with the client and design team, the expert advisor group and community group representatives.

The selected wall type for each location and notes from the group during the wall placement workshop process was documented. It should be noted that this was not a 'final' decision, but the suggested wall type (or types) and widths that would be consulted on given the site conditions at that location and opinion of the expert group. At several locations, more than one option was developed for the shared path as it was determined that multiple options would be possible and community feedback could help decide which was preferred.

For all locations it was agreed that it would be essential to seek input from the local community and potential path users before any decision was made. However, it was deemed appropriate to go to the community with options to help stimulate the engagement process and also to rule out clearly inappropriate solutions early in the process (for example the use of revetment at beach locations was considered to be fatally flawed during the MCA because of the major encroachment to the useable beach space resulting from the revetment footprint).

Alternatives included several different solutions to manage challenges or constraints along the corridor; or where multiple options achieve the same outcome, but with varying benefits or costs. The project option design maps (including areas highlighting multiple different option variants) were presented during the public consultation process (included in the Consultation Report, Appendix I of the resource consent application).

8.2 Engagement Outcomes

Many of the issues raised through the feedback process were taken on board and incorporated into the preliminary design. Similarly, the vast majority of the 'bay by bay' feedback received was included in the design. In York Bay, further discussions were held with local residents to try and find a solution that would be acceptable to the majority. This included the relocation of Atkinson Tree and the reallocation of the carriageway to reduce the encroachment onto the beach. A refined option ("Design Option 1A") was included that sought a balance between beach encroachment and limited road realignment. Option 1A achieved 0.5 to 1.0m of landward space, thereby resulting in avoiding 0.5-1.0m of encroachment onto the beach. Details of discussions with residents in the immediate area are set out in the Consultation Report.

Residents will be provided with an additional opportunity to submit or comment on the detailed proposal through the resource consent process instigated by Hutt City Council and Greater Wellington Regional Council.

It is recognized that it is unlikely with a project of this nature in such a constrained location to achieve a complete consensus from the community. However, there is a clear commitment by the HCC and the project team to maintain the high levels of engagement and community involvement through the detailed design process to ensure a high quality outcome that satisfies the community's requirements.

8.3 Recommended Option

Through the assessment and shortlisting of preferred options, and consultation with stakeholders and the community, a recommended option was determined. This option meets the intended outcomes and project benefits sought, while aiming to address and mitigate some of the key challenges and constraints that were identified during option development and consultation.

The recommended option following public engagement was as follows:

Table 8-1: Recommended option

Station ID	Location	Seawall Type	Path width (m)	Comments
520-610		no wall works	3.5	Path to connect to existing shared path
610-650	Point Howard	no wall works	3.5	Retain car parking
650-700	Point Howard	revetment	3.5	Retain parking and bus stop
700-820	Point Howard	curve	2.5	Beach
820-1000	Point Howard	curve	3.5	
1000-1070	Sorrento Bay	curve	2.5	Beach
1070-1120		no wall work	2.5	
1120-1140		curve		
1140-1160		no works		
1160-1300	Lowry Bay	revetment	3.5	Major storm surge impact
1300-1360	Lowry Bay	curve	3.5	
1360-1550	Lowry Bay	curve	2.5	Beach
1550-1750	Lowry Bay	dwarf	2.5	Beach
520-610		no wall works	3.5	Path to connect to existing shared path
1750-1800	Lowry Bay	curve	2.5	Beach
1800-1960		curve plus revetment	3.5	

Station ID	Location	Seawall Type	Path width (m)	Comments
1960-2190		no wall works	3.5	Whiorau Reserve
2190-2240		revetment, or single curve plus revetment	3.5	
2240-2400	York Bay	curve	3.5	
2400-2560	York Bay	curve	2.5	Further assessment of realigning road needed (refer to Option 1A)
2560-2870	York Bay	no wall works	3.0-3.5	Existing section of new path/curved seawall
2870-2910		no wall works	3.5	
2910-3020	Mahina Bay	revetment	3.5	Major storm surge impact
3020-3340	Mahina Bay	curve	2.5	Beach
3340-3400	Mahina Bay	curve	3.5	
3400-3440		revetment	3.5	
3440-3470		no wall works	3.5	
3470-3680		curve	3.5	
3680-3910	Sunshine Bay	curve	2.5	Beach
3910-4000	Sunshine Bay	revetment	3.5	Replacement of existing 'temporary' revetment
4000-5000	Days Bay	no wall works	N/A – no path through Days Bay	
5000-5500		curve	3.5	

The recommended option was developed into the Preliminary Design Plans which formed the basis of the environmental assessment undertaken by the technical specialists.

The Preliminary Design Plans have been amended and refined in a number of locations from the option that was originally consulted on with the community. The following changes were made:

8.4 Refinement of Design

Following completion of the preliminary design, initial technical assessments and pre-application discussions with consent authorities, a number of key project changes were agreed.

These changes are described below:

- Refinements at York Bay around "Option1A" based on ongoing community feedback.
- No revetment at northern Lowry Bay, in response to effects of the revetment on subtidal areas.
- Introduction of beach nourishment as a mitigation measure for the loss of beach amenity resulting from widening of the path into the coastal marine area – reassessment of path widths at Point Howard, Lowry Bay and York Bay.
    - Point Howard - widening out of path width to 3.5m from 2.5m together with beach nourishment to mitigate the loss from path encroachment.
    - North Lowry Bay - removal of proposed extensive revetment and replacement with double or triple curved seawall, in order to limit sub-tidal effects.
    - Lowry Bay - widening out of path width to 3.5m from 2.5m together with beach nourishment to mitigate the loss from path encroachment.

