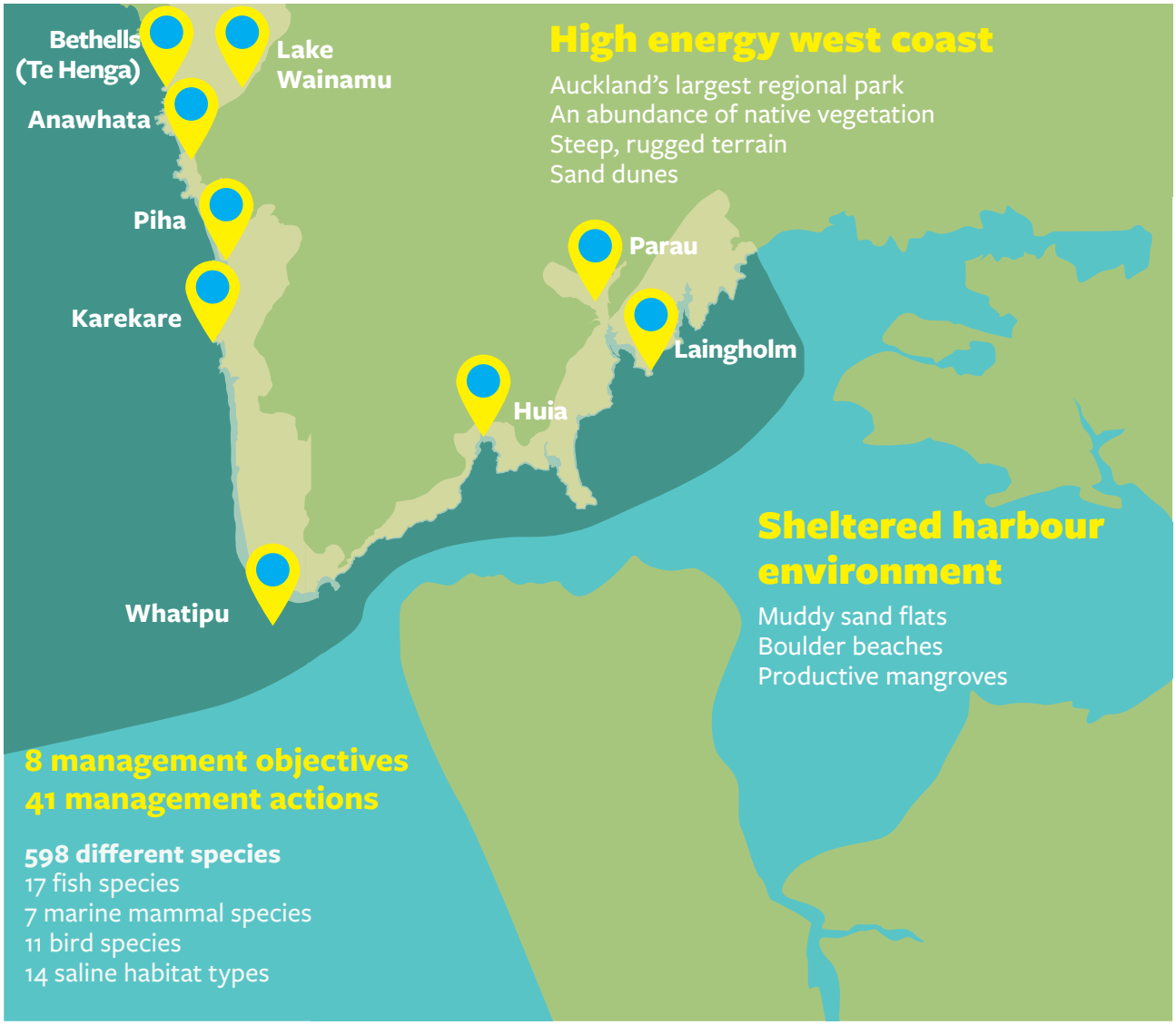
Waitakere Ranges Local Board
Auckland Council

Big Blue Waitākere

Coastal and Marine Information Report



Prepared for Waitākere Ranges Local Board by Morphum Environmental Ltd.
April 2018, Version 1.4.

The research was undertaken for this report during 2016 and early 2017.
Information released after this time may not be incorporated into the document.

From the Deputy Chair

The Waitākere Ranges local board area is intrinsically linked to the coastal and marine environment, with its diverse habitats, plants, birds, marine mammals and fish. It is also prized as a hub for human activities, as we swim in it, walk around it, fish in it and move through it.

The ways in which the environment and people interact is not without cost. Aucklanders already know that some of our beaches and lagoons have levels of pollution that make swimming in them a hazard, and for some of these waterways the situation has existed for a great deal of time. Locally and globally, threats to local flora and fauna are numerous and include greenhouse gas emissions and associated climate change, ocean acidification and sea level rise.

What we do as individuals and groups can and does impact on the quality of the wider marine and coastal environment. This means that it is also up to us to protect it and think about our relationship with it, now.

We have commissioned this report to pull into one place detailed information on the northern beaches of Manukau Harbour and the West Coast. The report has special topics on fisheries, recreation and safety, and also sets out management objectives and potential actions. We want to use this to highlight the existing condition of our marine and coastal areas, and any issues in them which need addressing.

In doing this, we want to prompt a wide-ranging local conversation about our unique marine and coastal environment, how we interact with it and how we work together to protect and restore it. We invite the communities of the Waitākere Ranges to consider the contents of this report carefully and to engage with us in a discussion about what we can do as a community to preserve and, where needed, improve our local treasure.

Saffron Toms
Deputy Chair – Waitākere Ranges Local Board

Big Blue Waitākere

Prepared for Waitākere Ranges Local Board by Morphum Environmental Ltd.
This report is a guidance document to inform the Waitākere Ranges Local Board (WRLB) in proposing directions, priorities, and projects to protect and restore, or enhance unique marine and coastal areas within the jurisdiction of the local board.
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Geospatial Data Sources

Land Information New Zealand (LINZ) Data Service
https://data.linz.govt.nz/
Land Air Water Aotearoa (LAWA)
https://www.lawa.org.nz/
Ministry for Primary Industries – NZ Fisheries InfoSite
http://fs.fish.govt.nz/Page.aspx?pk=91
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https://data.mfe.govt.nz/
Auckland Unitary Plan – Operative in Part, 2016 http://unitaryplan.aucklandcouncil.govt.nz/pages/plan/Book.aspx?exhibit=AucklandUnitaryPlan_Print

Executive Summary

The Big Blue Waitākere report intended to be used as a guidance document to inform the Waitākere Ranges Local Board (WRLB) in proposing directions, priorities and projects to protect and enhance unique marine and coastal areas within the board's jurisdiction.

The purpose in commissioning the report is to promote the sustainable and adaptive management of the WRLB coastal and marine environment in order to:

- Identify and consolidate existing data, information and conclusions that are currently available for the local board area. Identify gaps in the current understanding and knowledge of the area.
- Identify potential management objectives and actions to address the known issues.
- Present this information in a visually engaging report format that has a communication style designed to appeal to a wide audience, including the board, local communities and the general public.
- Identify the stakeholder projects and involvement being undertaken which aim to improve environmental condition in order to inform engagement in the future.

The WRLB area encompasses approximately 58 km of coastline, extending from Raetahinga Point (north of Bethells – Te Henga) on the west coast to east of South Titirangi, French Bay and Wood Bay within Manukau Harbour. In most places, this coastline borders the Waitākere Ranges Regional Park, consisting of 17,000 hectares of contiguous park land. This area is protected by the Waitākere Ranges Heritage Area Act 2008 which acknowledges the area's unique natural and cultural intrinsic values.

The structure of the report is into five parts as follows:

Part A: Manukau Harbour
- Coastal
- Shore and Beach
- Nearshore

Part B: West Coast
- Coastal
- Shore and Beach
- Nearshore
- Offshore

Part C: Finfish and Shellfish Fisheries

Part D: Recreation and Safety

Part E: Management and Stakeholders
- Management Objectives, Actions and Benefits
- Stakeholder Involvement

Throughout the report, the coastal and marine environment refers to the landforms or structures formed by coastal processes, and the foreshore, seabed, and water and air from mean high water springs (MHWS) to 200 nautical miles (NM).

Auckland's west coast faces the exposed Tasman Sea and is dominated by black sand beaches and jagged rocky shores.

The sheltered northern coast of the Manukau Harbour features a combination of muddy sand flats, boulder beaches, large shore platforms, pockets of rocky coast and extensive mangrove areas.

Some of the greatest threats to the diversity and resilience of marine and coastal habitats are global issues such as greenhouse gas emissions and associated climate change, ocean acidification and sea level rise. Several management actions identified relate to how the local board can advocate for local scale contributions to carbon emissions that contribute to these global issues.

The key pressures affecting the marine and coastal habitats within the WRLB area include; urban development and discharge of contaminants; fishing pressure and methods; habitat destruction; wastewater pollution; rubbish, plastics and marine debris; invasive species; and potential risks associated with petroleum and sand exploration and mining.

While improvements have been made to local and regional management approaches, 90% of our native seabirds and more than a quarter of our native marine mammals are threatened with or are at risk of extinction. The rapid expansion of urbanised Auckland has resulted in coastal marine habitats and ecosystems becoming degraded. Chemical contaminants, high levels of nutrients and discharged sediments from waterways will continue to result in negative impacts. Even with the implementation of best practice management, it is unknown how irreversible these ecosystem-level changes may be.

Eight overarching management objectives have been identified for the WRLB marine environment. These objectives provide a base for strategic planning decisions for local scale

anthropogenic impacts on the coastal and marine environment. Adopting an adaptive management approach through the following key objectives will improve understanding and build resilience to the issues outlined. These are supported by 41 possible management actions outlined in section 11.0. The feasibility, cost and benefit of these actions have not been assessed.

The WRLB is not obligated to undertake any works identified as enhancement or management options in this report, nor is WRLB bound by preliminary prioritisation of projects undertaken as part of this methodology. Recommendations made will be considered within the context of the WRLB obligations, constraints, drivers, project identification, and catchment prioritisation undertaken or identified by WRLB.

Management Objectives

1. **Water Quality**
   To take a catchment-wide and behaviour change approach in order to maintain and improve water quality and clarity in streams, lagoons, estuaries and coastal environments.

2. **Habitat Diversity and Natural Character**
   To improve native species abundance and diversity by enhancing habitats. To preserve the natural character of the coastal environment, and protect natural features and landscape values.

3. **Natural Coastal Processes**
   To maintain or enhance natural biological and physical processes in the shore and beach environment, recognising their dynamic, complex and interdependent nature.

4. **Sustainable Fisheries**
   To promote the sustainable management of fisheries by taking an ecosystem approach to increasing the life supporting capacity while recognising their contribution to people's wellbeing and recreational activities.

5. **Threatened Species**
   To improve education, monitoring and awareness, and to advocate for increased protection of the critically endangered Māui dolphin and other threatened or data deficient marine mammals and birds.

6. **Offshore**
   Collaborate with government agencies and regional councils to preserve and protect the natural character of the offshore environment, while protecting natural features and values.

7. **Recreational Value and Safety**
   To maintain and improve the quality and safety of recreational locations, opportunities and experiences.

8. **Knowledge and Research**
   To be well informed, and to incorporate new research into adaptive management actions for the marine environment. To build and encourage community capability and knowledge of the marine environment including through this report, and through monitoring habitats and communities.

Glossary

The Waitākere Ranges Local Board (WRLB) and Auckland Council have commissioned this Big Blue Waitākere report to increase local knowledge and appreciation of the marine and coastal environment in the WRLB area.

Several technical terms and abbreviations are used throughout this report. These are defined below.

The environment does not fit into neat boxes, and many things discussed in the report will cross, affect, or influence multiple areas from the land, harbour and into the deeper ocean. However, for the ease of dividing this report into chapters, four main zones have been defined as shown in figure 1 and described below.

