

Porirua Stream Mouth and Estuary Enhancement Concept

Final

Prepared For:
Greater Wellington Regional Council
Porirua City Council

A collaboration between:
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Images from Porirua Library Stock



1. Introduction

Although fringing the Porirua CBD and seen daily by thousands of commuters and Porirua residents, the estuary at the mouth of Porirua Stream until recently has received scant affection or even attention. This is a sad reality, given the huge potential of this area for the remnants of nature still remaining, the wider environment and the amenity of residents and visitors alike. It is a key area in the whole of the Porirua Harbour catchment and Porirua City.

The potential for restoration and enhancement of amenity has been recognised by a number of studies and more recently as a prominent project in the Porirua Harbour and Catchment Strategy and Action Plan. Restoration of key missing estuarine habitat such as salt marsh and sea grass communities, although ambitious, would be of particular ecological value. Revegetation of riparian areas on the lower Porirua Stream will be technically easier and have immediate amenity benefits. Flood control requirements and water quality constraints will, however, need to be carefully factored into restoration plans and cost estimates.

Most of the area is highly modified and some is currently polluted and unappealing visually. But vivid stories of kaimoana gathering, swimming and fishing on expansive tidal flats are well within the memory of people still living, so these stories should inspire the vision for what the area can become in the future, even when located right beside a vibrant city centre.

The Porirua City Centre Revitalisation project and strategic framework identified the site as part of the Harbour Quarter. Adjacent land has great opportunity for mixed use and is potentially the most valuable land in the city centre. We view this project as “setting the scene”, establishing a context for development that recognises the importance of the site for estuarine ecology and weaving within an ecological framework attractive connected places and settings for harbourside recreational activities.

The restoration project has been described as complex and ambitious but if successful will greatly enhance the ecological values of this key part of the Onepoto Arm. Furthermore it will greatly enhance visual amenity for residents and commuters, cultural values for tangata whenua, and environmental awareness and recreation benefits for all who come into the area. Parts of the area are highly accessible now, or can readily be made more accessible, while the inaccessibility of other parts offers opportunities for pest control and restoration of sensitive animal habitat. Most of the area has security of tenure under public ownership and current broad planning provisions that allow for restoration and enhancement of amenity and other values to be successfully realised.

The following pages summarise our analysis of the site, identify opportunities and six activity areas, outline design principles and concepts, and present draft restoration and implementation concepts for discussion.

Project Purpose

Enhancement of Porirua Stream mouth and estuary edge that:

- Increases public awareness and appreciation of the estuary edge
- Provides habitat for estuarine fauna
- Improves local biodiversity
- Provides for cycling, walking and picnicking
- Is an ‘attractive window to the harbour’.

Objectives

1. Attract public interest in the harbour and its habitat and use of harbourside Wi Neera Reserve.
2. Visual and ecological enhancement of the Porirua Stream mouth and associated estuary with an emphasis on development of a self-sustaining ecosystem, and at the same time retaining flood management.
3. Establish salt marsh habitat where feasible.
4. Opportunities for community participation in plan implementation.
5. Develop maintenance plans for vegetation.
6. Develop plans for natural debris maintenance and rubbish cleanup.
7. Implement in stages.

Key Benefits

- An attractive window to the harbour with positive changes that will continue to reshape public attitudes to the harbour
- Increased biodiversity, bird habitat and ecosystem services (e.g. shoreline stabilisation, sediment capture)
- Increased public use with informal recreation such as walking, cycling, and family friendly activities
- Increased public interest and potential for public engagement.

Project Scope

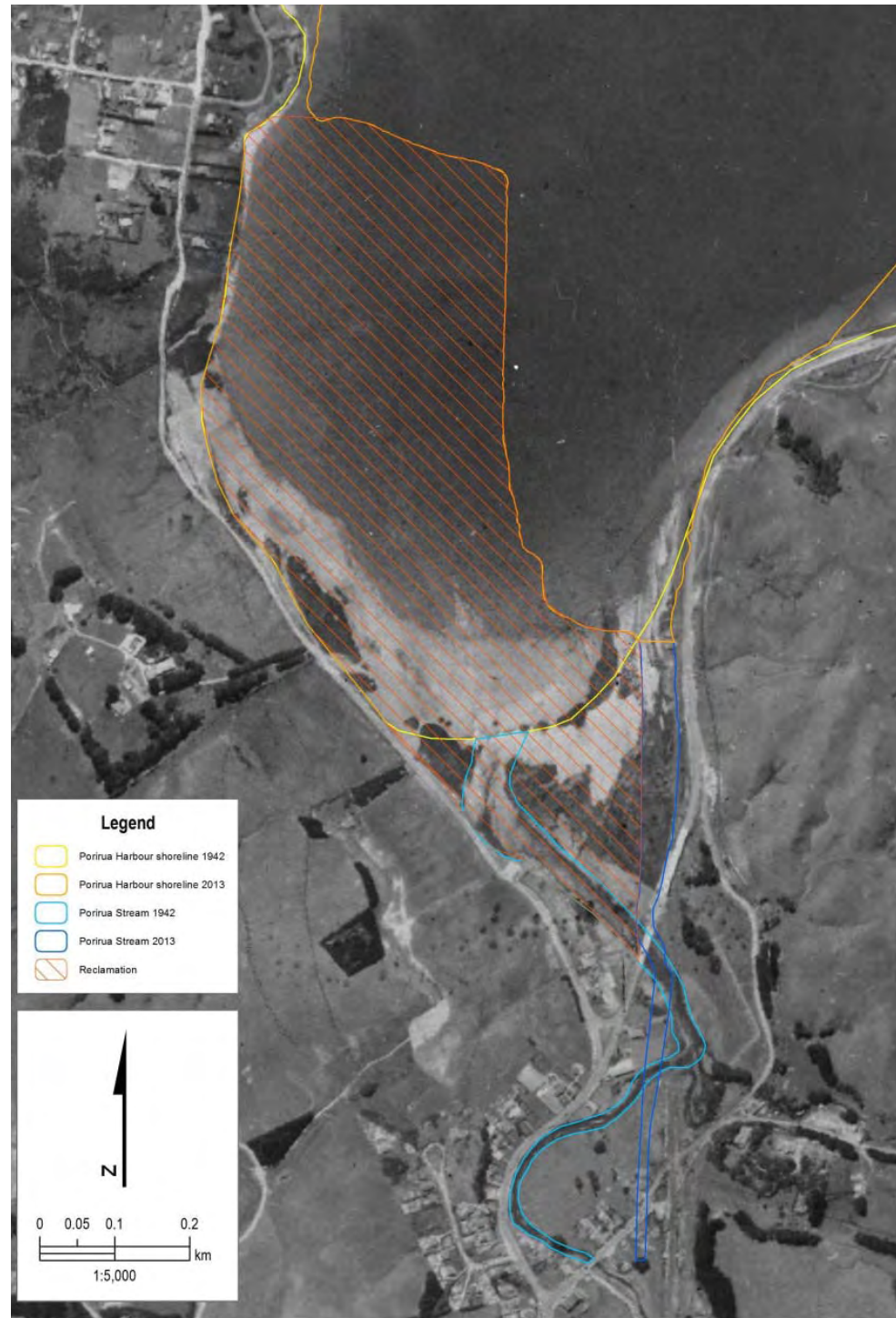
While the site has great potential, at this time resources are limited. At this stage the focus is on:

- Re-contouring of the harbour edge for physical and visual links and a transition between intertidal flats and vegetation
- Use of native plants
- Removal of debris from the harbour edges
- Development of areas for public use
- Options for stormwater outfall modification so that they are consistent with plan objectives
- Liaison with GWRC flood protection regarding flood management requirements
- Liaison with Porirua City Council to achieve consistency with visions and plans for the harbour edge.



View from Parumoana Street to the harbour

Changes to the harbour¹



South Onepoto Arm of Porirua Harbour before Porirua Stream was straightened (in 1961) and the western edge of the harbour filled (from the late 1950s and early 1960s).



The same area today with the straightened Porirua Stream and extensive reclamation between Parumoana Street, Norrie Street, and Titahi Bay Road.

KEY

- Porirua Harbour shoreline 1942
- Porirua Harbour shoreline 2013
- Porirua Stream 1942
- Porirua Stream 2013
- Reclamation

The land that forms the harbour edge within the project area was once part of the Onepoto Arm of Porirua Harbour. The mouth of Porirua Stream flowed into the tidal mudflats and saltmarsh edges of the gently sloping estuary margins. The area was an important source of seafood and had extensive cockle shell banks; one of the reasons Ngati Toa Rangatira settled around the harbour.

Modifications began in the early 1850s with forest clearance, drainage of wetlands and harbour edge roading. Railway line construction in the 1880s followed the natural curves of the bays along the eastern harbour edge but in the 1940s the track was realigned and an embankment and causeway encroached into the harbour.