- South Lowry Bay - removal of proposed revetment and replacement with double curved seawall, in order to limit sub-tidal effects.
- York Bay - widening out of path width to 3.5m from 2.5m together with beach nourishment to mitigate the loss from path encroachment.

These consenting related design changes are further detailed in the resource consent application.

8.5 Site specific alternatives

Generally, rock revetment will be placed only where it provides protection of Marine Drive, at locations prone to wave action where it would typically follow a 1V:2H gradient (1 metre in height with a 2 metre horizontal fall). While revetment does not stop wave overtopping, it does reduce the effects of overtopping and provides some protection to the shoreline. In turn, it offers protection to Marine Drive and the proposed shared path.

Given the ongoing issues with wave overtopping of Marine Drive along the northern section of Lowry Bay, a number of alternatives were investigated to address some of the problems. These alternatives included:

- Elevate the shared path by 150mm, however due to difficulties with the design in achieving adequate drainage along this section, the elevated shared path was disregarded.
- Place rock revetment with a gradient of 1V:3H along this section. The flatter gradient proposed at Lowry Bay offered a greater level of protection and resulted in a 9 metre wide rock revetment structure within the foreshore. Because of the presence of sub-tidal areas which have high levels of biodiversity, this option was disregarded due to the significant effects on the environment.

8.6 Design Features

Once the recommended option was selected by the project team and client, the project team went through an exercise to identify measures to be applied to the design so as to avoid, remedy or mitigate any adverse effects of the project on the environment.

Generic design features to be applied in the Preliminary Design were discussed at a mitigation workshop held on 8 February 2018 with the project team and community representatives. A number of variations (or design alternatives) were considered. Details of the design elements that have been applied to the shared path are outlined in the Design Features Report, Appendix J of the resource consent application.

These included:

- Seawalls
  - Rock revetment
  - Curved walls (single, double, triple)
- Beach Access
  - Steps - perpendicular vs parallel; standard and mini steps
  - Ramps - perpendicular vs parallel
- Transition zones
- Kerb separators
- Stormwater
- Penguin & Fish Passage
- Bus Shelters
- Planting
- Street Lighting
- Signage and Markers
- Path comfort facilities

9. Construction Methodology

Alternative techniques of construction were considered. In situ concrete construction has been adopted for this project as it is considered to provide a far better engineering solution from a constructability perspective than precast construction, in particular when considering the length of the project and the potentially difficult horizontal and vertical construction challenges associated with this site. This method of construction has also been proven to work well during the construction of the previously constructed York Bay section of wall. Whilst there are obvious benefits associated with a precast solution, they are generally focused on speed of construction and surface finishes. For a project that has the potential to present significant challenges during the construction stage a highly adaptable method of construction is considered to be of paramount importance. This flexibility is only achieved with in situ concrete construction.

The environmental challenges of in situ concrete construction are mainly associated with the risks of releasing of cementitious products into the aquatic environment which is detrimental to the ecology. This methodology includes clear procedures for the pouring of concrete and dewatering activities. Construction techniques will be refined during the detailed design stage and once the contractor has been selected. This will be managed through a Construction and Environmental Management Plan (CEMP).

The construction methodology is detailed in Design Features Report, Appendix J of the resource consent application.

10. Conclusion

This Alternatives Assessment outlines the various alternatives that have been assessed over the course of developing the design to ensure that all feasible options have been investigated. The recommended project option aims to provide a shared path that will achieve all of the desired outcomes, while minimising and mitigating the key constraints and challenges. Therefore, where possible, a 3.5 metre shared path will be constructed, enabling pedestrians and cyclists to share the space safely and with a high level of service for path users. At some locations, this width has been reduced to 2.5 metre to minimise the encroachment of beaches or to accommodate obstacles and it is considered this will still meet an acceptable, albeit reduced, level of safety and user level of service performance. The shared path will be supported by a seawall that will

In conclusion, the physical constraints on the landward side of Marine Drive, have resulted in the widening of the road on the seaward side as being considered the most practicable option.

Appendices

Appendix A Option 2a: Landward Side Shared Path Concept Plans

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED	NOT APPROVED	
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**
Date Stamp: **11.09.2018**
Scales: 1 : 500 (A1)
Drawing No.: 80509137-01-001-C300
Rev.: A