Actual catch	With respect to fisheries, the total quantity of fish caught annually. Calculated per fish **stock**.
Associated or dependent species (fisheries)	Species impacted by the removal of key prey or predator **target species**.
Benthic	Meaning 'bottom dwelling'. This can refer to habitat on and in the sediment of the seafloor, as well as the animals and plants that live in these environments.
Biogenic habitat	Habitat that is formed by animals; e.g., seagrass, mussel, coral and tube worm reefs. These have a high biological diversity (biodiversity).
Biomass	With respect to fisheries, the total weight (tonnes) of a specific species of fish or shellfish.
By-catch species	With respect to fisheries, species caught by accident while fishing for **target species**.
Catchment (also known as "watershed ")	An area of land bounded by hills or mountains from which water flows into streams and then out to the sea. The size of the catchment depends on the topography of the area, and very large catchments can be made up of many small catchments. Water runs from the headwaters, downhill towards the sea.
Coastal zone	This term has been defined specifically for this report. **WRLB catchments** that drain into the Manukau Harbour and the west coast of Auckland. Approximately 2 km landward of the mean high water spring (MHWS), habitats that are formed by coastal processes; e.g., dunes and dune lakes, and land associated with the marine **significant ecological areas** identified in the Auckland Unitary Plan – Operative in Part 2016 (AUP–OP Schedule 4, 2016). There are no universal definitions for a coastal habitat zone in Auckland or New Zealand. The definition has been formulated using a combination of definitions from the Auckland Council Regional Plan: Coastal. The coastal environment depends on the site specific features, such as **MHWS**, and refers to the **coastal marine area**, active coastal zone (e.g., beach and foreshore) and the landward component.
Coastal marine area (CMA)	The coastal marine area is defined in the Resource Management Act as the foreshore and seabed, coastal water and air space above the water between the landward boundary (**MHWS**) to 12 NM offshore.
Demersal	Usually refers to fish that live and feed close to the seafloor, but not directly on it.
DoC	Department of Conservation.
Ecological diversity	Ecological diversity takes into account the complexity of a biological system. Diverse ecosystems are more resilient to change and have a larger number of habitats for plants and animals to live in.
Endemic	Only found in New Zealand.
Exclusive economic zone (EEZ)	The exclusive economic zone (EEZ) is the area of sea beyond the territorial sea to 200 NM where New Zealand has sovereign rights and jurisdiction. New Zealand's EEZ is one of the largest in the world, 15 times larger than the area of our land.
Exotic (also "introduced")	Species that humans have brought to New Zealand, either by accident or on purpose.
Finfish	Bony fishes with a backbone such as cod, salmon, tunas and groupers.
Fish stock assessment	With respect to fisheries, a management tool used to collate biological and fisheries data for the regulation of fish **stock**. A stock assessment integrates the history and the possible impact future quotas will have on the fishery.
Fishing effort	With respect to fisheries, the total number of commercial fishing boats per day in a defined statistical area per annum.
Introduced (also "exotic")	Species that humans have brought to New Zealand, either by accident or on purpose.
Invasive	A species that is not native, and that can cause ecological or economic harm to its environment.

Invertebrates	Animals without a backbone; e.g., shellfish, crabs and octopuses.
Landings	With respect to fisheries, fish brought onto land.
Macroinvertebrates	Animals (**invertebrates**) that are typically bigger than 0.5 mm, including shellfish, marine snails, worms, crabs and others.
Mean high water spring (MHWS)	The MHWS tide level is traditionally defined as the average of pairs of successive high waters in a 24 hour period at new and full moon. This landward boundary moves somewhat with natural cycles of shoreline movement, and will continue to change with sea level rise. The MHWS level can be indicated by the toe of a dune or cliff, the highest line of driftwood, or the seaward edge of glasswort and other salt marsh plants.
MPI	Ministry of Primary Industries.
Native	Naturally found in New Zealand. May also be found in other countries.
Nautical mile (NM)	A nautical mile is 1,852 m long. This is based on the circumference of the Earth.
Nearshore zone	This term has been defined specifically for this report. Manukau Harbour – the furthermost extent of the WRLB area into the harbour. West Coast – approximately the low tide mark, shallow surf zone (approx. 30 m deep) out to the 12 NM limit.
Offshore zone	This term has been defined specifically for this report. From 12 NM to 200 NM (the section of the EEZ that would be covered if the local board boundaries were extended in a straight line).
Pelagic	Meaning 'open sea'. This refers to the water column in the open ocean (between the sea floor and the surface) as well as the animals and plants that live there.
Quota Management System (QMS)	The New Zealand Quota Management System (QMS) allows the management of fisheries resources through control of harvest levels for each species, dependent on geographical area.
Significant Ecological Area (SEA)	Significant Ecological Areas (SEAs) are identified by the Auckland Council to maintain and protect indigenous biodiversity. These areas are recorded in the Auckland Unitary Plan – Operative in Part 2016. Coastal marine areas are considered to be significant if they meet one or more of the following factors (AUP–OP Schedule 4, 2016.): 1. Recognised international or national significance. 2. Threat status and rarity; i.e., rare or threatened habitat types, or habitats where rare or threatened species are found. 3. Uniqueness or distinctiveness (to the Auckland region). 4. Diversity; i.e., consisting of a large number of different habitat types or species. 5. Containing stepping stones, buffers, and migration pathways. 6. Representativeness; i.e., gaps in representation across marine habitats and ecosystems or best examples.
Shore and beach zone	This term has been defined specifically for this report. The seaward extent of the **MHWS** to an approximated low tide mark.
Spawning stock biomass	With respect to fisheries, the total mass of breeding age fish. This varies between species.
Stock (fish)	With respect to fisheries, the sub-population of a specific species of fish within a defined geographic area.
Target species	With respect to fisheries, the species intended to be caught.
Total allowable commercial catch (TACC)	With respect to fisheries, the commercial quota for a particular species of fish per stock area.
WRLB	Waitākere Ranges Local Board.

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Introduction

The Waitākere Ranges Local Board (WRLB) is responsible for decision making on local issues, activities and services. The board provides input into regional strategies, policies, plans and is one of nine local boards that form the Manukau Harbour Forum (MHF). The MHF was formed in response to the deteriorating state of the harbour and advocates for its restoration. In the Auckland Council 2016 State of Auckland Marine Report card, the Manukau Harbour received a D rating based on water quality, contamination, sediment and ecology. Many of the northern Manukau Harbour beaches and the west coast lagoons are unsafe to swim in with standing long-term health warnings due to faecal contamination.

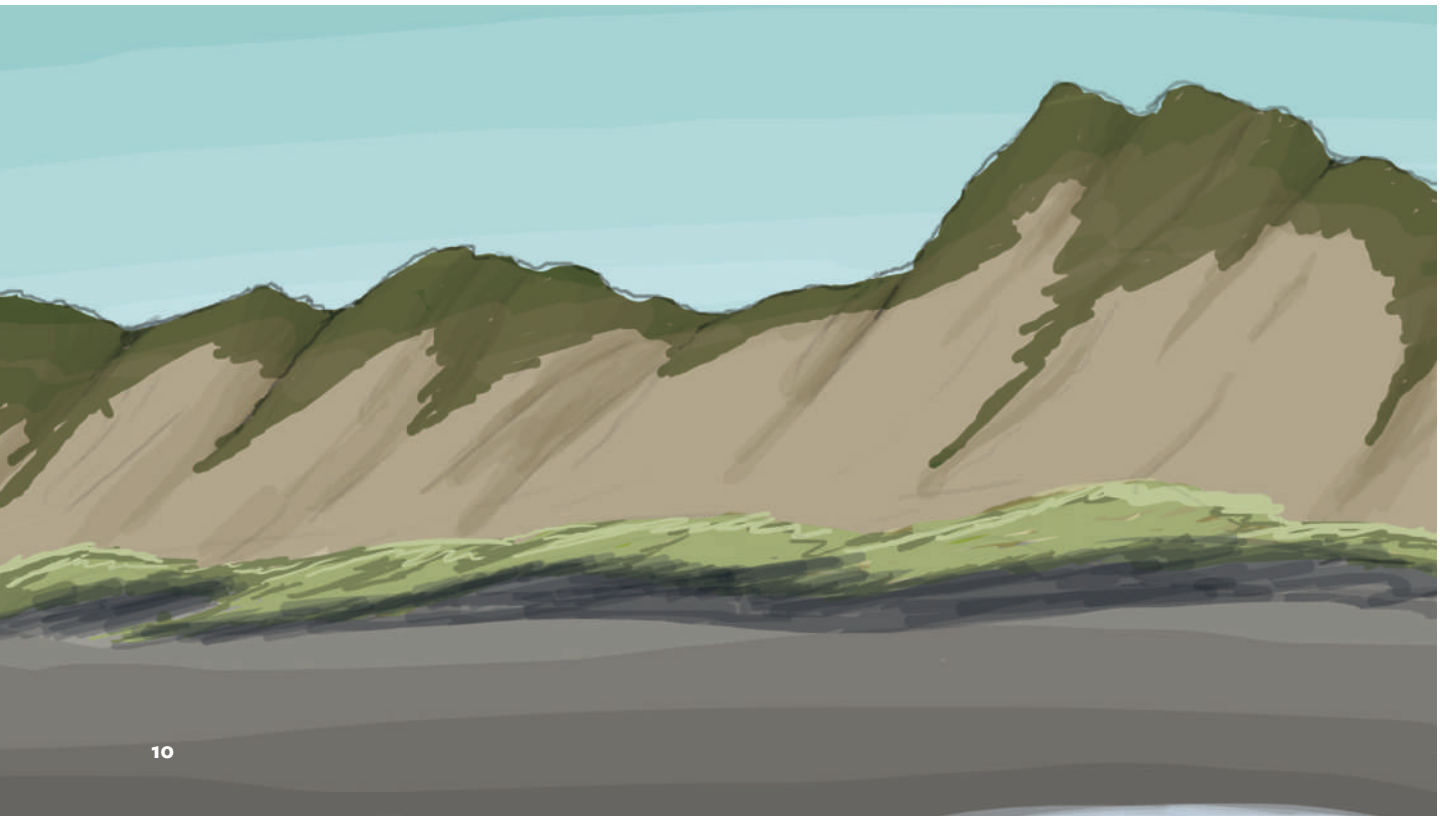
The WRLB have commissioned the Big Blue Waitakere Report which provides a summary of the existing knowledge of the coastal and marine environment within the WRLB area. The report provides guidance on proposed directions, priorities, and projects, to protect and enhance unique marine and coastal areas within the board's jurisdiction.

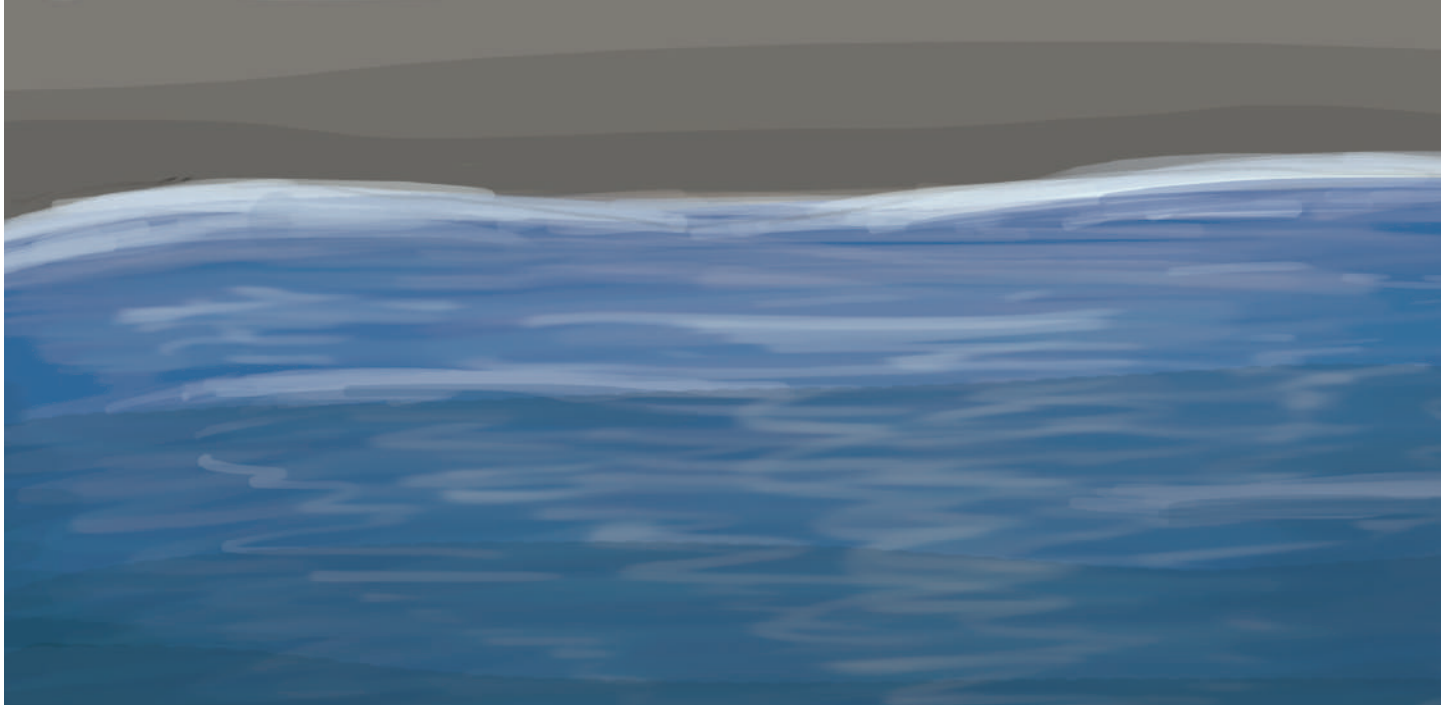
The WRLB area includes part of the Manukau Harbour, from Whatipu to east of South Titirangi, French Bay and Wood Bay. The WRLB coastline also extends northwards along the west coast from Whatipu to Raetahinga Point (north of Bethells – Te Henga). Almost all of the 27,720 ha of the Waitākere Ranges Heritage area is within the board's boundaries. This heritage area was designated to preserve the unique natural character and cultural heritage for future generations. The objectives of the heritage area include the management of the aquatic and terrestrial ecosystems in order to protect and enhance indigenous habitat, landscape, and amenity values.