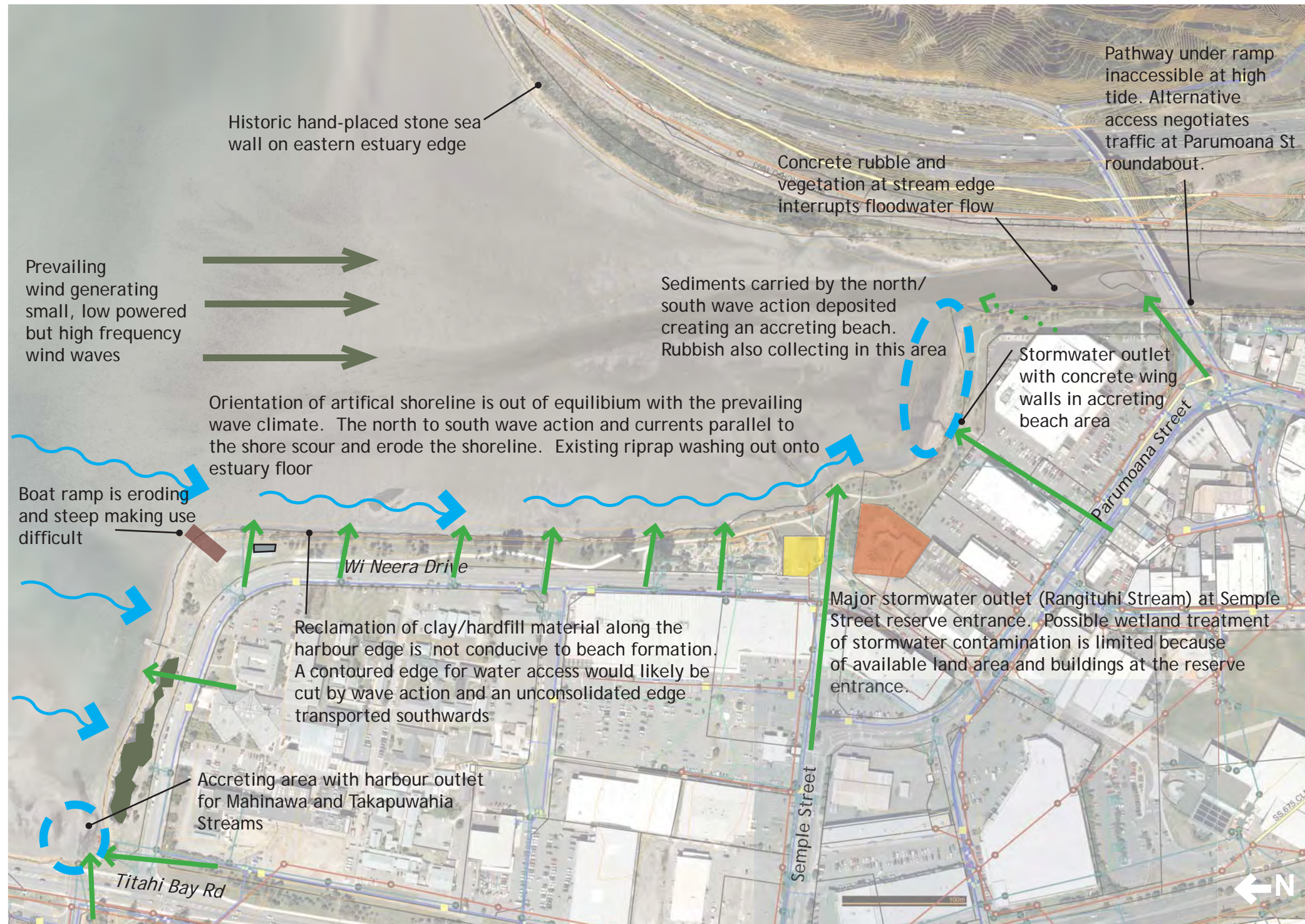
In the 1940s land pressure in the Wellington urban area led to new housing in Porirua. Porirua Stream was straightened and the first earthworks began in the summer of 1959/60 to fill in the southern area of Onepoto Arm for the Porirua shopping centre. Flat land was created for Todd Motors and other industrial development in the 1970s and the spoil was used to create a further seven hectares of land at the southern tip of Porirua Harbour.

The consequence was loss of intertidal flats and the accompanying habitats, and the city turning away from its estuary and harbour. The clay spoil and rock armouring of the harbour edge displaced saltmarsh and vegetation on the harbour edges. The artificial shoreline is out of equilibrium with the prevailing wave climate and wave energy is no longer absorbed. This has led to scouring and eroding of the shoreline and a steep harbour edge, which makes access to the water difficult. The rock armouring has also washed onto the harbour floor.





¹Maps developed by Ian Dawe, Greater Wellington Regional Council

2. Issues and Opportunities

2.1 Coastal Processes² and Stormwater



Key

-  Wind and wave action
-  Accreting areas with potential for saltwater wetlands and habitat
-  Redundant stormwater outlet
-  Sheltering Pines/Macrocarpa
-  Stormwater outlets
-  Waka ama ramp
-  Brass band facility on leased reserve land
-  CCDHB on privately owned land
-  Waka ama

Predicted sea level rise

The implications of environmental changes resulting from greenhouse gas emissions and human-induced climate change need to be considered. The most significant likely effects for this project are rising sea levels. Current Ministry for the Environment guidelines suggest that a sea level rise of at least 0.50m in the next 50 years should be factored into coastal planning. More recent projections suggest potential sea level rise of more than one metre in the next century.

Recent analysis of the long term sea level trends for the Wellington region shows that since records began in the 1890s, sea level has been rising consistently at a rate of 2.1 mm/yr. This equates to a 0.26 m rise in sea level over the past 125 years. In other words, sea level rise is already impacting on the Porirua shoreline and is set to continue. The effects will lead to increased incidences of coastal flooding, especially during storm events, greater pressure on coastal infrastructure and impeded drainage of stormwater.

Other likely effects include a greater frequency of damaging storms, more frequent exceedence of stormwater systems' capacity, and possibly drier summers.

It is important the project design adds to the resilience of the Porirua foreshore to accommodate the expected sea level rise and impacts this will have on the shoreline.

²Based on information from Iain Dawe, Greater Wellington Regional Council



Early nineteenth century hand-placed stone along stream and estuary edge



Concrete debris along Porirua Stream



Reclamation material eroded by wave action creates a barrier to water access



Riprap edge washing out into the harbour floor



Rangitui Stream outfall, Semple St



Accreting area with harbour outlet, Mahinawa and Takapuwhia Streams

Opportunities

1. East/west aligned shorelines from waka ama to Titahi Bay Rd and from Semple St to Porirua Stream mouth face the prevailing waves and are suitable for wide terraces or contouring to MHWs. A soft edge of sand, shell or gravel would absorb wave energy and avoid erosion of reclamation fill material and allow water access.
 2. The beach accreting area at the Porirua Stream mouth and the corner of Titahi Bay Rd and Wi Neera Drive are suitable for restoration planting and habitat restoration.
 3. Small wetland treatment areas at stormwater outlets on accreting beaches near the Harbourside Centre, Semple St and the corner of Titahi Bay Rd and Wi Neera Drive.
 4. Decreasing the slope at the estuary edge along Wi Neera Drive from Semple St/Rangitui Stream outlet to the waka ama area would enable future ecological restoration options. An attractive and robust finish would reduce erosion and scouring. Use of natural stone would repeat historic stone work at the eastern estuary edge and with careful design could be conducive to establishing plant species. Terraces and steps would allow access to the water.
- A leisurely harbour promenade or potentially a boardwalk between steps would bring people to the estuary edge, complementing the existing concrete pathway. Treatment of the estuary edge will need additional technical evaluation (see Activity Area 4 for proposed approaches).
5. Wetland species planting on small available areas around the Semple St stormwater outlet would raise public awareness of harbour sedimentation and contamination. Creating space for a treatment area is a future option. Additional treatment could include rain gardens in retail area carparks and other locations further up the catchment.
 6. Design throughout for higher coastal water tables, increased storm effects on coastal infrastructure and drier summers e.g. planting in raised beds in well-prepared soils with high organic matter and water-holding capacity.