ORIGINAL SIZE A1

DO NOT SCALE - IF IN DOUBT ASK

Last modified: Dec 12 2018 By Campbell Young

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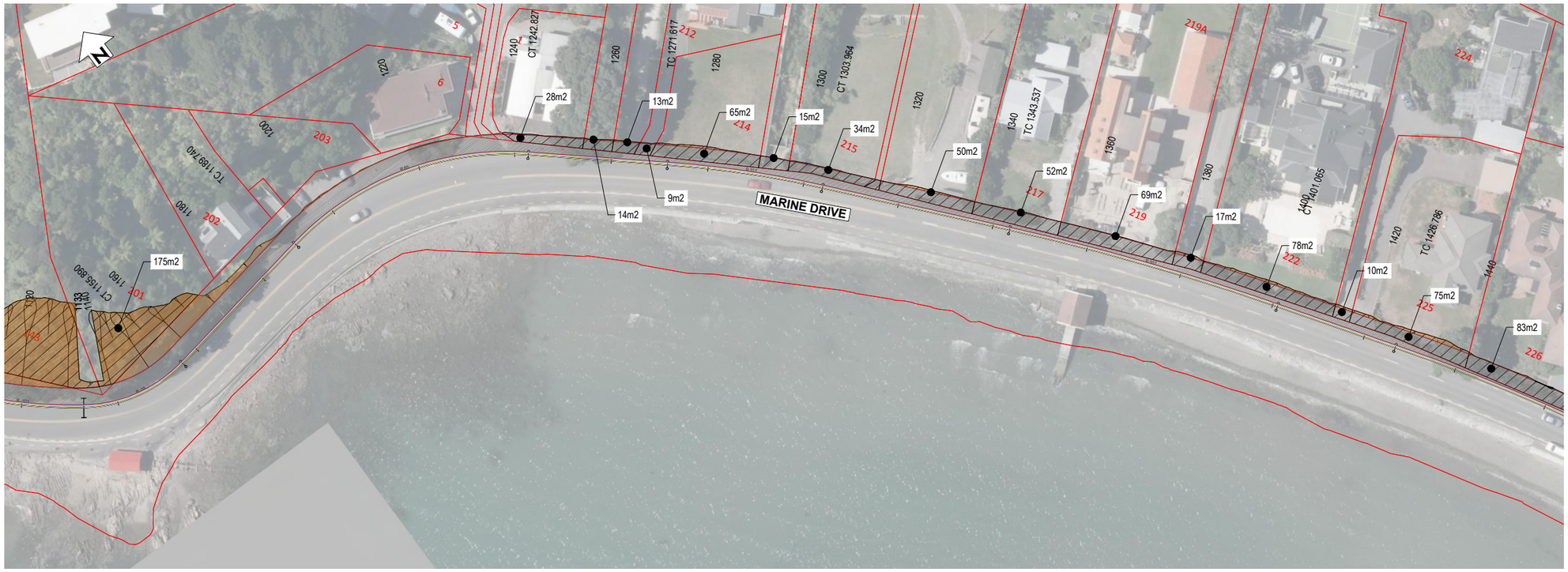

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

NOT FOR CONSTRUCTION

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

Last modified: Dec 12 2018 By Campbell Young

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW	NOT APPROVED	
APPROVED		
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**

Date Stamp: **11.09.2018**

Scales: 1 : 500 (A1)

Drawing No.: 80509137-01-001-C301

Rev.: A

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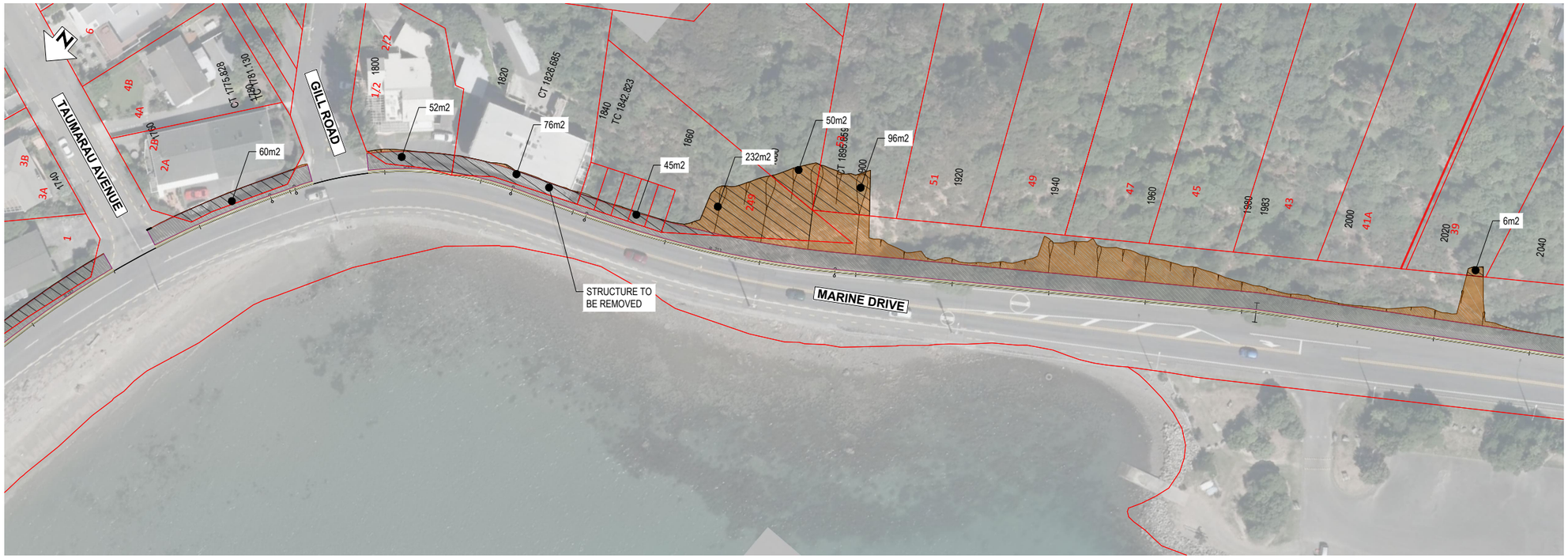