The Manukau Harbour covers a total area of approximately 365 km^2 at high tide, and has 460 km of coastline. The coastline consists of a series of sheltered inlets and embayments that feed into the main body of Manukau Harbour. It comprises a shallow basin, where 62% of the harbour is exposed at low tide, and a narrow mouth about 2.5 km wide, which is constricted by Awhitū Peninsula to the south and Whatipu to the north. The sheltered northern coast of the Manukau Harbour in the WRLB area features a combination of muddy sand flats, boulder beaches, large shore platforms, pockets of rocky coast and extensive mangrove areas.

Auckland's west coast is prized for its outstanding natural landscapes, with steep cliffs, extensive dune systems, sea caves and dynamic black sand beaches. The coastal environment has intact native coastal vegetation sequences which naturally grade into exposed rocky shore and surf beach environments. The freshwater dune lakes and wetlands are home to a number of threatened bird species.

The natural environment of both coasts; the dynamic west coast, and the sheltered bays of the northern Manukau Harbour are highly valued for many and varied recreational activities including surfing, fishing, swimming, walking, and more. These coastlines are home to a diverse range of habitats and an abundance of plants, birds, fish, and marine mammals, many that are endemic to New Zealand.





WRLB area has significant cultural and historical value however at this time these have been excluded.

Layout of Report

The northern Manukau Harbour (Part A) and west coast (Part B) are split into coastal, shore and beach, nearshore zones in each section. The offshore zone is only discussed in the west coast section, Part B. The current information for habitats and resources are described for each of the zones.

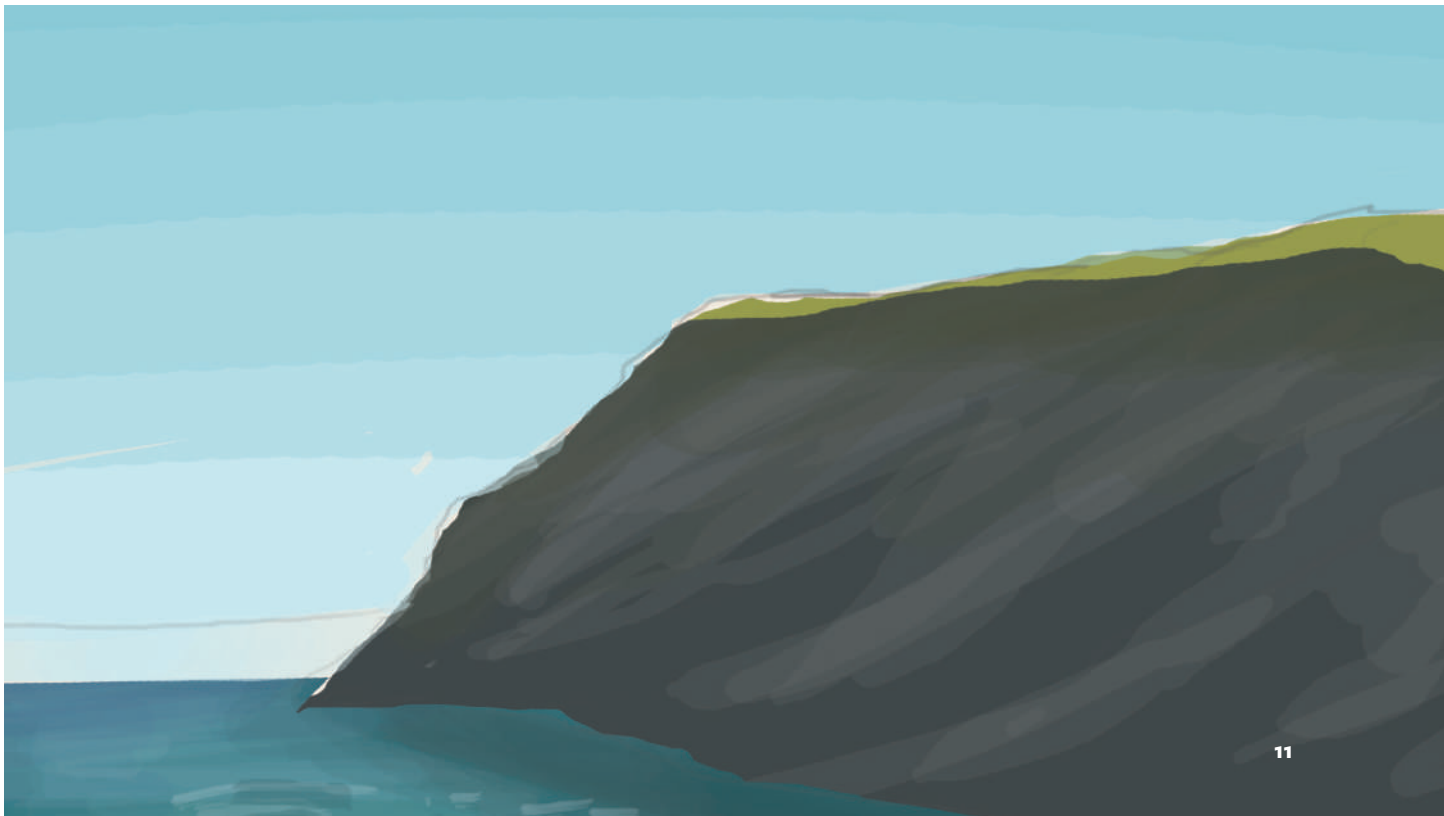
An overview of resources for finfish and shellfish fisheries are discussed collectively for Manukau Harbour and the west coast as these areas are unified in the North West fisheries management area (FMA 9).

Recreational values and public safety are also discussed collectively in a single chapter.

Definitions of Zones Used in this Report

Coastal Zone

WRLB catchments that drain into the Manukau Harbour and the west coast of Auckland. Approximately 2 km landward of the mean high water spring (MHWS), habitats that are formed by coastal processes; e.g., dunes, dune lakes and land associated with the marine significant ecological areas identified in the Auckland Unitary Plan – Operative in Part 2016 (AUP–OP Schedule 4, 2016).



Shore and Beach

The seaward extent of the MHWS to an approximated low tide mark.

Nearshore

Manukau Harbour: the furthermost extent of the WRLB area into the harbour.

West coast: the shallow coastal zone (30 m) out to the12 NM limit.

Offshore

12 NM to the 200 NM EEZ limit.

Parts A and B

Coastal Environment

Chapters One and Four focus on the catchments, streams, coastal lagoons, lakes and wetlands within the WRLB area.

There are two of the five catchments within the WRLB area drain into the Manukau Harbour:

1. Titirangi/Laingholm (1,238 ha)
2. Huia (6,939 ha)

Three of the five catchments in the WRLB drain to the west coast:

1. Okititoto (88/3,227 ha)
2. Piha/Karekare (8,328 ha)
3. Waitākere (6,603 ha)

Catchment water quality is related to land cover and use, geology and soil type and land management. The catchment water quality directly impacts the receiving environment; streams and beaches.

Major threats to water quality include:

- reduced water clarity resulting from sediment runoff from land,
- heavy metal contamination,
- pollution from polycyclic aromatic hydrocarbons (PAHs) and plastics, and
- point source pollution discharges such as spills and wastewater contamination.

Shore Environment

Chapters Two and Five focus on the information available for intertidal, beach and estuarine habitats in Manukau Harbour (Part A) and the intertidal and beach habitats of the west coast of Auckland (Part B). This includes describing the habitat types and dominant species in this zone and summarising long term environmental monitoring in the Manukau Harbour of intertidal sediment quality and benthic invertebrate communities.

Nearshore Environment

Chapters Three and Six focus on the presence and absence of biogenic habitats (e.g. seagrass, horse and green-lipped mussel beds), rocky reefs, marine mammals, seabirds, and water quality.

Offshore Status

Chapter seven focuses on benthic (seafloor) habitats and the presence of pelagic (living in the water column in the open ocean) species, and provides a summary of mineral mining, petroleum mining and exploration activities in the area. Within Auckland, local boards have jurisdiction to the 12 NM limit. Resources in the offshore environment are collectively managed by six government agencies and sixteen regional councils.

Part C

Status of Fisheries

The coastal and marine environment of the WRLB is highly prized for its amenity and recreational values for fishing, swimming, walking, boating, surfing and many more water based activities.

Part D

Recreational and Safety

The coastal and marine environment of the WRLB is highly prized for its amenity and recreational values for fishing, swimming, walking, boating, surfing and many more water based activities.

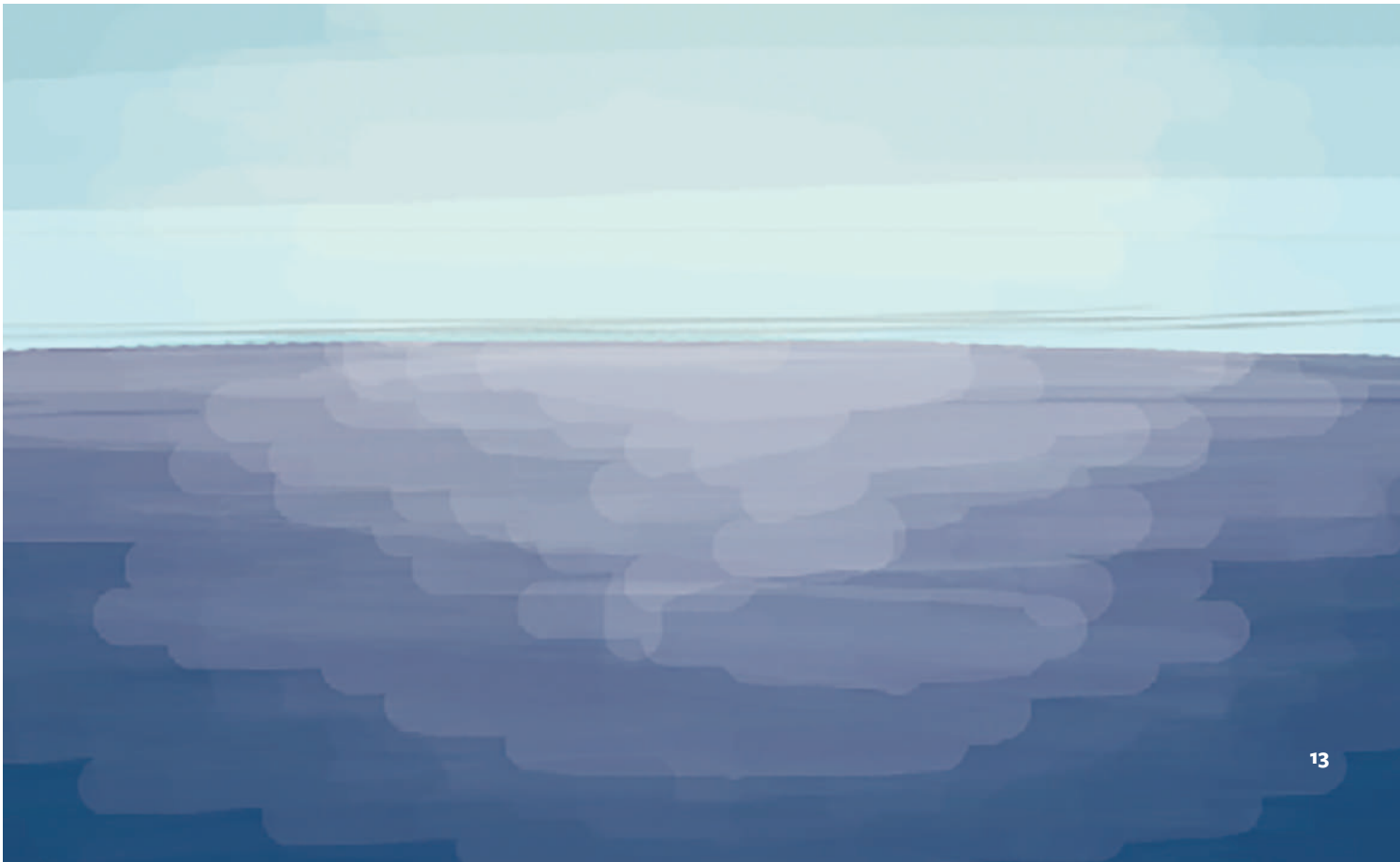
Chapter nine focuses on recreational water quality, a brief overview of coastal hazards and known invasive species in the area, walking tracks, public transport, surf beaches, emergency services, boating and drowning statistics.