Historic stonework along the estuary edge



Estuary edge with boardwalk access at Pauatahanui

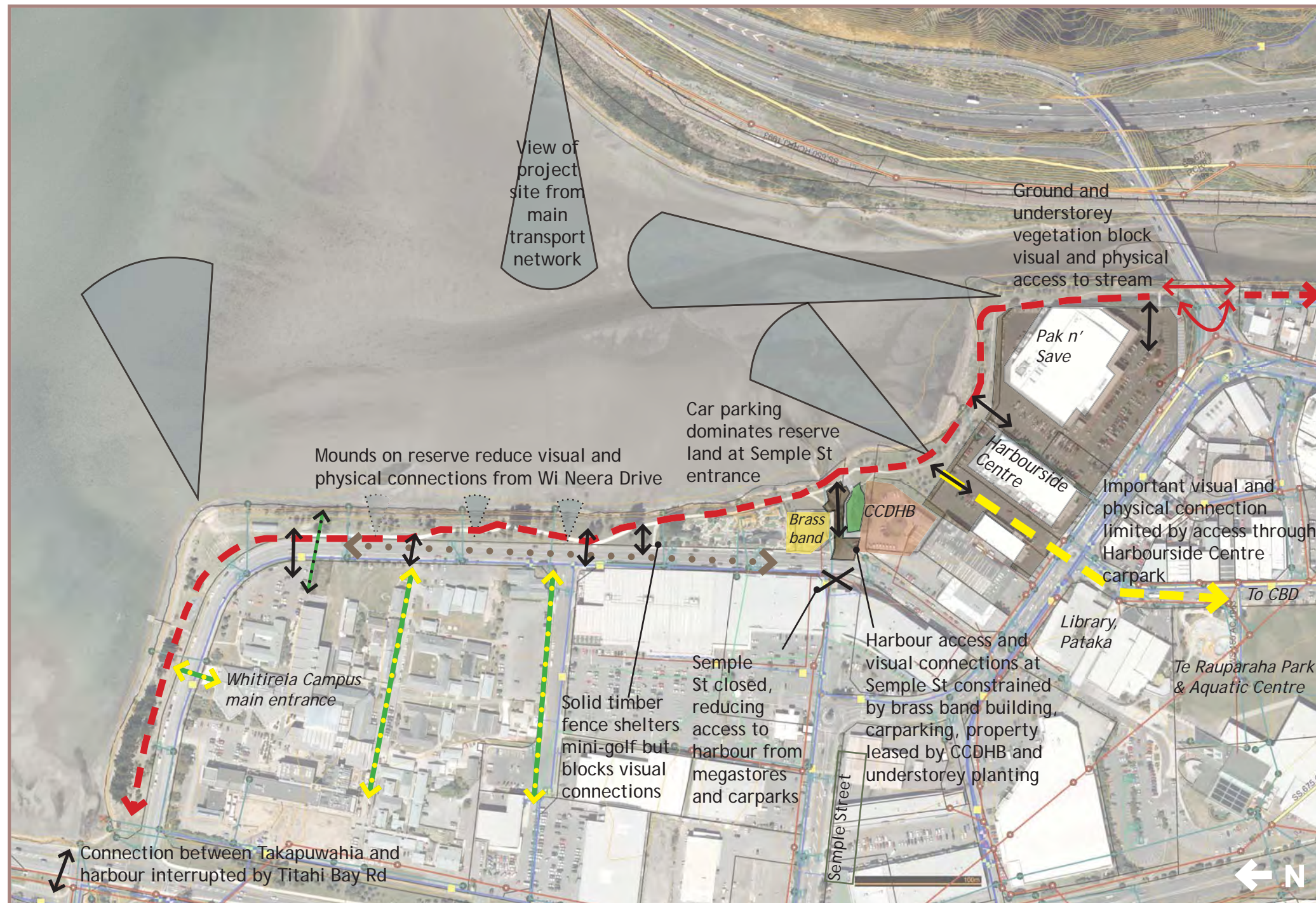


Boulder wall being colonised by planting, with promenade and steps - Wellington Harbour Greta Point

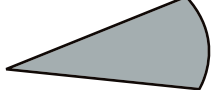













Grass terracing to water's edge - New Plymouth

2.2 Connections - Visual and Physical



Key

-  Visual connections
-  Visual connections and access restricted by mid level shrubs and trees and dominated by vehicle entrance to CCDHB carpark and carpark on harbour edge
-  Pedestrian/cycle harbourside path
-  Pedestrian access over/under vehicle ramp to SH1
-  Brass band building and carpark on Local Purpose Reserve
-  CCDHB leased property
-  Four reserve entrances from the CBD are through carparks (two large carparks are privately owned, one on reserve land)
-  Important visual and physical connection from CBD Library, Pataka, Te Rauparaha Park, Aquatic centre
-  Boulevard proposed in Porirua City Centre Revitalisation - Strategic Implementation Framework (Porirua Harbour Revitalisation)
-  Potential harbour connection for constructed wetland
-  Connections from Whitiwhara
-  Pohutukawa and understorey vegetation block views and access into reserve



Narrow public path on reserve land with vegetation limiting views



Access south through private supermarket car park



Visual clutter in key viewshaft connecting the CBD to the harbour



Restricted access/views at Semple St entrance with emphasis on vehicles



Grass mounds and vegetation limit harbour views and access



Disconnection between Takapuwahia and the harbour edge

Opportunities

Viewshaft and physical easement through the Harbourside Centre to connect to the harbour and the CBD, Pataka, aquatic centre etc.

Easement through Harbourside Centre carpark develops a safer pedestrian connection to harbour.

Remove selected trees and understorey vegetation to restore physical and visual connections to stream side.

Open up entrance to the harbour and reserve at the Semple St entrance and reduce the dominance of carparking.

Open up views and improve safety by removing mid-level shrubs at Semple St entrance.

Design treatment of Wi Neera Drive to develop a safer environment for pedestrians, reduce dominance of roading and improve access to the reserve and harbour. Boulevard proposed in Porirua City Centre Revitalisation - Strategic Implementation Framework (Porirua Harbour Revitalisation)



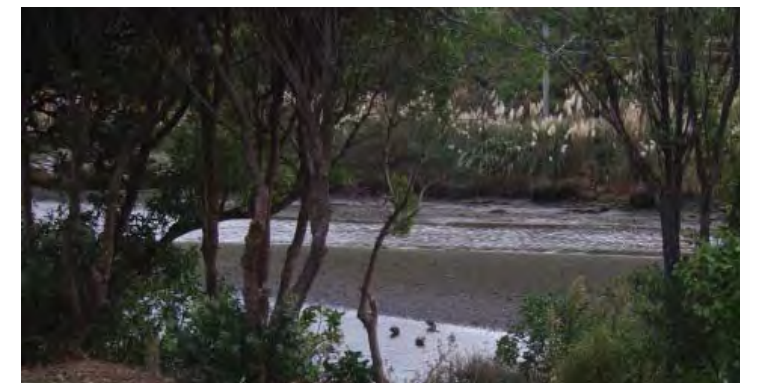
Harbourside Centre easement opportunity for access



Unattractive fencing on reserve boundary



Semple Street closed at Mega Store preventing access to harbour







Visual connections at stream edge where less understorey

2.3 Ecology, Vegetation and Habitat



Key

-  Areas for ecological enhancement, to increase biodiversity, habitat restoration and interpretation
-  Primarily amenity planting areas with increased biodiversity and habitat restoration where ground conditions and wind allows

-  Proposed future stormwater treatment wetland
-  Possible extension of constructed wetland

APPROACH TO ECOLOGICAL RESTORATION

Constraints

- Reclamation
- Heavily modified environment
- Lack of natural intertidal or riparian habitats
- Sometimes degraded water quality
- Strongly modified stream flow characteristics
- Significant access limitations to parts of the site
- Requirements for flood and erosion control and other infrastructure provision.

Opportunities

- Maintenance and restoration of natural ecological processes (albeit modified) in the interface between riparian, freshwater and estuarine environments.

On the eastern bank:

- Ecological restoration of vegetation and habitat for birds, reptiles, insects and fish
- Intensive control of plant and animal pests.

On the more modified western bank:

- Work with the few natural features and stream edges that while heavily modified are intact
- Keep structural streambank modification simple
- Maintain consistency with flood control
- Alteration of bank contours where possible in order to allow a greater variety of habitats.

On both sides of the stream:

- Carefully staged restoration of intertidal salt marsh habitats (water quality and surface sediment pollution are additional constraints in this habitat)
- Trials of techniques and feasibility (easily accessible eastern bank areas are a likely first stage).

Western Stream Mouth and estuary edge:

- Planting of small areas with coastal wetland species
- Planting species that attract native birds and moths to help develop a wider range of quasi-natural habitats and public appreciation
- Good quality interpretation of the natural and human history of the site.



Dominance of Pohutukawa, Norfolk Island Pine, Macrocarpa and pine



Recent tree thinning and shrub clearance for safety



Location for saltwater wetland on foreshore behind driftwood



Selected streamside trees to retain, limb up or remove for views and access



Rubbish accumulated on eastern embankment

Opportunities

Remove vegetation on stream banks that impedes water flow.

Remove selected trees and mid level planting at streamside to open up views and allow stream access.

Select pohutukawa and Norfolk Island pines for removal where they are struggling due to poor ground conditions and drainage and/or block views to reserve and harbour views.

Open up views by clearing understorey vegetation and medium to large shrubs at the harbour edge between the waka ama and Semple St.

Increase biodiversity and habitat by planting a wider range of indigenous tree and plant species suited to the conditions.

When planting, improve growing conditions and provide shelter to help vegetation establish where necessary.

Develop estuary shore habitat/wetlands in accreting areas.