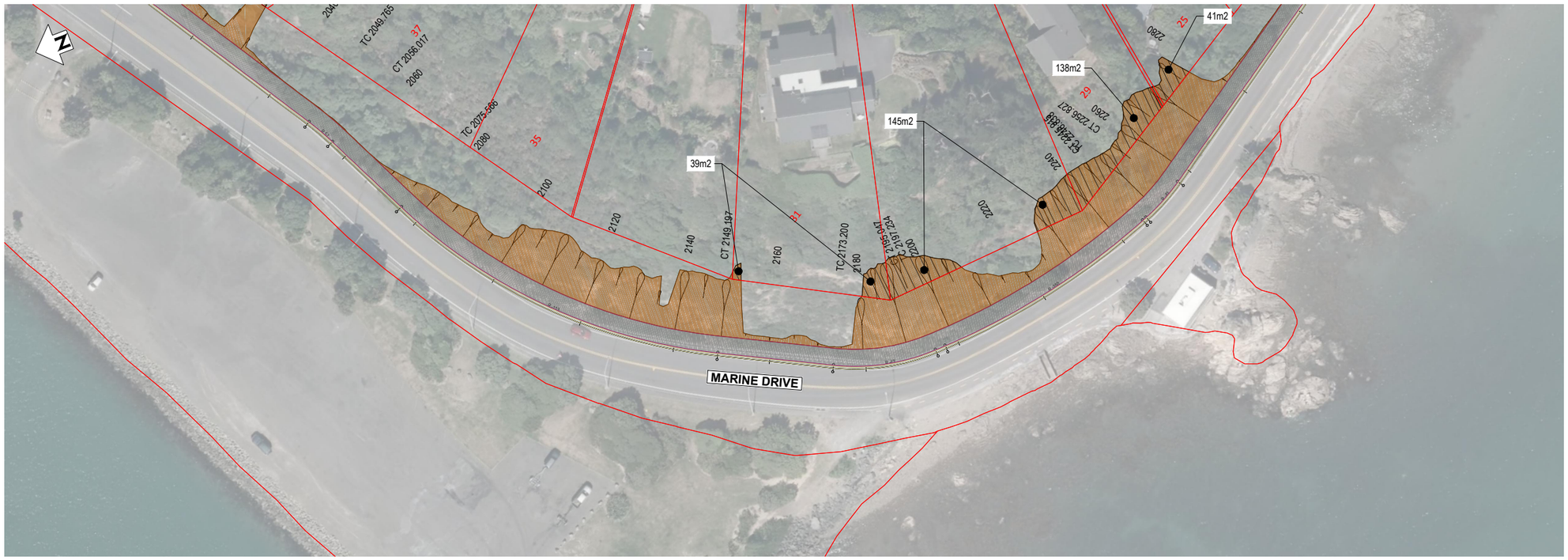

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED	NOT APPROVED	
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**
Date Stamp: **11.09.2018**
Scales: 1 : 500 (A1)
Drawing No.: 80509137-01-001-C302
Rev.: A

DO NOT SCALE - IF IN DOUBT ASK
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ORIGINAL SIZE A1
Last modified: Dec 12 2018 By Campbell Young

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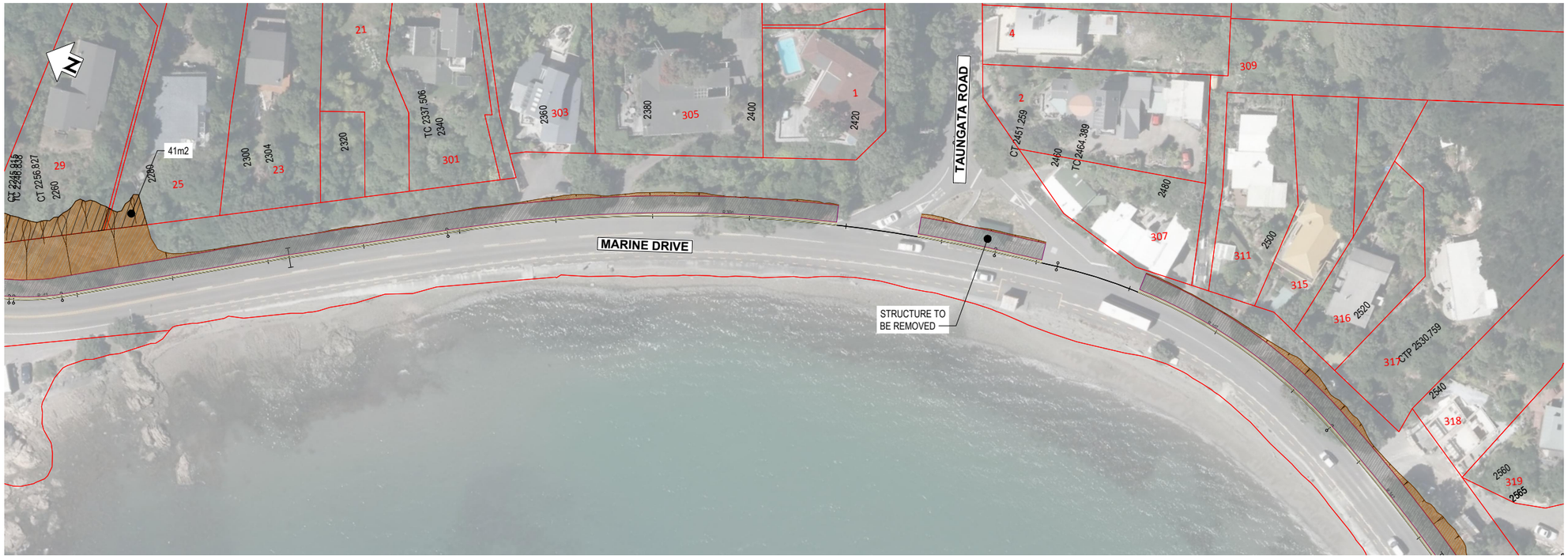