Part E

Management and Stakeholders

In chapter ten, eight overarching management objectives are identified for the WRLB coastal and marine environment to provide a base for strategic planning decisions for local scale anthropogenic impacts on the coastal and marine environment. These are supported by 41 management actions collated across from across parts A to D that aim to target identified impacts on the coastal and marine environment within the scope of the local board.

In chapter eleven, potential stakeholder interests and involvement are divided into groups organised on known locations of interest. Where possible, existing and current projects are linked with proposed management actions; however, this is not an exhaustive list.




Wood Bay
French Bay
Little Muddy Creek
Big Muddy Creek
Laingholm
Huia
Kakamatua
Cornwallis

Part A

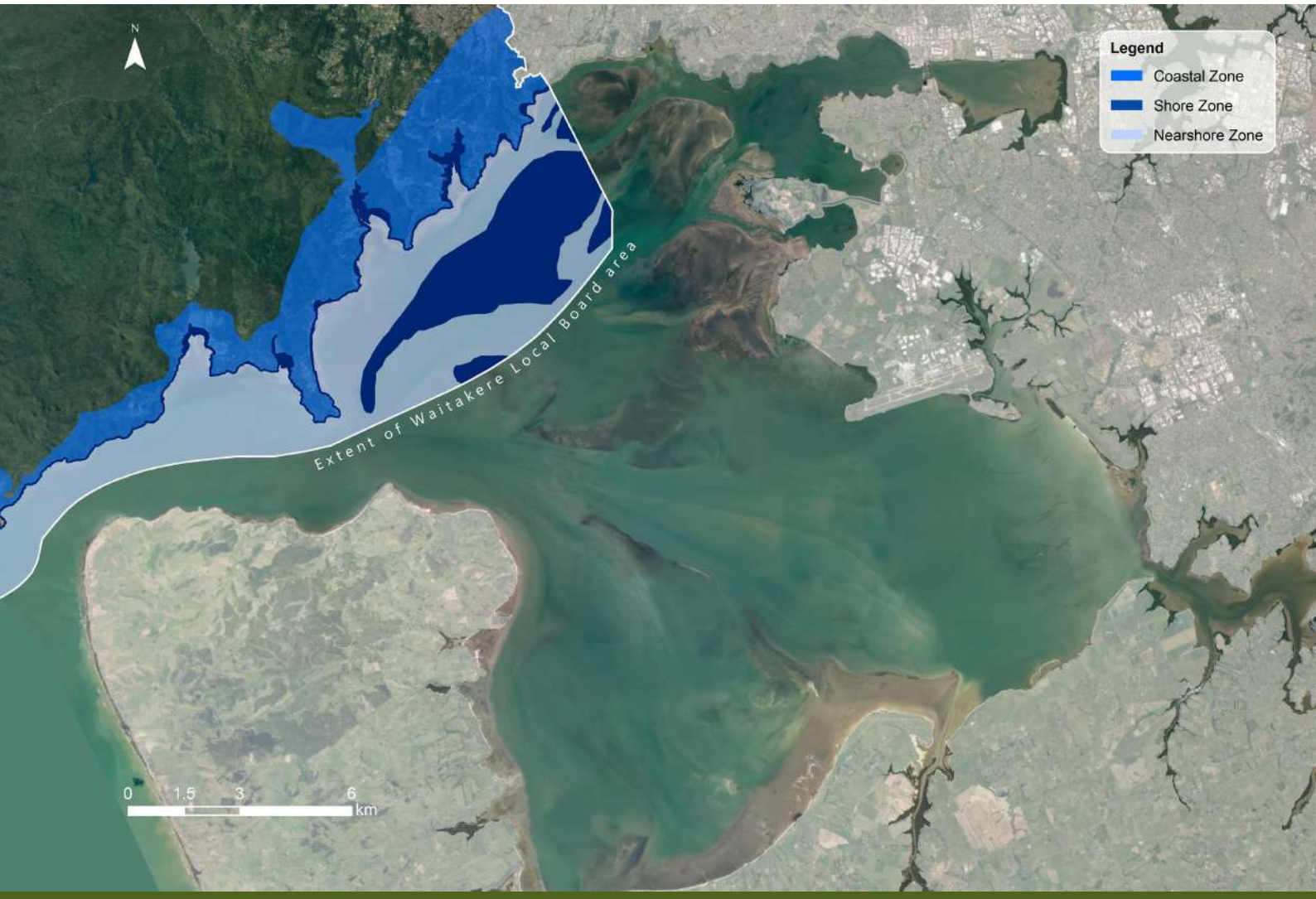
Manukau Harbour

1.0 Coastal

This chapter focuses on the two catchments within the WRLB (Huia and Titirangi/Laingholm) that drain into the Manukau Harbour. Catchment water quality is related to land cover and use, geology and soil type and land management (Lintern *et al*., 2017). Catchment water quality directly impacts the receiving environment; streams and beaches. To capture these catchment wide effects, the coastal zone in this study has been defined as approximately 2 km landward of the mean high water spring (MHWS), or land associated with the marine significant ecological areas identified in the Auckland Unitary Plan – Operative in part, Schedule 4, 2016 (AUP–OP Schedule 4, 2016) (Figure 1).

Rainfall runoff is a natural process whereby rainwater runs over land, is filters through sediment and vegetation to groundwater, streams, lakes and wetlands, and then finally out to the coast. In a modified catchment with increasing urbanisation, the ground is gradually covered by impervious surfaces (e.g., concrete and tar seal) which do not allow rainfall (stormwater) to penetrate into the ground (Ira and Faire, 2014). Surface runoff picks up pollutants from roads, buildings and other infrastructure (Ira and Faire, 2014. Increased stormwater volumes and velocities can cause erosion on land and in watercourses (Ira and Faire, 2014). Stormwater transports nutrients from agricultural land into streams and contributes to wastewater contamination (Ira and Faire, 2014). Chemical contaminants can bind to fine sediment particulates, which tend to accumulate in sheltered, low energy coastal environments such as estuaries and harbours (Mills *et al*, 2012). Thus, the health of coastal waters is influenced by the quality of freshwater that runs through streams and rivers, and flows over the land as stormwater (Walker and Vaughan, 2014).

Figure 1: Zones of the northern Manukau Harbour; Coastal Zone; from the Auckland Council District Plan: Coastal, Shore Area (MHWS to approx. low tide) and Nearshore zone (approx. low tide to the edge of the WRLB area).



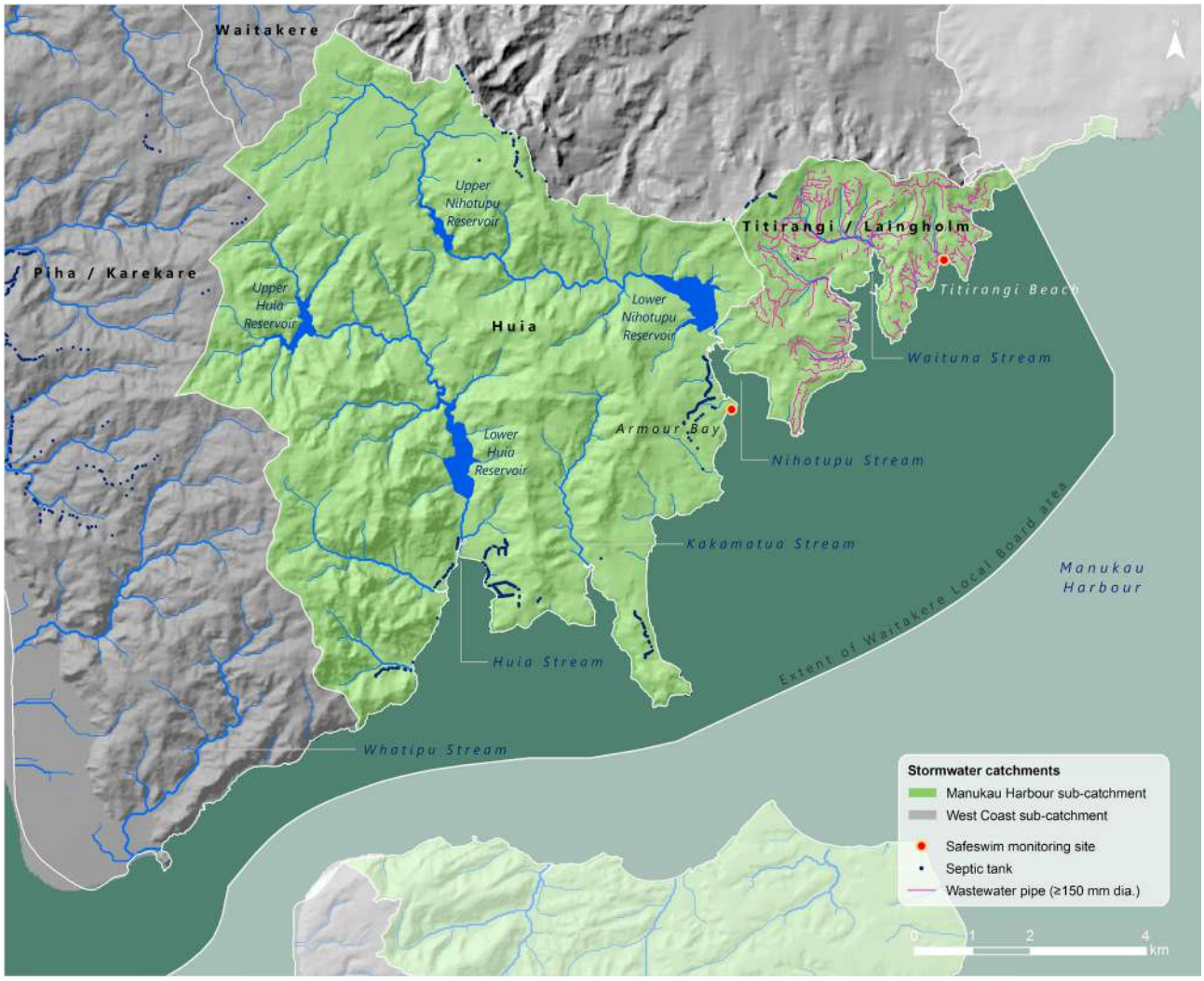


Figure 2: Catchments, streams, septic tank and wastewater network in the northern Manukau Harbour coastal environment.

The coastal marine area includes "the foreshore, seabed, water, and air from mean high water springs to 12 nautical miles (territorial sea).

The mean high water springs boundary is indicative only as this is a dynamic and varying boundary defined by the largest 10% of all high tides.

Auckland Unitary Plan: Coastal

1.1 Streams and Catchments

Of the five catchments in the Waitākere Ranges Local Board (WRLB) area, there are two Titirangi/Laingholm and Huia that drain solely into the Manukau Harbour (Figure 2).

1.1.1 Titirangi/Laingholm

The Titirangi/Laingholm catchment is located on the southern end of the Waitākere Ranges, with the Waituna and Woodlands Streams flowing from the foothills into the Manukau Harbour via Little Muddy Creek. Paturoa Stream discharges to Titirangi Beach. Gullies are mostly forested, with residential land use around the ridges and on the flat coastal areas. The Waituna Stream is in the urban residential environment of Woodlands Park, and is serviced by a local reticulated wastewater network.