Develop saltmarsh rushland habitat in suitable intertidal areas, principally through planting searush (*Juncus kraussii*). Associated species such as makaka (saltmarsh ribbonwood, *Plagianthus divaricatus*) and oioi (jointed wire rush, *Apodasmia similis*) may also be suitable in places.

Utilise eastern harbourside where human/predator access is difficult to develop habitat for terrestrial fauna.

Create a butterfly/moth garden - with habitat supporting the life



Copper butterfly, *Lycaena salustius*



Salt marsh ribbonwood, *Plagianthus divaricatus*



Grove of karaka and cabbage tree (Ivey Bay)



Sea rush, *Juncus kraussii*

2.4 Destinations and Activities



Key

- Destinations
- Activities
- ◄.....► Linear recreation: walking, cycling
- ▭ Carparking: viewing estuary
- Brass band practice
- Mini golf
- ⛶ Waka ama and ramp
- Children's play area
- Fishing from pontoon

Successful linear harbourside public space usually links destinations and provides activities that attract users. In Porirua City, the CBD estuary edge has few activities and is mostly passive one-dimensional open space. It is also separated from many destinations by buildings, carparks and roading and has limited access to and interaction with the harbour.

The Porirua City Centre Revitalisation is likely to improve linkages, develop destinations and bring diversity to the harbourside area. This would mean a more populated CBD, a wider community of interest, and a more active harbour edge at different times of the day.

Currently, the streamside and harbour edge pathways link destinations Takapuwhia and Titahi Bay beyond, Whitireia campus, Mana College, Pataka, the library, aquatic centre, skatepark, Te Rauparaha Arena and the railway station. Current key activities that attract people to the harbour edge are the pathway, mini golf and the waka ama.

Additional activities will bring more people to the harbour edge: observation of harbour activities, birdlife, boardwalks, estuary edge planting and habitat, interpretive displays, picnic areas, play opportunities that reflect the harbour setting, interaction with the water and a wide pathway linking activities and leading to destinations. The tidal mudflats mean that water access is not always possible, and access to another type of water experience that relates to the setting is an option.



Cycling and other linear activities, with places to stop and linger



Waka ama and other water sports



Brass band clubrooms at Semple St



Mini golf



Children's play area



Pontoon for float plane and fishing



The harbour edge as a lunch venue for Whitireia students and staff



Existing seating

Opportunities

Water access in selected locations with open views of stream, estuary and birdlife.

Interpretation and experiencing estuary and stream habitat.

Butterfly/moth garden and supporting habitat.

Estuary boardwalk to more closely experience estuary and birdlife.

Informal recreation - picnicking, barbeque facilities, seating/tables, viewing, informal kick-a-ball type activities, beach volleyball and similar types of activities.

Flexible open space for events and temporary activities.

Walking, cycling, jogging, dog walking.

Toilets and outdoor shower facilities for water sports.

Food outlets/cafe.

Children's playground and other play opportunities to reflect harbour character.



Play opportunities that reflect the harbour setting



Picnic and BBQ facilities bring a setting alive



Water experience options










Flexible open space for casual use

2.5 Land Ownership



Key

-  Porirua City Council owned lands
-  Wi Neera Esplanade Reserve - classified Recreation Reserve under the Reserves Act and managed according to policies in the Porirua City Reserves Management Plan
-  Local Purpose Reserve (Community) - part of Wi Neera Reserve and managed according to policies in the Porirua City Reserves Management Plan
-  Porirua Stream Esplanade Reserve - classified Local Purpose Reserve (Environment) under the Reserves Act and managed according to policies in the Porirua City Reserves Management Plan
-  Road network land - managed as part of Wi Neera Reserve
-  This area is made up of a number of land parcels owned either by Kiwi Rail or Land Transport NZ
-  Viewshaft and pedestrian right of way easement (approximately 105 x 20 metres)

Most of the lands directly on the western harbour edge are Porirua City owned. They are reserve lands and classified for specific purposes under the Reserves Act. This means that they are managed according to the policies of the Porirua City Reserves Management Plan (2013).

Land at the Semple Street entrance is part of the road network. Neighbouring properties are fenced for security but actual boundaries extend further into the reserve.

Parts of the land on the eastern side of the estuary are owned by Kiwi rail and others by NZ land Transport.

The carpark at Harbourside Centre has an easement for the purpose of a pedestrian right of way and viewshaft - length 105 metres, width 20 metres and an upper height level of 6.15 metres.

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3. Design Principles and Core Projects

The project area is divided into 6 activity areas. Development of each area is guided by design principles and core projects. The six activity areas are:

1. Eastern Estuarine edge
2. Streamside
3. Harbourside Hub
4. Wi Neera Promenade
5. Waka Ama Recreation
6. Takapuwhia/Whitireia Connections

Given the budgetary limits at this stage of the project, development of activity areas and core project implementation were prioritised in collaboration with key stakeholders. Areas to be developed in the first instance are:

- Activity Area 1
- Activity Area 2
- Activity Area 3
- Estuary restoration planting, habitat restoration and amenity at the corner of Wi Neera Drive and Titahi Bay Road in Activity Area 6.

Activity Area 4 requires further investigation and development. Activity Area 5 and the balance of Activity Area 6 require collaboration among a broad group of interested parties.

The following section establishes principles and core projects for the activity areas. Projects are coded in three groups of priority:

- 1 - High priority and immediate
- 2 - High priority but needs more planning and resources to implement
- 3 - Medium priority.

Projects suitable for community participation are identified for each activity area. Many of the projects are suitable for corporate sponsorship.



Activity Areas to be developed in the first instance are circled in red.

3.1. EASTERN ESTUARINE EDGE

Design Principles

1. Low levels of public use provides an opportunity for more “pure” ecological restoration of vegetation and habitat for birds, reptiles, insects and fish.
2. Extensive areas of intertidal habitat - potential for restoration with significant ecological benefits, but needs to be carefully staged and water quality and sediment pollution likely to be constraints in intertidal zone.
3. Safe basic access needed for pest control and restoration work.
4. Manage public access in the short to medium term. Long term potential for public visitation once safe access has been established (given proximity to train tracks).

Core projects in order of implementation, potential for community participation and sponsorship
(see Section 4 for details)

Priority	Project	Community Participation	Sponsorship
1	Safe basic access track for pest control and restoration projects with public access managed for safety		
1	Weed control of priority species starting at southern end	[Yellow bar]	[Yellow bar]
1	Litter removal		
1	Planting Muehlenbeckia vineland habitat and coastal rock edge, including planting for moth and lizard habitat		
1	Trial techniques and feasibility of salt marsh community restoration on estuary edge, trialing combinations of depth, substrate and tidal flow		



- Key**
- [Brown line] Track for maintenance with public access managed for safety
 - [Green area] Intertidal zone for sea rush restoration trials
 - [Yellow area] Insect and lizard garden restoration

Activity Area 1 - Eastern Estuarine Edge

3.2. STREAMSIDE

Design principles

1. Open up views to the stream and harbour.
2. Avoid protrusions into the existing stream edge that would impede and slow water flow.
3. Improve stream side habitat.
4. Improve people's experience of the stream environment.
5. Improve the linear pathway - this is already used by a range of pedestrians and cyclists for recreation and commuting, and use is likely to increase with development of the Streamside Quarter and implementation of Porirua City Centre Revitalisation.
6. Sedges, rushes and other riparian species planted in streamside locations to improve habitat but do not impede stream flow.
7. Design and locate new structures such as steps so that they are built back from the existing stream edge.
8. Keep the area open for safety, avoiding understory vegetation that creates spaces between the Pak n Save wall and vegetation.
9. Improve safety for users by opening up sightlines and widening the path for multiple users.
10. Interpret streamside environments.








Core projects in order of implementation, potential for community participation and sponsorship (see Section 4)

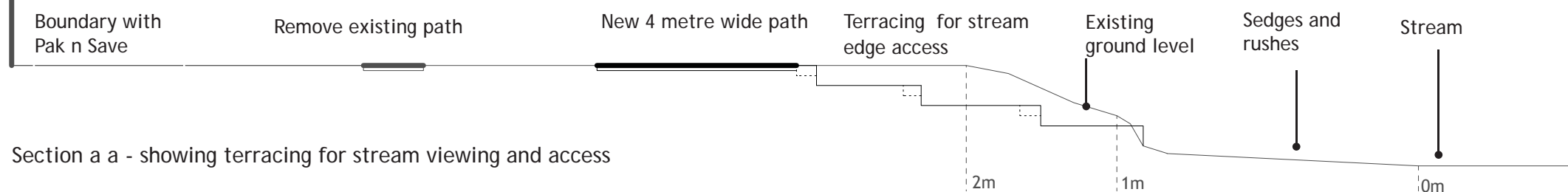
Priority	Project	Community Participation	Sponsorship
1	Open up stream views and views to the harbour by clearing understorey vegetation, removing selected trees and large shrubs, and lifting canopies of remaining trees		
1	Remove existing narrow path and replace with wider path for multiple users (cyclists, walkers, joggers, wheelchairs, pushchairs etc)		
3	Remove debris from stream edge (concrete, dead and damaged vegetation etc)		
3	Improve streamside habitat with sedges, rushes and other riparian species		
2	Improve stream access in selected location via terracing and steps with seating		