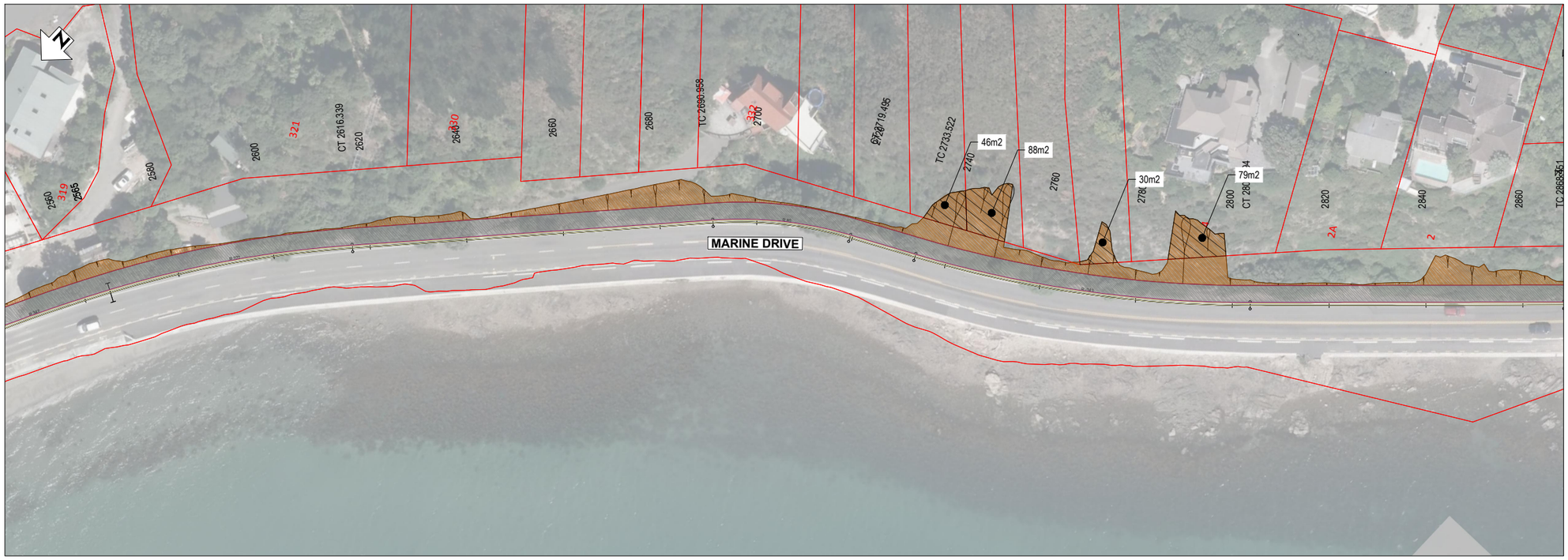

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

Last modified: Dec 12 2018 By Campbell Young

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED	NOT APPROVED	
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

NOT FOR CONSTRUCTION

Status Stamp: **WORKING PLOT**

Date Stamp: **11.09.2018**

Scales: 1 : 500 (A1)

Drawing No.: 80509137-01-001-C303

Rev.: A

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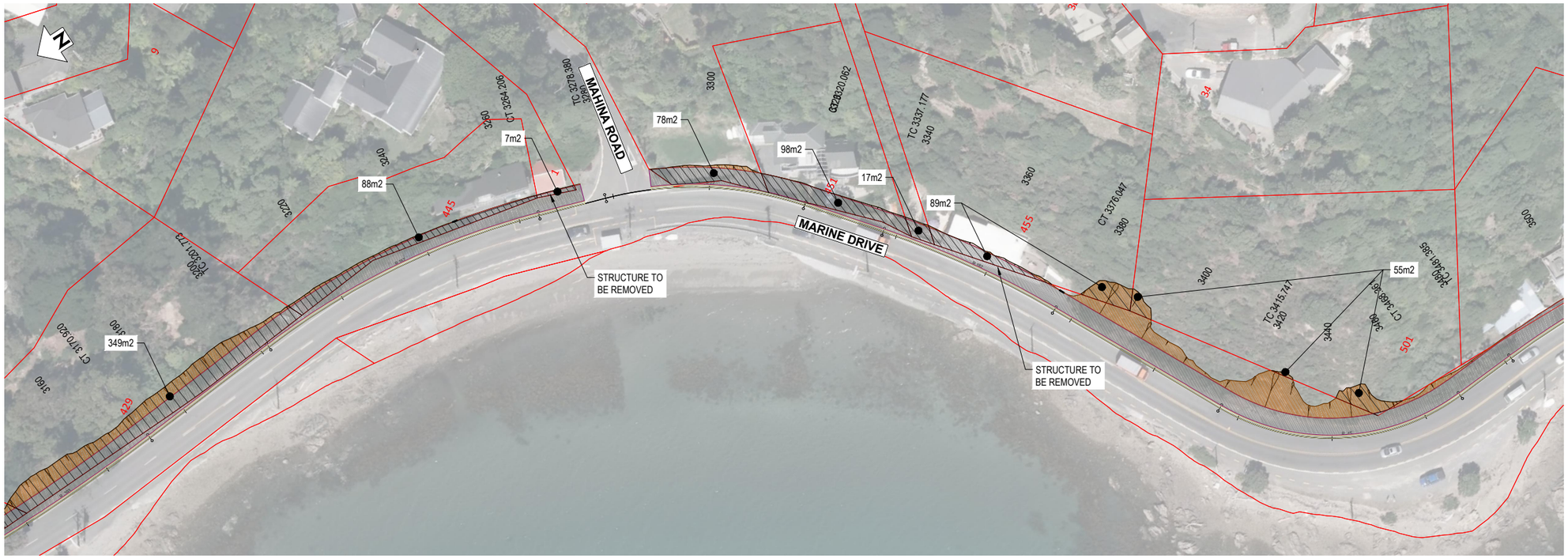

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

DO NOT SCALE - IF IN DOUBT ASK

ORIGINAL SIZE A1

Last modified: Dec 12 2018 By Campbell Young

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
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DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED	NOT APPROVED	
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**

Date Stamp: **11.09.2018**

Scales: 1 : 500 (A1)