A small percentage of the coastline is modified by human use, particularly in Wood Bay, South Titirangi and Laingholm coastal areas.

Long term data analysis of temporal trends in streams and estuaries in the Auckland region indicate stream water quality is a major driver of water quality at inner harbour sites (Scarsbrook, 2008). Consequently, improvements in water quality in major streams following remedial works will contribute to improving water quality in receiving water bodies, such as harbours and estuaries (Lowe *et al*., 2014).

Rapid stream assessments were undertaken to support the Manukau Harbour Consolidated Receiving Environment (CRE) ecological health report (Lowe *et al*., 2014). Specifically, focal (major) streams were isolated by GIS as follows:

- located within the metropolitan urban limit, and
- more than 50% of the stream reach is located on land zoned as public open space.

Focal stream assessments of Paturoa and Waituna Streams were conducted during September and October 2013 by Morphum Environmental. Significant erosion hot spots were identified on Paturoa Stream near Titirangi Beach Road and on Waituna Stream, which may be contributing to sediment inputs to Little Muddy Creek. Whilst Paturoa stream was primarily located within remnant native forest, the riparian margin of Warituna Stream is impacted by residential land use, resulting in reduced shading, stormwater filtration, and other habitat and channel stability functions.

To supplement this physical stream assessment, the data from each of the focal streams was summarised from the Water Quality Program (Management of Streams) carried out by EcoWater for Waitākere City Council (2004). Water quality parameters such as dissolved oxygen, pH, temperature, conductivity and suspended solids were compared against The Australian and New Zealand Guidelines for Fresh and Marine Water Quality 1992 trigger guidelines to assess the overall health of the watercourse. Biological health was assessed using the macroinvertebrate community index, which is a tool that measures the number of species and abundance in the reach, and the sensitivity of those species to organic pollution. This provides a more integrated picture of water quality than physico-chemical monitoring alone. Habitat parameters for native fish were assessed by collecting surrounding site details such as land use, litter, stream vegetation, water and sediment odours, turbidity and surface oils. This information has been summarised in Table 1 (Woodward and Jones, 2004).

Table 1: Data from Water Quality Programme (Management of Streams) Laingholm/Titirangi (June 2004). Prepared for the former Waitākere City Council.

	Paturoa Stream	Warituna Stream	Woodlands Stream
Water quality	Moderate	Moderate	Moderate/ good
Biology	Good	Good	Good
Habitat	Moderate/ good	Good	Good

Figure 3: Coastal forest above MHWS in the upper reach of Nihotupu Stream which drains into Big Muddy Creek. Photo: Cat Davis.

These data provide a baseline for further monitoring at these streams to assess the watercourse's current state, and potential impacts to the watercourse over the past decade.

1.1.2 Huia

The Huia catchment is 6,939 ha dominated by public open space (predominantly Waitākere Regional Park) with small pockets of residential housing in Parau, Cornwallis, Huia and Little Huia.

The area is drained by the Huia and Nihotupu streams, which discharge to Big Muddy Creek. Nihotupu and Huia streams are restricted by the four reservoirs that are present on each of their main channels (Figure 2).

The Waitākere Ranges Regional Park is large area of 1,370 ha and 26% of this area has significant barriers to fish passage (Barners, 2005). This is a result of the large reservoirs, Huia and Nihotupu dams that have instream barriers which reduce the abundance, diversity and distribution of native fish (Barners, 2005). Due to the closeness of the lower Huia and lower Nihotupu reservoirs to the coast, it is likely that they both have a significant controlling impact on fish community composition (Watercare Services Ltd, 2001). Several galaxiids, longfin and shortfin eels are known for their climbing ability. However, other species in particular common bully, crans bully and red finned bully are known as swimmers would be restricted moving into the upper catchment. The reservoirs significantly reduce the catchment flow by 65% to 99% which may influence the macroinvertebrate, fish and algae populations in downstream reaches (Watercare Services Ltd, 2001).

Watercare Services Ltd monitor water quality at four reservoirs: Upper Huia, Lower Huia, Upper Nihotupu and Lower Nihotupu. Based on this data, the water quality is high and nutrient levels are low which is reflective of the low level of development within the catchment.

Reservoirs are known to have an impact on sediment transport through a catchment by catching and retaining sediment in the reservoir and/or releasing it periodically into the downstream environment (Annandale, Morris, and Karki, 2016). This means that the downstream habitats are either starved of nutrients and/or material which form soft shores along coastlines (Annandale, Morris, and Karki, 2016). During cleaning processes, trapped sediment is flushed from reservoirs and released as a large surge into the stream and ultimately the marine environment (Annandale, Morris, and Karki, 2016). High levels of sediment runoff remain a major concern for coastal environments due to increased turbidity (reduced water clarity) and the associated smothering of marine organisms and habitats (Thrush *et al*., 2004).

The downstream environment of the Huia reservoir lacks overhanging vegetation cover (riparian), has excessive algae growth and lacks diversity in stream habitat; i.e., a variety of stream/estuary categories such as still, backwater, pool, riffles, run, rapid and cascades (Uttarwar, L., 1998).

The Huia catchment is not serviced by reticulated sewer or water supply network, so most houses have onsite water supply and wastewater treatment systems, mainly rainwater collection and septic tanks. It is likely that poorly performing onsite wastewater systems could be having an impact on the water quality in these areas (Figure 2).

In 2012, Auckland Council took over management of the private septic tank maintenance in an effort to improve water quality in streams, lagoons and ultimately harbours. Private septic tanks are held in a register, are cleaned and maintained in systematic way and managed on a cyclic basis. The blue dots Figure 2 represent private septic tank systems which are maintained on this cyclic maintenance schedule by Auckland Council Healthy Waters. The Titirangi and Laingholm catchment is the only area that is serviced by a reticulated sewer network, shown by the pink wastewater pipe lines (Figure 2).

1.2 Seabirds

Currently, there are programs monitoring seabirds at Laingholm and Cornwallis, but this data is not publicly available. Citizen science online platforms, such as ebird and New Zealand Birds Online, house data of public sightings for New Zealand bird species. These platforms identify that Huia in the Manukau Harbour is a bird hot spot (54 species) (Figure 4). The threatened grey-faced petrel is known to breed at Cornwallis and be present in South Titirangi (Figure 4). This habitat is likely reduced due to the presence of introduced predators such as rats, dogs and cats which prey on the eggs and young as well as adults. Further details on the wading birds that are present in the area are discussed in Section 2.1.3.

Figure 4: Locations of the grey-faced petrel burrows at Cornwallis and seabird species hot spot at Huia.

Dr James Russel, The University of Auckland – School of Biological Sciences, 2017 and ebird.org, accessed on 20/02/2017.

1.4 Coastal Management

Overall, the greatest threats to the diversity and resilience of habitats and fauna and flora in this zone include anthropogenic land use pressures and their impacts on streams draining to the coastal environment, predator and human disturbance of nesting seabirds, and the potential impacts of dams on sediment transport and fish passage. In consideration of these issues, the following three management objectives and six management actions have been identified for the Manukau Harbour coastal WRLB area.

Objectives

1. To improve water quality and clarity in the streams, estuaries and harbour environment.
2. To enhance habitats to improve native species abundance and diversity.
3. To preserve the natural character of the coastal environment and protect natural features and landscape values.

Actions

1. Continue to support the initiatives of landowners, volunteers and community groups that enhance the ecology of the area through pest control, pest plant control, and coastal and riparian planting.
2. Encourage and implement programs that improve public awareness around pollution in waterways and into the stormwater network. Examples are Water Sensitive Communities,Water Sensitive Schools and Wai Care programs.
3. Enhance degraded watercourses in the catchments by:
   a. Enhancing native riparian vegetation to a mini mum corridor width of 15 m where possible, including engaging with private landowners and residents. Key areas identified in previous stream assessments include Warituna Stream and down stream of the Huia dam.
   b. Investigating potential naturalisation options for modified and lined channels.
   c. Investigating erosion prevention and mitigation works, particularly at Paturoa Stream and Waituna Stream.
   d. Support a review and assessment of in-stream structures to improve fish passage upstream, particularly those with respect to coastal infrastructure in the Huia catchment.
4. Advocate for proactive identification and remediation of water contamination issues within the area.
5. Support/implement predator control initiatives on coastal cliffs, wetlands and other habitats to protect native shore and coastal birds, including colonies of grey-faced petrel.

1. From the Muddy Creeks; Local Area Plan for Parau, Laingholm, Woodlands Park and Waimā – Draft July 2013

2.0 Shore and Beach

This chapter focuses on the shore and beach zone of the northern Manukau Harbour which also includes estuaries and coastal wetlands.

For the purpose of this study, the shore and beach zone has been defined as mean high water springs (MHWS) to an approximated low tide mark.[2]

This chapter provides an overview of:

- Habitat types and dominant species assemblages in this zone.
- Long term environmental monitoring of intertidal sediment quality and benthic invertebrate communities.

Knowledge of habitat types, community structure and the current status of the these environments is important in understanding how threats such as erosion, fishing pressure, climate change and pollutants may be impacting species presence and abundance in an area.

The intertidal zone is a harsh environment where inhabitants undergo significant changes in temperature, salinity, exposure and desiccation with the rise and fall of the tide. The intertidal zone is exposed to the air at low tide and covered with water at high tide. This results in distinct zonation of organisms (plants and animals) vertically along the intertidal zone.

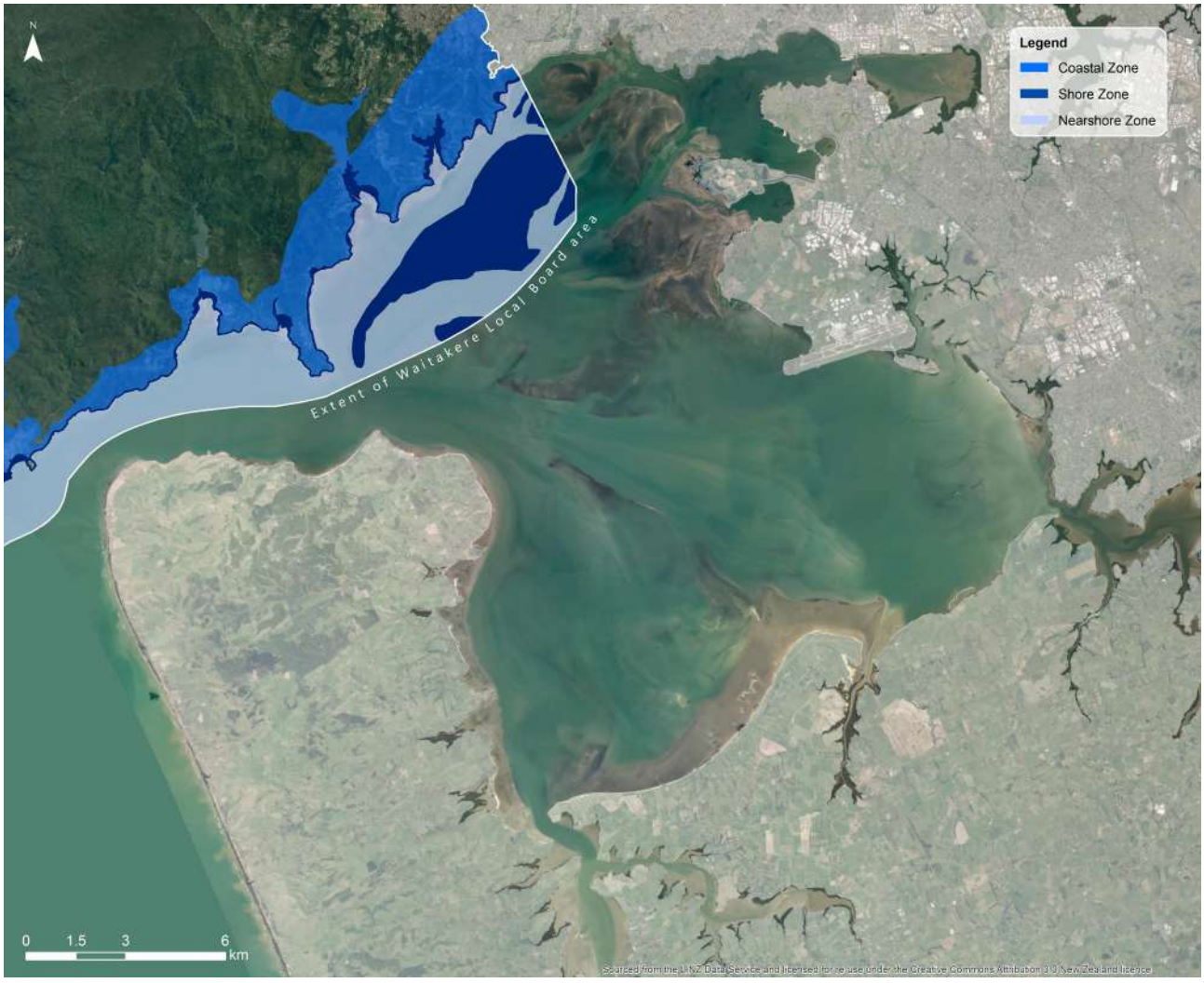


Figure 5: Zones of the northern Manukau Harbour; Coastal Zone, from the Auckland Council District Plan: Coastal, Shore Area (MHWS to approx. low tide) and Nearshore Zone (approx. low tide to the edge of the WRLB area).