Further projects

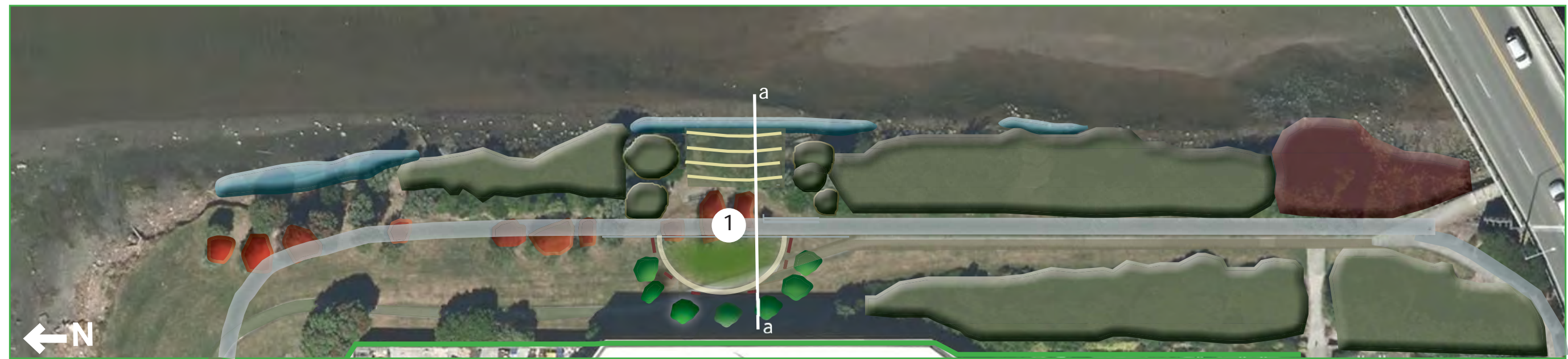
- Redesign streamside pathway under vehicle ramp for accessibility at high tides.

Key

-  Wider and relocated pathway for multiple users replaces existing narrow path
-  Remove trees that block views to harbour
-  Remove vegetation and lift tree crowns for sightlines to the stream
-  Keep existing vegetation to block views to underside of the vehicle ramp
-  Remove streamside debris and plant sedges and rushes
-  1 Create 'node' e.g. terracing with stream viewing and access, planting, seating
-  Treat wall to deter graffiti (self clinging plants) Until plants cover walls, an appropriately themed mural will deter graffiti and an opportunity to involve local artists.



Section a a - showing terracing for stream viewing and access



3.3. HARBOURSIDE HUB

Design principles

1. Restore estuary edge vegetation and habitats and highlight intertidal mudflat and estuary ecology for public interest and enjoyment and for their intrinsic ecological values.
2. Reduce erosion of reclamation fill material at the estuary edge.
3. Improve the relationship and access between the reserve, the CBD and neighbouring built edge.
4. Create estuary entranceways that reflect the importance of the harbour to Porirua City.
5. Create a public open space that is attractive, has flexible open space, is inviting and interesting.

Core projects in order of implementation, potential for community participation and sponsorship

(see Section 4 for details)




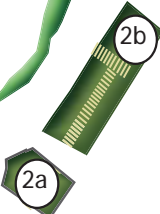
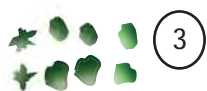









Priority	Project	Community Participation	Sponsorship
1	Re-contour the estuary edge and CBD side of the stream mouth to remove the 'lip' where reclamation fill material has been eroded by wave action and replace with a soft wave energy absorbing area of shells, sand or gravel to allow a greater variety of habitats. This allows direct access to the harbour edge		
1	Develop a coastal wetland at the estuary edge and around the stormwater outfall in front of the Harbourside Centre. Stormwater is redirected through the wetland and rat population controlled	■	
1	Widen the linear pathway		
1	Create a native 'garden' which supports the lifecycle of NZ butterflies and moths and interpret to highlight an estuary edge ecosystem		■
2	Improve the Semple Street reserve entrance to make it more prominent, inviting and safer, moving the focus from vehicles and carparking to pedestrians and cyclists		
2	Work with the owner and businesses of Harbourside Centre to use the easement through the carpark to develop safer pedestrian access from Paraumoana Street and an attractive reserve entrance		■
3	Remove selected pohutukawa and Norfolk Island Pine where they are struggling due to poor drainage and ground conditions or block harbour views and access and improve growing conditions and drainage for new planting		
3	Develop a flexible grassed open space with facilities for picnicking and events and space for activity development		
3	Develop facilities to attract use. Ideas include a fitness trail, canoe and small dinghy storage, BBQs, water play		■
2	Construct a pier out into the intertidal area to enhance a visual and physical connection with the harbour and to better observe estuary birdlife		■
2	Interpretation of butterfly and moth garden and wetland		

Further projects and considerations

- Work with property owners at reserve boundaries to develop more attractive boundaries, connections and potentially open up buildings to activate the reserve and better integrate the built edge with the harbour
- Work with the Harbourside Centre to develop facilities that activate the harbour edge and improve access, connections and the reserve entrance
- Develop the Semple Street entrance to improve access and its profile as a significant reserve entrance. Review waterfront reserve land use on expiry of the Brass Band lease in 2020
- Consider acquiring or negotiating boundary adjustments between the Harbourside Centre and the Semple Street entrance
- Consider acquiring or negotiating boundary adjustments between reserve land and the property occupied by CCDHB on the southern side of the Semple Street entrance. This would create space for a viable stormwater treatment area (reducing harbour sediment and contamination) and linkages between the CBD and the harbour edge.



Key





-  Estuary edge recontoured for access to the estuary edge
-  Remove redundant stormwater outlet and other debris
-  Coastal wetland with stormwater redirected through the wetland, with appropriate control of rats
-  Native butterfly and moth garden is raised to improve growing conditions with concrete edging doubling as seating. Path of 'stepping stones' through garden. Native plant species with rocks and shingle to provide warm sunning spots to support butterflies and moths. The planting would graduate from ground covers no more than .5 metres high to protect the viewshaft (2a), to low growing shrubs and trees (2b) - see Appendix 1 for species list
-  Native coastal trees to support the lifecycle of moths and butterflies. Trees planted in groves with ground level raised to improve growing conditions and grassed sloping edges for sitting and sunning
-  Path is relocated in some sections and wider for pedestrians and cyclists to share
-  Indicative pedestrian link through harbourside utilising viewshaft and pedestrian right of way easement (approximately 105 x 20 metres), and working with Harbourside owners and businesses
-  Pier into intertidal area with interpretation (dimensions, length and location to be determined)
-  Grassed open space for activities e.g. picnicking, BBQ, events, fitness trail with soft surface path, trees and drainage as necessary
-  Open up views and access at Semple Street entrance by selecting pohutukawa for removal, limbing up others and removing shrubs, moving the emphasis from vehicles to pedestrians, widening and adding to entrance pathways, reconfiguring vehicle entrance and parking
-  Low growing coastal species
-  Platform at Rangituhi Stream outfall with leaner
-  Existing pohutukawa to stay
-  Cables on Pak n Save wall to support *Tecomanthe speciosa* (Three Kings climber)

3.4. WI NEERA PROMENADE - NB This activity area requires further investigation and resourcing



Design Principles

1. A linear parkland for informal recreation such as walking, cycling, dog walking, picnicking, relaxing etc.
2. A water's edge that reduces scouring and erosion of the reclaimed harbour edge and decreases the slope to the estuary edge. This would enable future ecological restoration and better access. Use of natural stone would repeat historic stone work at the eastern estuary edge and with careful design could be conducive to establishing plant species. Terraces and steps would allow access to the water. A leisurely harbour promenade or potentially a boardwalk between steps would bring people to the estuary edge, complementing the existing concrete pathway.
3. Improved visual connections and access to the estuary edge.