Drawing No.: 80509137-01-001-C304

Rev.: A

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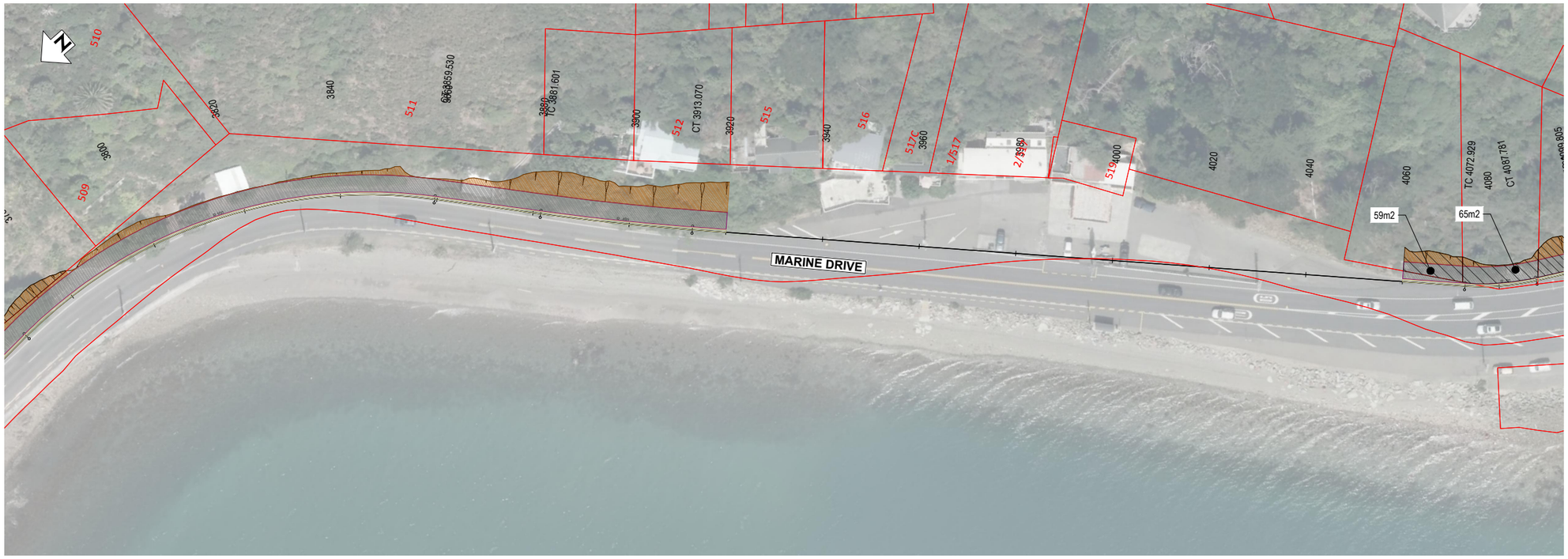

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW	NOT APPROVED	
APPROVED		
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**
Date Stamp: **11.09.2018**
Scales: 1 : 500 (A1)
Drawing No.: 80509137-01-001-C305
Rev.: A

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
Last modified: Dec 12 2018 By Campbell Young

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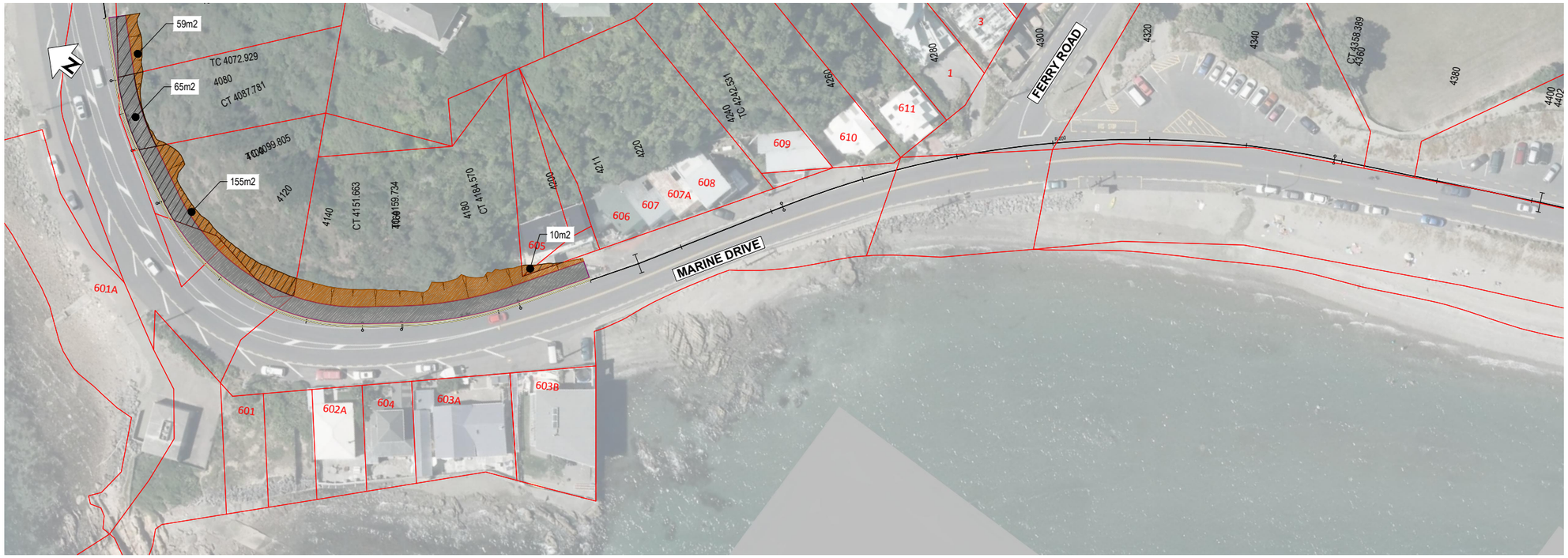