2. This approximated low tide mark was created in GIS using a Digital Terrain Model (DTM) to generate contours from Light Detection and Ranging (LIDAR) surveys of the area. This created gaps in some areas (e.g. cliff faces) this was manually filled in using aerial imagery.

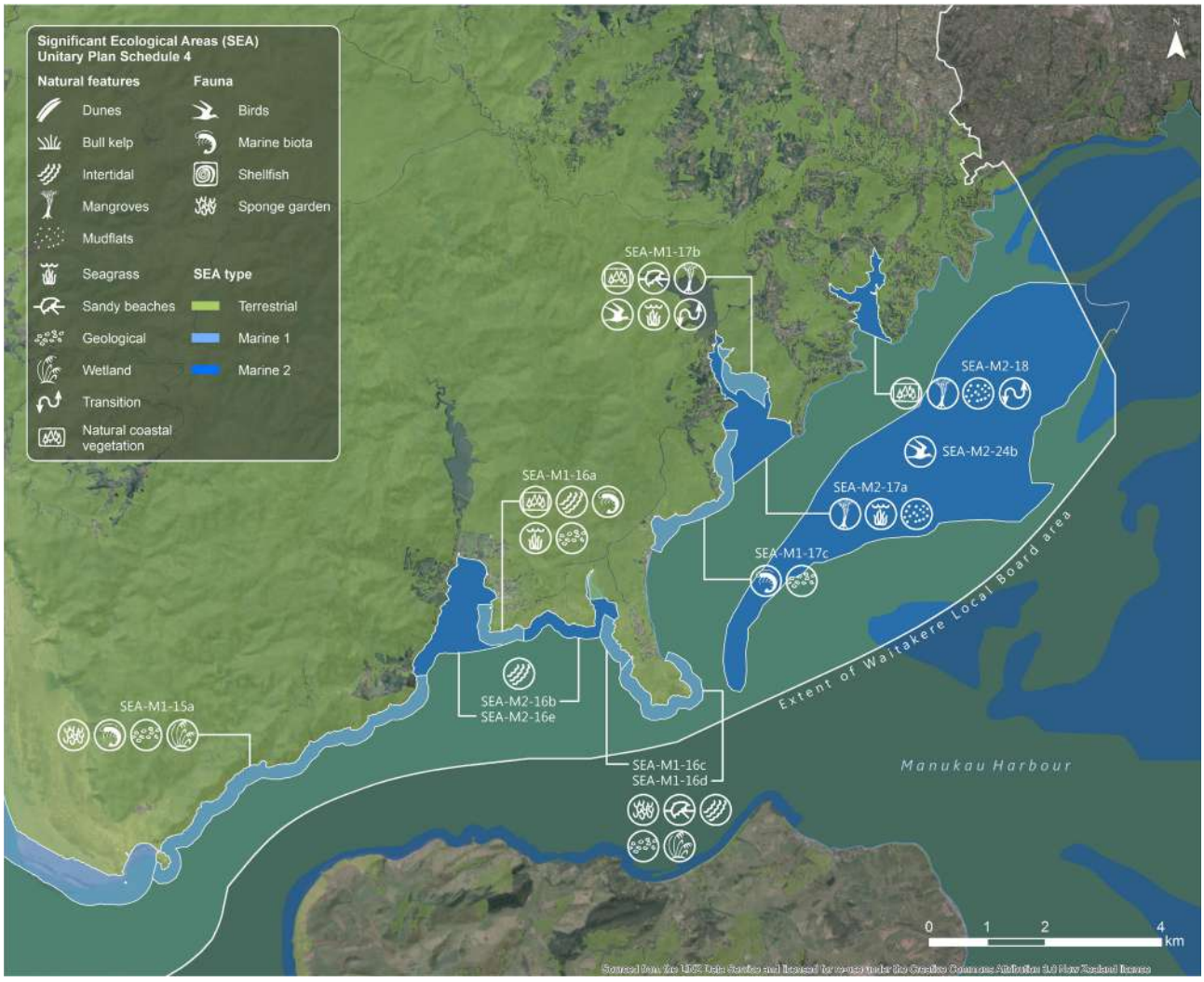


Figure 6: Significant Ecological Areas (SEA) and dominant ecosystem values in the northern Manukau Harbour intertidal zone.

Modified from the AUP–OP Schedule 4, 2016.

2.1 Habitat Types

The main habitat types within this zone are rocky platforms, sandy beaches and extensive sand flats in the harbour which are exposed at low tide (Figure 6). Each of the main beaches and inlets in this zone are outlined in the following paragraphs from Omanawanui at the harbour mouth to South Titirangi, French Bay and Wood Bay in the inner harbour (Figure 6).

Shore and beach habitats consist of tide-dominated and tide-modified beaches. In the WRLB area, these beaches have low wave energy and a high tidal range; i.e., the intertidal zone is wide (NIWA, 2016).

The shore habitats also include the large shell banks present in the harbour. These shell banks are designated Significant Ecological Areas (SEAs) under the Auckland Unitary Plan – Operative in part, Schedule 4, 2016 (AUP–OP Schedule 4, 2016). Inside the local board area, the most notable shell bank is SEA M2 24b (AUP–OP Schedule 4, 2016). This shell bank is an important wading bird habitat, and include extensive shellfish and seagrass beds on SEA M2 24 (Figure 6).

The Department of Conservation (DoC) and Ministry of Fisheries – now the Ministry of Primary Industries (MPI) – undertook a collaborative mapping study to classify marine habitats across New Zealand (data sourced from DoC, Coastal marine habitats and marine protected areas in the New Zealand Territorial Sea: a broad scale gap analysis. (2011) Department of Conservation and Ministry of Fisheries. Referenced as "DoC and MPI, 2011" henceforth). The aim of this study was to protect biodiversity by ensuring a broad range of habitats and ecosystems is represented in marine reserves (DoC and MPI, 2011). One of the outcomes of this study was a consistent and detailed geospatial coastal habitat classification of the entire country (DoC and MPI, 2011). For the purposes of our study, the marine habitats have been mapped for the Waitākere Regional Local Board (WRLB) area only (Figure 7).

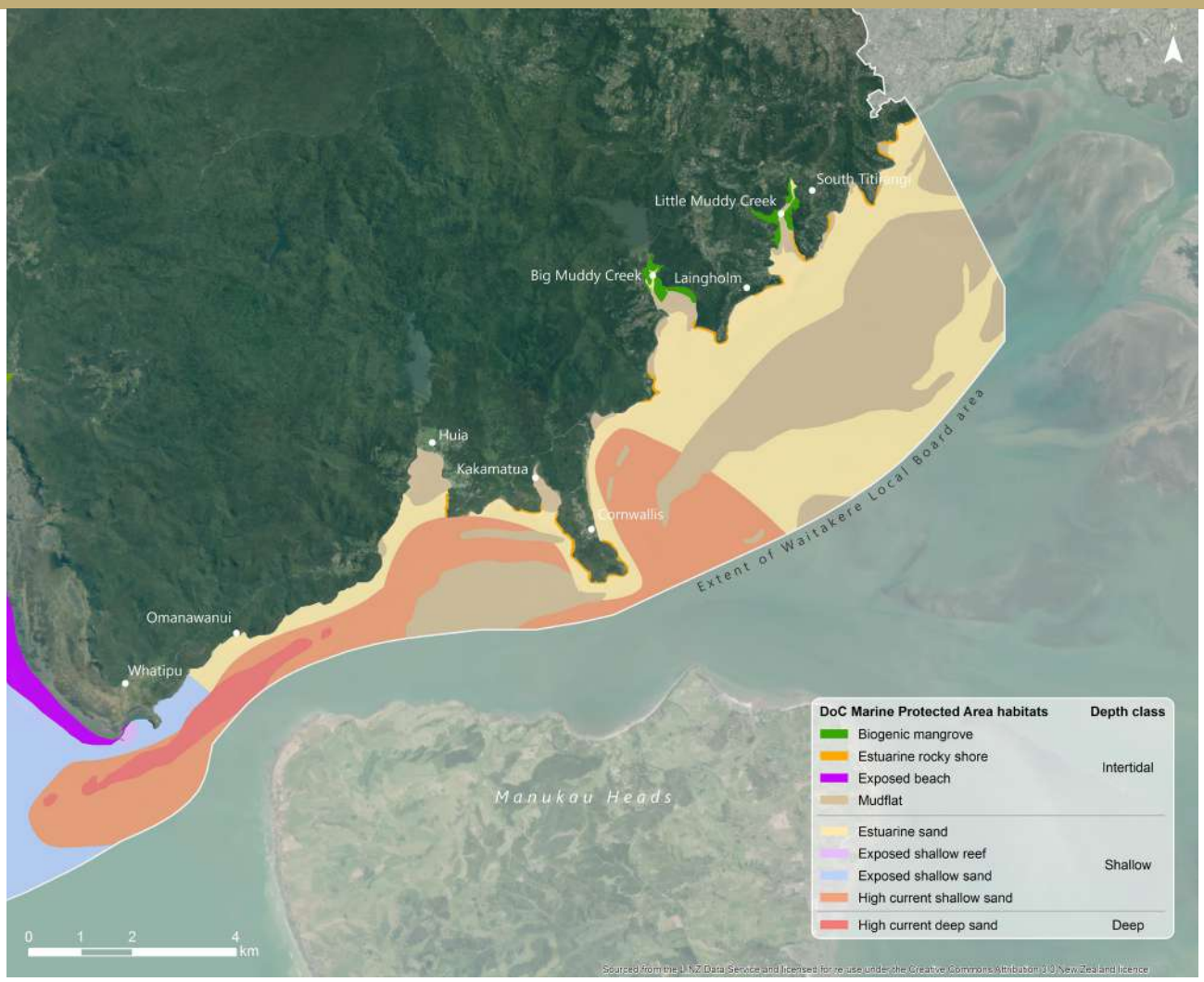


Figure 7: Coastal and marine habitats for the shore (intertidal depth) and nearshore (shallow) zone in the northern Manukau Harbour (DoC and MPI, 2011).

Earlier research in this area was undertaken from 1998 to 2002, where the intertidal communities of sheltered northern Manukau Harbour shore and beach environments were comprehensively surveyed (Hayward and Morley, 2004 – TP298). This coast is dominated by sheltered rocky shore, with areas of sheltered estuarine rocky shore, boulder beaches, shelly banks and mudflats, and large areas of mangrove forest (Figure 7). These areas grade into subtidal sands, shallow reefs and other areas of subtidal biogenic habitat which are described in Section 3.0.

2.1.1 Rocky Shores, Boulder Beaches, and Sandy and Muddy Shores

Several of these areas include designated SEAs which are summarised in Figure 6.

Omanawanui

The Omanawanui rocky coastline is situated at the entrance to the Manukau Harbour and is classified as an SEA (M1-15a) (AUP–OP Schedule 4, 2016). This area represents a transition between the high energy west coast and sheltered harbour environments. This diversity of habitat results in overlapping species distributions forming a unique intertidal environment, uncommon elsewhere on the west coast of the North Island (over 146 species recorded) (AUP-OP Schedule 4, 2016). Adventurous rock pool seekers may be rewarded by seeing small numbers of small green lipped mussels, unique and colourful nudibranchs and native sea squirts among other rare invertebrates such as trumpet shells that inhabit the low tidal zone (TP298; Hayward and Morley, 2004 and AUP–OP, schedule 4, 2016).

Huia Bay

Huia Bay is a sheltered bay with large intertidal sand flats at low tide (Tonkin and Taylor, 2016) (Figure 6) and is classified as a SEAM2-16e).