Key

-  Remove vegetation and debris at the water's edge. In the longer term decrease the slope at the estuary edge for future ecological restoration options and harbour edge access.
-  Wide terraces with water access
-  Develop picnic areas with BBQ facilities among pohutukawa
-  Investigate making changes to Wi Neera Drive for safety with traffic calming, increased parking capacity and improved pedestrian connections

Core projects in order of implementation, potential for community participation and sponsorship (see Section 4 for details)

Priority	Project	Community Participation	Sponsorship
1	Open up views by clearing understorey vegetation and medium to large shrubs at the harbour edge		
1	Remove debris such as concrete from the estuary edge		
3	Construct the first of an intended suite of wide terraces in a selected location		
3	Remove trees where they are struggling with poor drainage and ground conditions		
3	Develop picnic areas with BBQ facilities among pohutukawa groves on mounds for shelter and shade		
3	Develop changes to roading and parking along Wi Neera Drive in line with Boulevard proposed in Porirua City centre Revitalisation to reduce speed, develop parking capacity and safer connections for pedestrians and a road environment that reflects the harbour character and setting		

Further projects

The following requires further investigation and resourcing but are critical to the long term success of the harbourside improvements:

- Investigate land/water edge treatment options to reduce scouring and erosion
- Investigate options or a combination of the two to link terraces to access the water edge:
 - A boardwalk running parallel to the shoreline to allow more extensive estuary access and to observe estuary birdlife
 - A promenade with a permeable surface at the harbour edge for pedestrians. This promenade would be for leisurely pedestrians and complement the existing concrete pathway which would be used by cyclists/pedestrian commuters



Activity Area 4 - Wi Neera Promenade

3.5. WAKA AMA RECREATION³

NB This activity area requires further investigation in collaboration with waka ama clubs, Takapuwahia Village Plan and other potential water sports. Only initial enhancement is included at this stage

Design Principles

1. Develop primarily for waka ama with potential for other water sport involvement and development.
2. Develop in collaboration with waka ama club and Takapuwahia Village Plan.
3. Improve water access for recreation.
4. Allow for future development as a potential hub for regional and national waka ama events and wider water sports.
5. Retain open space for waka ama, other water sports events and associated recreational activities and facilities.

Core projects in order of implementation, potential for community participation and sponsorship

(see Section 4 for details)

Priority	Project	Community Participation	Sponsorship
1	Relocate the boat ramp to the adjacent north facing beach where it will be less exposed to erosion and scouring and has a gentle grade for waka launching and remove the existing ramp		■
1	Re-contour the north facing beach to remove the 'lip' where reclamation fill material has been eroded by wave action and replace with a soft wave energy absorbing area of shells, sand or gravel		
3	Upgrade the children's playground		

Further projects

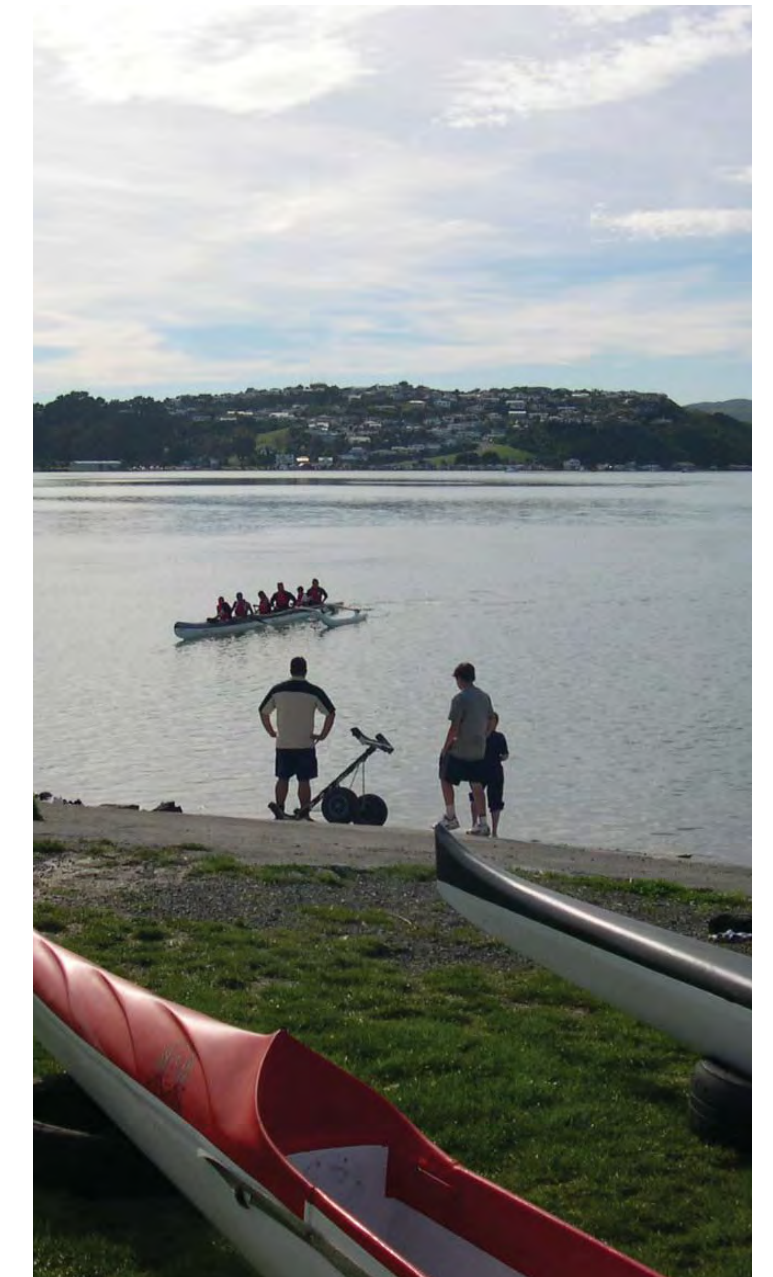
The following requires further investigation and resourcing but are critical to the success of the harbourside improvements:

- Work with waka ama club and other water sports users to improve facilities and develop the sport, which is a feature of the harbour with potential to grow
- Design and construct toilets and an outdoor shower to support water sport activities.



Key

- Relocated boat ramp
- ✗ Removed existing ramp
- Recontour for beach access
- Open space for water sports and events



Activity Area 5 - Waka Ama Recreation

3.6. TAKAPUWAHIA/WHITIREIA HUB

Design Principles

1. Estuary restoration planting, habitat restoration and amenity that integrates with the Takapuwahia Village Plan.
2. Integrate development of the area with the Takapuwahia Village Plan, improving visual connections and access between the harbour edge and Takapuwahia.
3. Focus resources in the first instance on the corner of Wi Neera Drive and Titahi Bay Road for estuary restoration planting, habitat restoration and amenity.

Core projects in order of implementation, potential for community participation and sponsorship (see Section 4 for details)

Priority	Project	Takapuwahia Participation	Sponsorship
1	Remove concrete, other debris and riprap that has been washed from the estuary edge	High	None
1	Trial intertidal salt marsh community restoration in conjunction with Takapuwahia community and Ngati Toa	High	None
1	Small coastal wetland above the estuary edge around the Stream outlets	High	None
1	Coastal species planting at the corner of Wi Neera Drive and Titahi Bay Road	High	None
2	Platform above stream mouths with a leaner and seating for viewing	None	None
1	Re-contour the grassed area where a shell beach is forming and remove the 'lip' where reclamation fill material has been eroded and form wide terraces with concrete edges for seating and steps	None	None
2	Interpretation of estuarine environments	Low	None
3	Estuary edge species 'garden' with karaka and cabbage trees spaced to allow clear sightlines and integrated play opportunities along the pathway	None	Low

Further projects and considerations

- The following requires further investigation and resourcing:
- Allow for integration with proposed walkway/boardwalk around Onepoto Inlet
 - Remove the pines and macrocarpa. Any development/enhancement should consider the effects of the loss of shelter they are providing.



Activity Area 6 - Takapuwhia/Whitireia Hub

Key

Improved connections with Tapuwahia:

-  Trial intertidal habitat restoration - indicative location
-  Coastal wetland
-  Coastal species planting
-  Platform above the outlets of Mahinawa and Takapuwhia Streams with leaner and seat for viewing
-  Steps from viewing platform, path at wetland edge with seat leading to terraces and beach access
-  Wide terraces to access beach with seating at terrace edge
-  Recontour grass edge for beach access
-  Improved access and connections to Whitireia: traffic calming across Wi Neera Drive, gathering/entry area, seating, tree planting e.g. karaka and cabbage trees

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4. Implementation Plan for Key Projects

Introduction

This table has implementation details for high priority and immediate projects (identified in Section 3 Design Principles and Key Projects as priority projects 1 and 2). The projects are listed in the table by Activity Area.

However, this does not exclude projects identified in Section 3 as medium priority projects or as 'further projects' in high priority Activity Areas 1,2,3 and the western end of Area 6, or projects that receive external support or funding (which may be identified as have higher priority).

Projects needing more planning and resources

Projects in italics are high priority but need more planning and resources to implement.

Implementation agencies

The table shows Councils as the primary implementation agencies. This does not exclude Ngati Toa iwi, community or private stakeholders who may also be key players in implementation of specific projects.

Sponsorship

The table also suggests projects that are suitable for community partnership and sponsorship by private and corporate sectors.