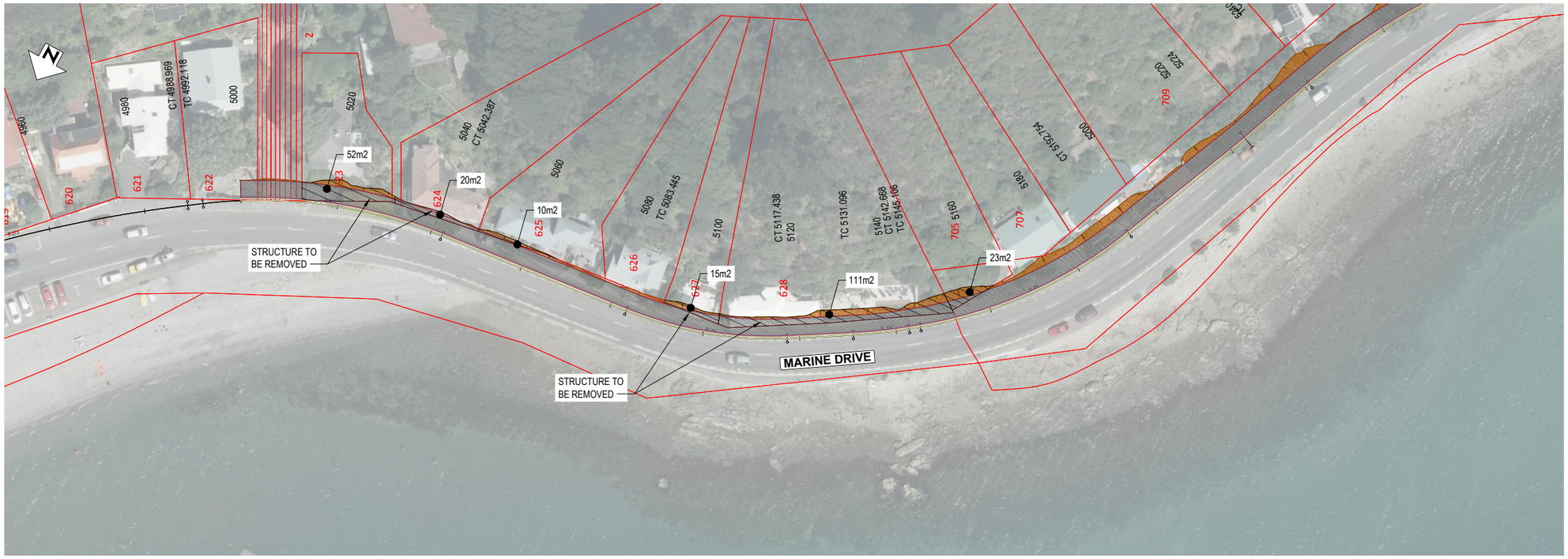

LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED	NOT APPROVED	
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**
Date Stamp: **11.09.2018**
Scales: 1 : 500 (A1)
Drawing No.: 80509137-01-001-C306
Rev.: A

DO NOT SCALE - IF IN DOUBT ASK
ORIGINAL SIZE A1
Last modified: Dec 12 2018 By Campbell Young

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LEGEND

- EARTHWORKS EXTENT
- SHARED PATH
- PROPERTY ENCROACHMENT

DO NOT SCALE - IF IN DOUBT ASK

200 mm
150
100
90
80
70
60
50
40
30
20
10
0

ORIGINAL SIZE **A1**

Last modified: Dec 12 2018 By Campbell Young

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE

SURVEYED		
DESIGNED	KEVIN SINGH	08.2018
DRAWN	CAMPBELL YOUNG	09.2018
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW	NOT APPROVED	
APPROVED		
PROF REGISTRATION:		

Stantec

Client: HUTT CITY TE AWA KAIRANGI

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH - DBC

HUTT CITY COUNCIL
EASTERN BAYS SHARED PATH

Status Stamp: **WORKING PLOT**

Date Stamp: **11.09.2018**

Scales: 1 : 500 (A1)

Drawing No.: 80509137-01-001-C307

Rev.: A

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Appendix B Option 2a: Landward Side Shared Path Visualisations

Looking North West towards 123 Marine Drive from road adjacent to 135 Marine Drive

Existing Situation

HUTT CITY TE AWA KAIRANGI

SORRENTO BAY

Consultants: Stantec NZ Ltd; Drakeford Williams Ltd

MARCH 2019 .

Reference: DWL16004W/SK04A

Existing Situation

Looking north west towards 123 Marine Drive from road adjacent to 135 Marine Drive

Simulated view of a 3.5m wide shared path on the inland side of Marine Drive.
In order to avoid extending into the coastal zone or narrowing the current carriageway, the path would require some cuts into the coastal escarpment, encroachment into a number of adjacent residential properties and removal of some structures and dwellings.
Note:
Excavation for the construction of the path is shown with an escarpment cut slope profile of 55 degrees. Should the rock strata indicate instability, the angle may require slopes of up to 45 degrees (1:1 gradient) which would result in higher cuts on the escarpment and with a greater likelihood of extending into adjacent residential property.

HUTT CITY TE AWA KAIRANGI

SORRENTO BAY

Consultants: Stantec NZ Ltd; Drakeford Williams Ltd

MARCH 2019 .

Reference: DWL16004W/SK04Ac

Existing Situation

MAHINA BAY

HUTT CITY TE AWA KAIRANGI

Consultants:

Stantec NZ Ltd; Drakeford Williams Ltd

March 2019.

Reference: DWL16004W/SK/008a

Existing Situation

Looking south along Marine Drive towards Mahina Road intersection.