The beach at the northern end of the bay is narrow and characterised by coarse shell and sand. This area of Huia Bay has a diverse assemblage of species. In particular it is an important habitat for nationally vulnerable reef herons (AUP–OP, schedule 4, 2016). Rocky platforms are present on the eastern edge of the bay. These have an array of intertidal species; lichens are found close to the base of the rocky cliffs and the dominant species grades into bands of

Figure 8: Overlooking Huia Bay.
Photo: Morphum Environmental.

periwinkles, arthropods and limpets (Hayward and Morley, 2004). Barnacles dominate the mid-tide mark and below (Hayward and Morley, 2004).

On the central and western side of Huia Bay, the shoreline has been subject to erosion due to a combination of heavy swell and extreme tides (Tonkin and Taylor, 2016). Erosion is present along the toe and behind the seawall as well as on the unprotected shoreline by the trees and toilet block (Tonkin and Taylor, 2016). This erosion reduces the presence of a high tide beach for recreational use. There are current proposed mitigation actions which include seawall repair and maintenance, beach nourishment and managed realignment (Huia Domain Erosion Public Workshop, 2015).

Kakamatua Inlet

Kakamatua inlet has a similar environment and species assemblage to Huia Bay. It is characterised by volcanic rocky platforms on the western side and a large intertidal sand flat at low tide (Figure 9). On the eastern side of the bay, the beach is characterised by boulders which provide a sheltered habitat for rich assemblage of sponge gardens. The south eastern side of the Kakamatua inlet is classified as a SEA (M1 16c) (AUP - OP– Schedule 4 2016).

Cornwallis

Around Cornwallis wharf, the shoreline is punctuated with small pockets of beaches of sand and stable cobbles. The high currents around Puponga Point (SEA M1-16c) stop fine sediments from the catchment from settling on the surfaces (AUP–OP Schedule 4, 2016). A rich array of sponge gardens occupies the low tide line, the most diverse around the Waitākere Coast. This coast is also home to two species of the ornate Calliostoma snail which is endemic (only found here) to New Zealand and predates on the sponges. There are beds of the introduced Pacific oyster which grows periodically along the rocky shore here.

Laingholm – Lawry Point Coast

This 2 km strip of coast is characterised by sandstone reefs, sandstone and andesite boulders with sandy beaches of are dispersed in between these. This region contains high biodiversity of intertidal species and the iconic species including: rare trumpet shells (Spengler's Trumpet and giant triton), nudibranchs, shelly tube worm and richest sea squirt habitat on the Manukau Harbour coast.

South Titirangi, French Bay and Wood Bay

Titirangi Beach, French Bay and Wood Bay are enclosed bays with a soft shore intertidal environment. The intertidal zone grades into a sandy, shelly beach marked with Pohutukawa on the beach edge. The sand flats extend out past the headland a low tide and are fringed by rocky shore platforms either side of the bay.

Figure 9: Kakamatua Inlet shore zone. Photo: Morphum Environmental.

2.1.2 Wetlands and Estuaries

Wetlands are nationally threatened ecosystems and have been reduced dramatically from their historical extent due

to pressures from agricultural land use, reclamation of land, and impacts from pest plants and animals (Johnson and Gerbeaux, 2004).

Wetlands provide important ecosystem services of natural filtration, trapping of nutrients and habitat for many coastal species (DOC, 2005). Wetlands provide refuge and habitat for a number of New Zealand's threatened species and are affected by upstream land use activities (Robertson *et al*., 2016). Estuarine wetlands are important transition zones between the fresh and salt water environments, and between saline vegetation and terrestrial forests.

The current and potential wetland ecosystems have been mapped for the Auckland Region by Singers *et al*., (2016) as a tool to prioritising management. The data from this study has been used to show the wetland habitats present in the northern Manukau Harbour in Figure 11 and on the west coast of Auckland in Figure 28.

On this coast, typical coastal estuarine vegetation sequence grades from seagrass at the low tide line to mangroves, glasswort, jointed rush, salt marsh to flax, manuka, kowhai and Pohutukawa above mean high water spring (MHWS) (Figure 10).

This diverse and complex habitat supports coastal and wading birds such as shags, herons, spoonbill, waterfowl, banded rail, marsh crake, migratory and NZ resident shore birds and kingfisher. As well as marine and freshwater fish such as short and long fin eels, inanga, Australian anchovy, yellow eyed mullet, gobies and flatfish (Morrison *et al*., 2002).

There are four coastal saline wetlands at entrance of Huia, Kakamatua, Nihotupu and Waituna stream mouths in the Waitākere Local Board coastal area (Figure 11). These are outlined below.

Huia Stream and Swamp and Kakamatua Inlet

The Huia and Kakamatua estuaries are small in comparison to Big Muddy Creek. There are small areas of salt marsh and salt meadow around the fringes of the estuarine areas which is a mix of rushes such as oioi, wiwi, ribbonwood (Hayward and Morley, 2004). The lower intertidal zone has patches of seagrass which will be under threat from fine sediment discharges from the catchment (Tonkin and Taylor, 2016). The Huia stream wetland is not mapped below in Figure 11.

Big Muddy Creek/Parau and Little Muddy Creek

This estuarine inlet contains a number of habitat types and vegetation sequences. The lower intertidal zone is categorized by sand flat species and seagrass (*Zostera* sp.) meadows. These graduate into widespread mangrove flats and into coastal forest types dominated by pohutukawa to puriri,

Figure 10: Big Muddy Creek looking landward from Takaranga Reserve, showing a gradient of mangrove to native bush. Photo: Cat Davis.

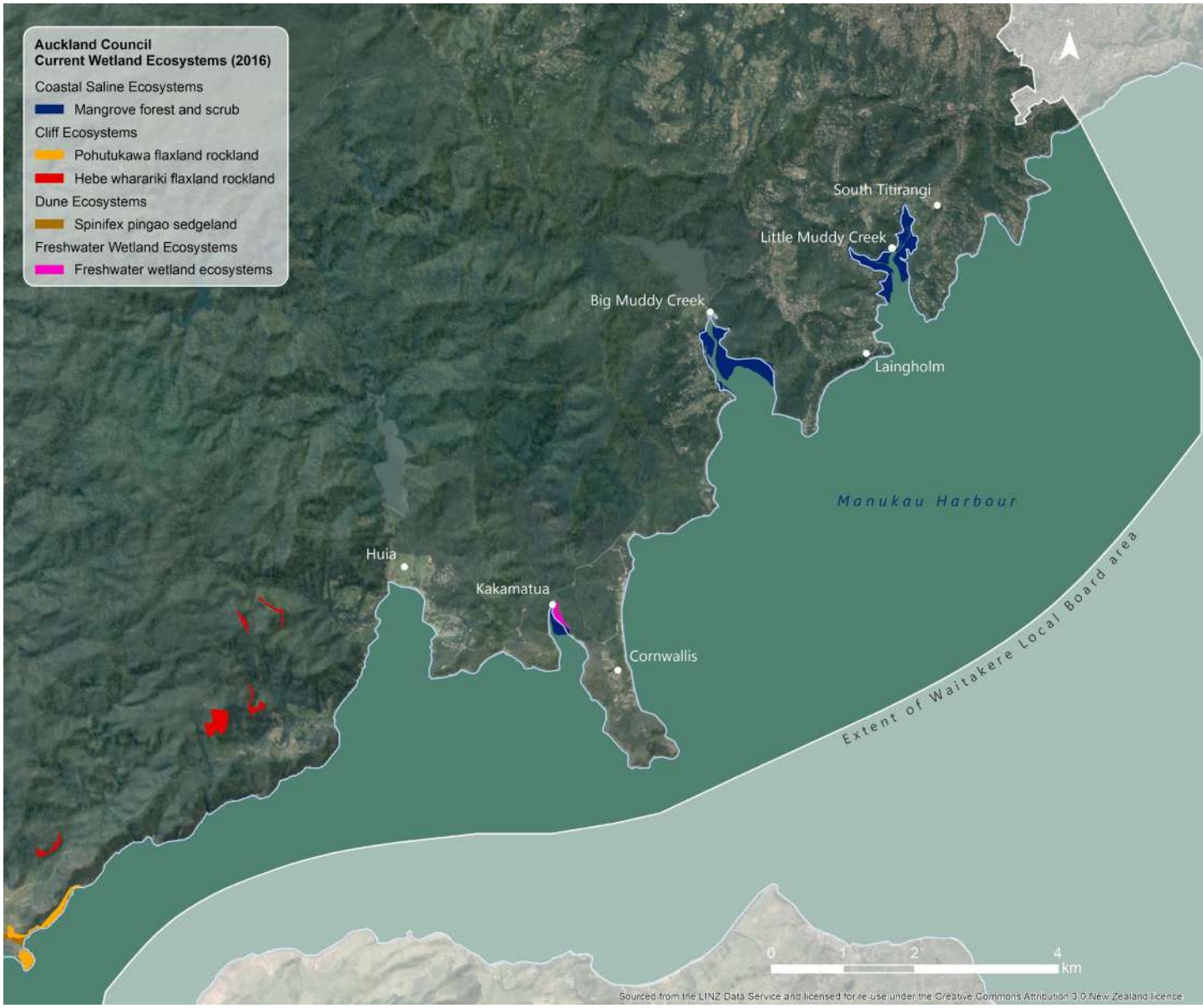


Figure 11: Saline and freshwater wetland ecosystems and wetland management areas in the northern Manukau Harbour.

Singers *et al*., 2016; AUP–OP, schedule 4, 2016.

to kanuka (Figure 11). Mangrove forest at Parau can reach up to 4-5 m high, among the biggest in Auckland (Hayward and Morley, 2004). The area provides an important habitat for threatened coastal birds (AUP - OP– Schedule 4 2016). Issues have been identified regarding potential re-invasion of weeds from private properties to coastal parkland (Craw, 2015).

Little Muddy Creek is similar in characteristics to Big Muddy Creek. It is an estuarine inlet has a variety of intertidal habitats including rocky shore, mudflats and algal beds. As a SEA (M2-18) it has important natural transition from seagrass meadows, mangrove marsh into coastal forest (Figure 11).

An in depth geospatial wetland ecosystem study has just been completed by Auckland Council (Singers *et al*., 2016). This report looks at the current and potential (without the influence of humans) wetland types in the Auckland Region and the physical drivers such as temperature, soil characteristics, wind that allow their formation (Singers *et al*., 2016). This report identifies that there would be oioi rushland/reedland habitat hugging the upper saline limit of mangrove forest at Kakamatua, Big Muddy Creek and Little Muddy Creek. However, due to the current pressures along this coast is it absent.