Project name	Primary Implementation agency	Suits Community Partnership	Suits Sponsorship	Comments
Activity Area 1: EASTERN ESTUARINE EDGE				
1.1. Safe basic access track for pest control and restoration projects.	GWRC			Track formation. Use gated and unobtrusive western entrance to avoid attracting public use. Possibly could be undertaken in collaboration with Treescape (KiwiRail contractor).
1.2. Weed control of priority species starting at southern end.	GWRC	✓		Partially undertaken in June 2014. Initial priority species fennel, holly-leaved senecio, wandering willie (hand-pulled), followed by buckthorn, gorse, broom, karo; finally blackberry, pampas, all vine spp (likely to need herbicide). Undertake in conjunction with Porirua Stream Mouth Wetland Restoration Plan 2010.
1.3. Litter removal.	PCC	✓		Can be undertaken by supervised volunteers, but not until access is more secure. To be repeated 2-yearly.
1.4. Planting Muehlenbeckia vineland habitat and coastal rock edge, including planting for moth and lizard habitat.	GWRC	✓		Planting to follow weeding (project 1.2) within 12 months of weeding. See "suitable species" lists in Appendix.
1.5 Salt marsh community restoration trial on estuary edge	GWRC			Trial of techniques and feasibility with different combinations of depth, substrate and tidal floor. Unlikely to be suitable for volunteers unless safe access is assured (project 1.1).
Activity Area 2: STREAMSIDE				
2.1. Open up stream views and views to the harbour by clearing understorey vegetation, removing selected trees and large shrubs, and lifting canopies of remaining trees.	PCC			Principles and details as in recent understorey vegetation clearance against Pak n Save wall.
2.2. Remove existing path, relocate and replace with wider pathway for multiple users.	PCC			3-4m wide concrete path. Construction details as for recent PCC streamside paths.
2.5. Improve stream access in selected location via terracing and steps with seating.	PCC		✓	Detailed design required. See restoration plan for indicative profile.
Activity Area 3: HARBOURSIDE HUB				
3.1. Re-contour the estuary edge and CBD side of the stream mouth to remove the 'lip'.	GWRC /PCC			Detailed design required, including GW Flood Control involvement. Likely to require resource consents.
3.2. Develop a coastal wetland at the estuary edge and around the stormwater outfall.	GWRC / PCC	✓	✓	Detailed design required. May require resource consent if end of stormwater pipe needs re-location or re-engineering, e.g. small meander loop inserted to create larger wetland environment. Ideally projects 3.2 and 6.3 should be planned and implemented together. See "suitable species" lists in the Appendix.

Project name	Primary Implementation agency	Suits Community Partnership	Suits Sponsorship	Comments
3.3. Re-locate and widen the linear pathway.	PCC			As for project 2.2.
3.4. Create a native 'garden' which supports the lifecycle of NZ moths and butterflies.	GWRC / PCC		✓	Detailed design and planting plan required. See "suitable species" lists in Appendix. Likely to need ground preparation, drainage and raised planting area because of nature of fill material and need to address rising water table on coastal fringe. Raised concrete edge can be used for seating. Complemented by project 3.11.
3.5. Improve the Semple Street reserve entrance to make it more prominent, inviting and safe.	PCC			Detailed design required. Planning with private stakeholders /property owners required. Involves relocation/reconfiguration of car parking spaces.
3.6. Use the easement through Harbourside Centre carpark to construct a pathway from Paraumoana Street and develop an attractive and high profile reserve entrance.	PCC			Detailed design required. Extensive planning with private stakeholders /property owners required. Relocation or reconfiguration of car parking spaces may be required.
3.10. Construct a pier out into the intertidal area to enhance a visual and physical connection with the harbour and to better observe estuary birdlife.	PCC		✓	More detailed design required including location, length and dimensions of pier. Likely to require resource consents.
3.11. Interpretation of moth and butterfly garden and wetland.	GWRC / PCC		✓	To be complemented by interpretation of Activity Areas 1 (from western side of stream), 2 and 6 (projects 1.6, 2.6 and 6.7). Highlight an estuary edge ecosystem in this area More detailed design required for integrated interpretation/signage project for whole plan area.
Activity Area 4: WI NEERA PROMENADE				
4.1. Remove vegetation at the water's edge for harbour views.	PCC			As for project 2.1. May be undertaken at the same time as 2.1.
4.2. Remove debris such as concrete from the estuary edge.	GWRC PCC			Some riprap may be able to be placed to retain edge but other items will need to be removed to clean fill. Removal of estuary edge debris or rip rap repair in all Activity Areas over whole site, including those that are not priority projects, could be planned and consented as one project.
Activity Area 5: WAKA AMA RECREATION				
5.1. Relocate the boat ramp to the adjacent north facing beach, and remove existing ramp.	PCC		✓	Detailed design required (some already undertaken). Likely to require resource consents.
5.2. Re-contour the north facing beach to remove the 'lip'.	GWRC			Detailed design required. Likely to require resource consents.
Activity Area 6: TAKAPUWAHIA/WHITIREIA HUB				
6.1. Remove concrete, other debris and riprap that has been washed from the estuary edge.	GWRC/ PCC	✓		As for project 4.2.
6.2. Trial intertidal seagrass community restoration in conjunction with Takapuwahia community and Ngati Toa.	GWRC	✓		Trial of establishment and growth at different intertidal positions and distance from the stream outlet.
6.3. Small coastal wetland above the estuary edge around the stream outlets.	GWRC / PCC	✓	✓	As for project 3.2, with similar species used. Ideally these two projects should be planned and implemented together. See "suitable species" lists in Appendix.

Project name	Primary Implementation agency	Suits Community Partnership	Suits Sponsorship	Comments
6.4. Coastal species planting at the corner of Wi Neera Drive and Titahi Bay Road.	PCC	✓	✓	Planting plan required. Plant height limitations for traffic visibility. May include pathway to viewing platform.
6.5. Platform above stream mouths with a leaning rail and seating for viewing.	PCC		✓	Detailed design required.
6.6. Re-contour the grassed area where a shell beach is forming, remove the 'lip', and form wide terraces with concrete edges for seating and steps.	PCC			Detailed design required.
6.7. Interpretation of estuarine environments.	GWRC / PCC		✓	To be complemented by interpretation of Activity Areas 1 (from western side of stream), 2 and 3 (projects 1.6, 2.6 and 3.11).

Summary of projects and costs by activity area

Name of activity area	Number of high-priority projects (priority 1 and 2)	Estimated total cost range of high priority projects	Number of other projects (priority 3 and 'further projects')
1: EASTERN ESTUARINE EDGE	4	\$25K- 50K	2
2: STREAMSIDE	3	\$50K- 100K	3
3: HARBOURSIDE HUB	8	\$280K- 550K	3
4: WI NEERA PROMENADE	2	\$12K- 25K	4
5: WAKA AMA RECREATION	2	\$50K- 100K	1
6: TAKAPUWAHIA/WHITIREIA HUB	7	\$70K- 120K	1
TOTAL	26	\$487K- 945K	14

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Appendix 1 - Proposed plant species

Activity Area 1

Plantings for moths and butterflies

Abundant plantings of pohuehue (*Muehlenbeckia complexa*) and koromiko (*Hebe stricta*).

Note that these two species should be planted widely across the activity area (and beyond), the former as a food plant for the caterpillars of coastal copper butterflies, the latter as a source of nectar for the adults of a range of butterflies.

NZ tree nettle (*Urtica ferox*) and swamp nettle (*Urtica linearifolia*) as larval food plants for red and yellow admirals.

Aciphylla squarrosa as food plant for speargrass weevil

Manuka / Kanuka as nectar sources for adults

Senecio lautus and *Calystegia soldanella* on shingle shores as larval food plants for magpie moth and kumara moth respectively.

Coastal Wetland plant species for Activity Areas 3 and 6

The following can be used in the planting plan for these areas. They have been adapted from *Porirua Stream Mouth Coastal Wetland Restoration Plan* (KB Ecology for GWRC and PCC, 2010) and 'Best Bets' species list for restoration planting in the Porirua catchment (Blaschke et al 2009 Ecological Restoration priorities for the Porirua Stream and its catchment).