Simulated view of a 3.5m wide shared path on the inland side of Marine Drive.
In order to avoid extending into the coastal zone or narrowing the current carriageway, the path would require some cuts into the coastal escarpment, encroachment into a number of adjacent residential properties and removal of some structures and dwellings.
Note:
Excavation for the construction of the path is shown with an escarpment cut slope profile of 55 degrees. Should the rock strata indicate instability, the angle may require slopes of up to 45 degrees (1:1 gradient) which would result in higher cuts on the escarpment and with a greater likelihood of extending into adjacent residential property.

HUTT CITY TE AWA KAIRANGI

MAHINA BAY

Consultants: Stantec NZ Ltd; Drakeford Williams Ltd

March 2019.

Reference: DWL16004W/SK/008Aca

Existing Situation

HUTT CITY TE AWA KAIRANGI

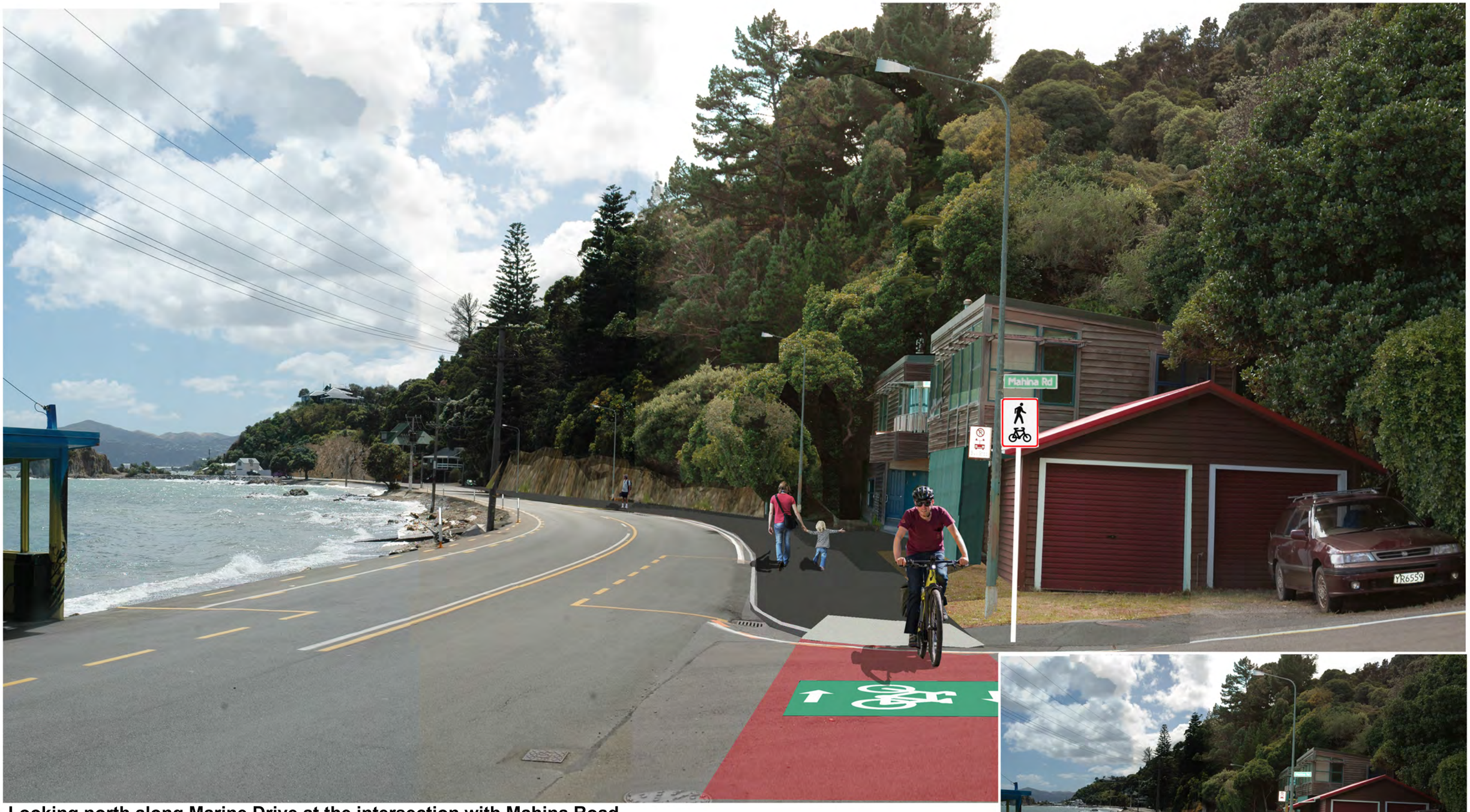
Consultants:

MAHINA BAY

Stantec NZ Ltd; Drakeford Williams Ltd

March 2019 .

Reference: DWL16004W/SK/008B



Existing Situation

Looking north along Marine Drive at the intersection with Mahina Road

Simulated view of a 3.5m wide shared path on the inland side of Marine Drive. In order to avoid extending into the coastal zone or narrowing the current carriageway, the path would require some cuts into the coastal escarpment, encroachment into a number of adjacent residential properties and removal of some structures and dwellings.

Note:

Excavation for the construction of the path is shown with an escarpment cut slope profile of 55 degrees. Should the rock strata indicate instability, the angle may require slopes of up to 45 degrees (1:1 gradient) which would result in higher cuts on the escarpment and with a greater likelihood of extending into adjacent residential property.

MAHINA BAY

HUTT CITY TE AWA KAIRANGI

Consultants: Stantec NZ Ltd; Drakeford Williams Ltd

March 2019 .

Reference: DWL16004W/SK/008Ac

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