Scientific name	Common name
<i>Carex flagellifera</i>	
<i>Carex geminata</i>	Rautahi
<i>Carex secta</i>	Purei
<i>Carex virgata</i>	Pukio
<i>Coprosma propinqua</i>	Mingimingi
<i>Coprosma robusta</i>	Karamu
<i>Cordyline australis</i>	Ti kouka /Cabbage tree
<i>Cortaderia toetoe</i>	Toetoe
<i>Disphyma australe</i>	Horokaka/NZ ice plant
<i>Leptinella squalida</i> subsp. <i>squalida</i>	
<i>Lobelia anceps</i>	Punakuru/NZ lobelia
<i>Phormium cookianum</i>	Harakeke
<i>Samolus repens</i>	Sea primrose
<i>Selliera radicans</i>	Remuremu
<i>Sophora malloyi</i>	Cook Strait kowhai

Moths and butterfly garden in Activity Area 3

Scientific name	Common name	Notes
Ground cover and herb layer amongst rocks and shingle:		
<i>Pimelea prostrata</i> (subsp: <i>prostrata</i> and/or <i>seismica</i>)	Pinatoro / Prostrate daphne	Notoreas moths (day-flying and endangered)
<i>Raoulia hookeri</i>	Vegetable sheep	Associated with rocky headlands and scree slopes
<i>Senecio lautus</i>	Shore groundsel	
<i>Parietaria debilis</i>	NZ Pellitory	Magpie moth (day-flying)
<i>Muehlenbeckia axillaris</i>	Creeping pohuehue	Red admiral and yellow admiral butterflies
<i>Calystegia soldanella</i>		Copper butterflies
<i>Coprosma propinqua</i>		
<i>Dichondra spp</i>		
<i>Haloragis erecta</i>		
<i>Helichrysum lanceolatum</i>		
<i>Leptinella nana</i>	Pygmy Button Daisy	
<i>Plantago spp.</i>		
<i>Plantago maritima</i>		
<i>Plantago raoulii</i>		
<i>Sonchus kirkii</i>	Shore puha	

Shrub layer - these should be carefully placed so as to not to block views and allow clear lines of sight:

<i>Muehlenbeckia complexa</i>	Pohuehue	Copper butterflies
<i>Hebe stricta</i>	Koromiko	Nectar source
<i>Sophora molloyi</i>	Cook Strait kowhai	Kowhai moth
<i>Phormium sp.</i>	Flax	Flax notch-cutter moth
<i>Bracyglottis greyii</i>		
<i>Ozothamnus leptophyllus</i>	Tauhini	

Trees - these grown in groves in raised planting areas to improve growing conditions

<i>Cordyline australis</i>	Cabbage tree	Cabbage tree moth
<i>Hoheria sexstylosa</i>	Lace bark	Nectar sources
<i>Kunzea ericoides</i>	Kanuka	
<i>Leptospermum scoparium</i>	Manuka	
<i>Myoporum laetum</i>	Ngaio	
<i>Sophora molloyi</i>	Cook Strait kowahi	

Other species for amenity and habitat areas

Scientific name	Common name	Scientific name	Common name
<i>Aciphylla squarrosa</i> var <i>flaccida</i>	Taramea, Speargrass, Spaniard	<i>Meliclytus crassifolius</i>	Thick-leaved mahoe
<i>Apodasmia similis</i> *	Oioi/Jointed wire brush	<i>Muehlenbeckia astonii</i>	Tororaro
<i>Carex cf. testacea</i>	Speckled sedge	<i>Olearia paniculata</i>	Akiraho, Golden akeake
<i>Carmichaelia australis</i>	Common broom	<i>Olearia solandri</i>	Coastal tree daisy
<i>Clematis forsteri</i>	Small white clematis	<i>Phormium cookianum</i>	Mountain flax
<i>Corynocarpus laevigatus</i>	Karaka	<i>Pimelea prostrata</i> subsp <i>prostrata</i>	Pinatoro/NZ daphne,
<i>Discaria toumatou</i>	Matagouri, Wild Irishman	<i>Pimelea prostrata</i> subsp <i>seismica</i>	Pinatoro
<i>Euphorbia glauca</i>	Waiu-atua/Shore spurge	<i>Plagianthus divaricatus</i> *	Makaka/Saltmarsh ribbonwood
<i>Juncus kraussii</i> *	Searush	<i>Poa billardierei</i>	Hinarepe/Sand tussock,
<i>Meliclytus aff. obovatus</i>	Koromiko	<i>Poa cita</i>	Silver tussock
		<i>Tetragonia tetragonioides</i>	Kokihi/NZ spinach/Tutae-ikamoana

* saltmarsh species

Appendix 2 - Notes on butterflies, moths and associated plants

This appendix summarises information about moths and butterflies considered native to the general Porirua district and with potential for eco-restoration at Porirua Harbour. It also summarises information on suitable plant species for the activity areas in the Enhancement Plan.

Moths and butterflies with potential for eco-restoration

Note that more than 200 native Lepidoptera have been recorded in coastal Wellington between Cape Palliser to Sinclair Head (Brian Patrick, unpublished information).

Common Copper, *Lycaena salustius*, Pepe Para Riki

This species is already abundant in Activity Area 1 and could most likely be encouraged to other Activity Areas by planting appropriate food plants.

Food plants: They prefer the three types of *Muehlenbeckia*: Wire Vine, Pohuehue (*Muehlenbeckia complexa*), Large-leafed Pohuehue (*Muehlenbeckia australis*) and Creeping Pohuehue (*Muehlenbeckia axillaris*). There are records of eggs on Sheep's Sorrel (*Rumex acetosella*) and Broad-leaved Dock (*Rumex obtusifolius*).

Rauparaha's Copper, *Lycaena rauparaha*, Mokarakare

(Named after Te Rauparaha because the butterfly is found up and down the Kapiti coast, the stronghold of Maori chief, Te Rauparaha, of Ngāti Toa.)

Not recently recorded within the PSEEP area, but the species has been recorded via NatureWatch at Titahi Bay and Pukerua Bay. It prefers coastal dunes with mixed vegetation. It can also be found in other coastal areas if their larval food plant is present.

Food plants: Only recorded on Pohuehue (*Muehlenbeckia complexa*) and Creeping Pohuehue (*Muehlenbeckia axillaris*), but it is suspected that it would also use Large-leafed Pohuehue (*Muehlenbeckia australis*).

Yellow Admiral, *Vanessa itea*, Kahu Kowhai

An open country and garden butterfly that is seen in most types of habitat since its food plants grow in most habitats from the foothills to city gardens. Often seen sunning itself on rocks and paths, especially in the afternoon.

Food plants: It will feed on any of the Nettle species (*Urtica* spp), but prefers the softer leaved varieties like Small and Scrub Nettle (*Urtica urens* [introduced] and *Urtica incisa* [native]). It will eat the introduced Perennial Nettle (*Urtica dioica*). It has been recorded on New Zealand pellitory (*Parietaria debilis*), a stingless plant of the Nettle family found in coastal dunes, lowland scrub and rocky places. *Urtica linearifolia*, swamp nettle [native] may be appropriate for river margins in association with flax but it has a vicious sting.

New Zealand Red Admiral, *Vanessa gonerilla*

Food plants: Thought to be similar to yellow admiral. Its favourite is the introduced perennial nettle (*Urtica dioica*), and the native favourite is nettle tree - onga onga, (*Urtica ferox*); however, it will feed on any of the nettle species (*Urtica* spp). Food plant = nettles *Urtica* spp. (Source = <http://nzbutterfly.info>) *Urtica linearifolia*, swamp nettle [native] is appropriate for river margins in association with flax - it has a vicious sting.

Kumara Moth *Agrius convolvuli*

Food plants: Shore bindweed (*Calystegia soldanella*) and kumara

Magpie Moth - *Nyctemera annulata* - Mokarakara

Day-flying moth

Food plant: Any *Senecio* spp. e.g. *Senecio lautus*

Cabbage tree moth - *Epiphyryne verriculata*

Food plant: *Cordyline*

Flax notch cutter moth - *Tmetolophota steropastis*

Food plant: *Phormium* spp

Kowhai moth - *Uresiphita polygonalis maorialis*

Food plant: *Sophora* spp

Notoreas spp. moths

Coastal Notoreas moths are conspicuous, but rare, day-flying moths, whose larval food plant is sand daphne and other *Pimelea* spp.

Location of the nearest confirmed populations of Notoreas spp. are probably north of Levin and near Cape Palliser / Onoke Spit, and maybe Pencarrow. There are old records of a new Notoreas species from Makara. The PSEEP area is likely to be sub-optimal. Recommendation is to plant *Pimelea*, but not to expect too much in the way of a natural colonisation (approval to translocated is unlikely, at least initially).

Food plant: *Pimelea* spp.

Sand daphne (*Pimelea* aff. *arenaria*) is normally associated with sand dunes rather than the types of habitats present at this site, but nonetheless it could be planted as an ornamental ground cover that is not completely out-of-place for a coastal site. *Pimelea prostrata* might be more suited to rocky/shingle habitats. Nomenclature of *Pimelea* species is confusing with *P. urvilleana* and *P. villosa* also used synonymously with Sand Daphne / prostrate daphne.

There are three *Pimelea* coastal species (taxonomy and nomenclature of the genus is complex and changing):

1. *Pimelea villosa* (was *P. arenaria*) sand daphne, autetaranga, toroheke, sand pimelea. Conservation status = At risk, declining. *Pimelea* aff. *arenaria* (Sand Daphne) has been recorded from Hongoeka /Karehana Bay just north of Porirua (Milne & Sawyer 2002). Has been planted in semi-stable mid-dune at Onehunga Bay in 2011.
2. *Pimelea prostrata* (with 5 subspecies), pinatoro. The subspecies local to the Wellington region is *P. prostrata seismica* and perhaps also *P. prostrata* subsp *prostrata* (see photo below). *Pimelea prostrata seismica*, was recorded at northern head of Whiteria Park by Robyn Smith. This sprawling plant may be a good option for ground cover. Habitat: coastal to slightly inland, open sites, grassy site, rocky outcrops.
3. *Pimelea durvilleana* (with 2 subspecies). A prostrate plant very similar to *P. prostrata*.



Copper butterfly, *Lycaena salustius*