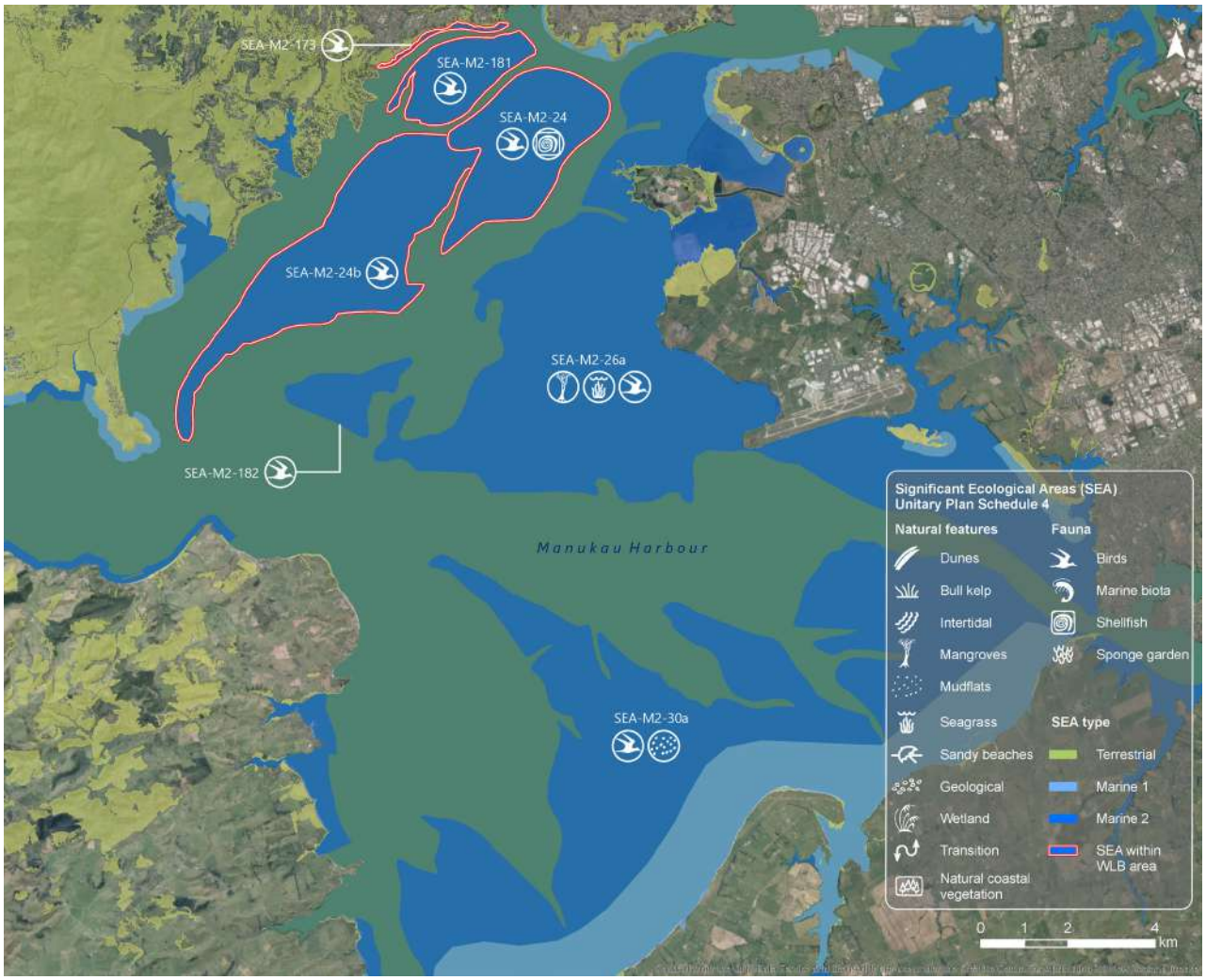


Figure 12: Significant Ecological Areas (SEA) and dominant ecosystem values for seabirds, wading birds and shorebirds in the northern Manukau Harbour intertidal zone.

Modified from the AUP–OP Schedule 4, 2016.

2.2 Wading and Shore Birds

The Manukau Harbour is a nationally and internationally significant habitat for breeding and feeding of native and migratory birds (Kelly, 2008). Te Tau Bank West (SEA M2 24b) is the main shell bank within the WRLB area which is known as a SEA for wading and shore birds (Figure 1, AUP - OP– Schedule 4 2016). A number of threatened and at risk species including: **black billed gull** (NE), **NZ dotterel** (NV), **wrybill** (NV), **South Island pied oyster catcher** (D) and **eastern bar tailed godwit** (D) are found here (AUP - OP - Schedule 4 2016). It is likely that these birds are transitory and have large home ranges so that birds that feed and nest outside the WRLB could be found here too. Karore Bank West (SEA M2 182), Motukaraka Bank (SEA M2 181) are adjacent to the WRLB area and has an even higher diversity of bird species with the addition of the **little penguin** (D) and **white fronted terns** (D) (marked in red in Figure 12).

The biggest threats to bird populations in the Manukau are disturbance from predators (such as cats, dogs, stoats and rats) and humans, fishing entanglements and habitat loss.

2.2.1 Threatened, At Risk and Declining

The following species are not in the unitary plan and thus their exact location within the WRLB is unknown. The following information was taken from www.nzbirdsonline.org.nz (accessed on 12/12/2016) for the whole Manukau Harbour.

There are seven threatened and at risk species that are known to be present in the Manukau Harbour these are **caspian tern** (NV), **lesser knot** (NV), **red-billed gull** (NV), **variable oystercatcher** (RC). **The little black shag** (NU).

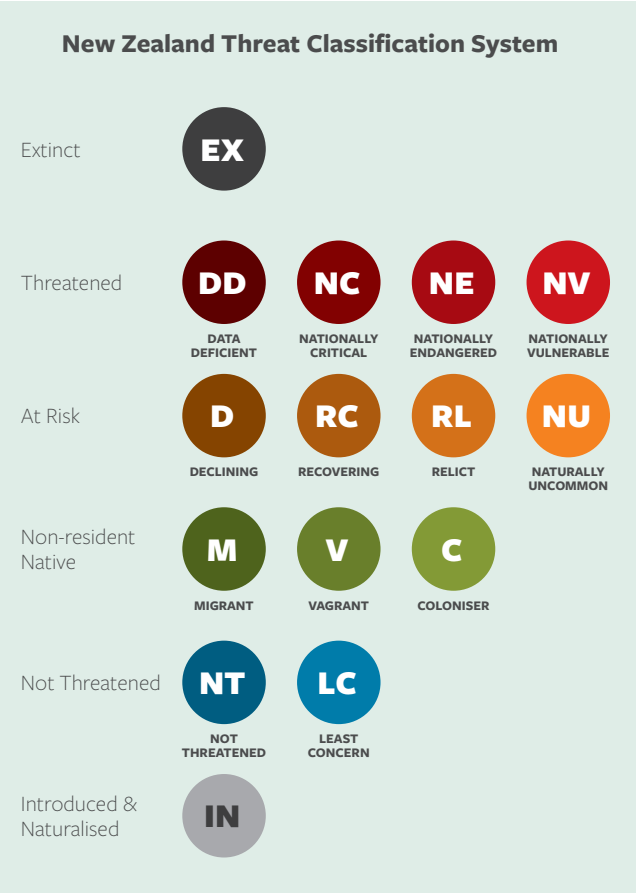


Figure 13: Threatened status of species by the New Zealand Threat Classification System (NZTCS).

Information taken from Hugh *et al*., 2013.

The following three species of wading and shore birds that are known to be present in the Manukau Harbour that are classified as declining; **White fronted terns** (D), **South Island pied oyster catcher** (D), **eastern bar tailed godwit** (D).

The **variable oystercatcher** (RC) is a wading and shore birds that is known to be present in the Manukau Harbour that is classified as recovering.

The following are wading and shore birds classified that are known to be present in the Manukau Harbour as naturally uncommon**; little black shag** (NU), and **royal spoonbill** (NU).

2.2.3 Migrants and Vagrants

New Zealand has a large number of migrating bird species, many which are native to New Zealand and breed in continents across the globe or international visitors who travel to the Manukau Harbour to breed and feed (Williams *et al*., 2006). The Manukau Harbour is a hotspot for coastal and sea birds (AUP - OP– Schedule 4 2016). There are nine species that are vagrants and migrants to the Manukau Harbour. These include: curlew sandpiper, eastern curlew, little tern, pacific golden plover, red-necked stint, ruddy turnstone, sharp-tailed sandpiper, whimbrel and grey-tailed tattler.

It is likely that these birds utilise the extensive sand flats which are exposed at low tide to feed and roost in estuaries, large coastal trees such as pohutukawa and foreshore areas. The site specific locations that are used by these birds in the WRLB is a potential project area for future monitoring programmes.

2.2.4 Not Threatened

There are ten species of coastal and shore birds that are found in the Manukau Harbour. These include: grey faced petrel, grey teal, little shag, paradise shelduck, pukeko, sacred kingfisher, southern black-backed gull, spur-winged plover, swamp harrier, welcome swallow, white-faced heron.

2.3 Environmental Monitoring

To be productive and healthy, coastal and marine species need high quality water and sediment to live in. The Manukau Harbour has several long term monitoring sites measuring water quality, benthic invertebrate community health, sediment, nutrients, and bacteria (Figure 14). Until recently (2012), shellfish health (full tissue analysis) was monitored by Auckland Council for beaches in the Manukau Harbour but this has been discontinued as it is an unreliable ecological health indicator (Stewart *et al*., 2013). MPI issues warnings for shellfish biotoxin alerts from weekly sampling results. These are taken from popular shellfish gathering locations around New Zealand (MPI https://mpi.govt.nz/travel-and-recreation/fishing/shellfish-biotoxin-alerts/ 2016).

Manukau Harbour has many historical long term monitoring programmes:

- Manukau Harbour Ecological Monitoring Programme – established in October 1987 (ARC).
- Shellfish Contaminant State of the Environment Monitoring Programme (oyster monitoring 1987 – 2012, mussel monitoring 1999 – 2012).
- ARC Continuous Monitoring Saline water quality, at 6 sites since 1989 and one site since 2009.
- State of Environment monitoring of benthic communities – initiated in 1987 by the Auckland Regional Water Board as part of Manukau Action Plan. 6 sites initially monitored – reduced to 2 representative sites in 1993. Cape Horn site re-established in 1999 – monitored to current.
- SafeSwim (MfE guidelines) (discussed in Recreational and Safety section 11.0)
- State of the Environment sediment chemistry monitoring, 27 sites at 1-2 year intervals since 1998

3. This information is from www.nzbirdsonline.org.nz (accessed on 12/12/2016) so it may not be an exclusive list.

A summary of the northern Manukau Harbour monitoring sites are shown Figure 14 below.

2.3.1 Sediment Monitoring

Sediment quality is measured in relation to Environmental Response Criteria (ERC) which was developed to provide an early indication of urban derived contaminants (heavy metal and petroleum (PAH)) in intertidal sediments (ARC, 2004).

Environmental Response Criteria (ARC 2004)
Low risk to biology so the site is unlikely to be impacted
Contaminant levels are elevated and the biology of the site is **possibly** impacted
Contaminant levels are high and the biology of the site is **probably** impacted

Sediment quality is monitored at four sites in the Waitākere Local Board Area (Figure 14):

1. Cape Horn - Te Tau Bank opposite French Bay
2. Little Muddy
3. Big Muddy
4. Mill Bay

2.3.2 Benthic Community Health

Sediment quality is also measured by assessing the state of the benthic communities that live in the sediments. Some invertebrates are more sensitive than others to increasing heavy metal contaminants and the accumulation of finer mud particles. Monitoring benthic communities is important as they are a food source for other species (e.g. fish, birds and people), important in nutrient and carbon cycling, stabilise sediment and influence water clarity and algal blooms (Carbines *et al*., 2013).

Changes in the community composition and abundance of these species overtime provide an indicator of shift in the ecological function and health of intertidal mudflats and sand flats through the benthic health model (BHM) (Anderson *et al*., 2006, Carbines *et al*., 2013). This is measured on a five point scale from 1 to 5, where 1 is healthy (shown as blue) and 5 is polluted (shown as red) (Figure 14).

2.5 Shore and Beach Management

Key threats and management issues affecting this zone are related to the quality of the water discharging from surrounding land use and how this affects sediment, benthic health, and water quality of the intertidal environment. The biggest threats to bird populations in the Manukau are disturbance from predators and humans, fishing entanglements and habitat loss. These issues and relevant management actions are discussed in section 1.0

Proposed mitigation actions are currently being developed regarding shoreline erosion issues at Huia Bay.

Objectives and actions are summarised below and overarching environmental benefits are outlined in section 9.0.

Objectives

5. To enhance habitat diversity to improve native species abundance and diversity.
6. To enhance current extent and native species diversity of wetland and estuaries
7. To improve water quality and clarity in the streams, estuaries and harbour environment.

Actions

1. Digitise and map baseline intertidal survey data (Hayward and Morley 2004) and integrate with existing habitat mapping (DoC and MPA, 2011) to inform management of this area.
2. Undertake baseline ecological monitoring of the previously un-surveyed intertidal areas of the Green Bay coastline and update current baseline data for the region.
3. Support and encourage mangrove, seagrass, and shellfish monitoring programmes with particular focus on those below MHWS
4. Support biogenic habitat restoration projects e.g. the enhancement of shellfish and seagrass beds
5. Review the outcomes of Watercare's hydrodynamic modelling project and identify further management actions to target high rates of sedimentation, erosion and infiltration rates.
6. Support or undertake planting and weeding programmes to reduce habitat fragmentation and improve connectivity between coastal and terrestrial habitats.
7. Use current wetland habitat mapping (Singers *et al*., 2016) to inform wetland management plans for the northern Manukau Harbour to support or introduce programmes to:
   h. Support pest control programmes.
   a. Target weed control and enhancement planting particularly at Big Muddy Creek including engagement with private land owners.
   b. Improve resiliency for projected sea level rise scenarios including adaptive planting plans, and investigate potential engineering solutions to protect freshwater wetlands.
   c. Fence to exclude stock grazing and trampling in the Huia catchment.
8. Support biogenic habitat restoration projects e.g. the enhancement of shellfish and seagrass.

4. This information is from www.nzbirdsonline.org.nz (accessed on 12/12/2016) so it may not be an exhaustive list.

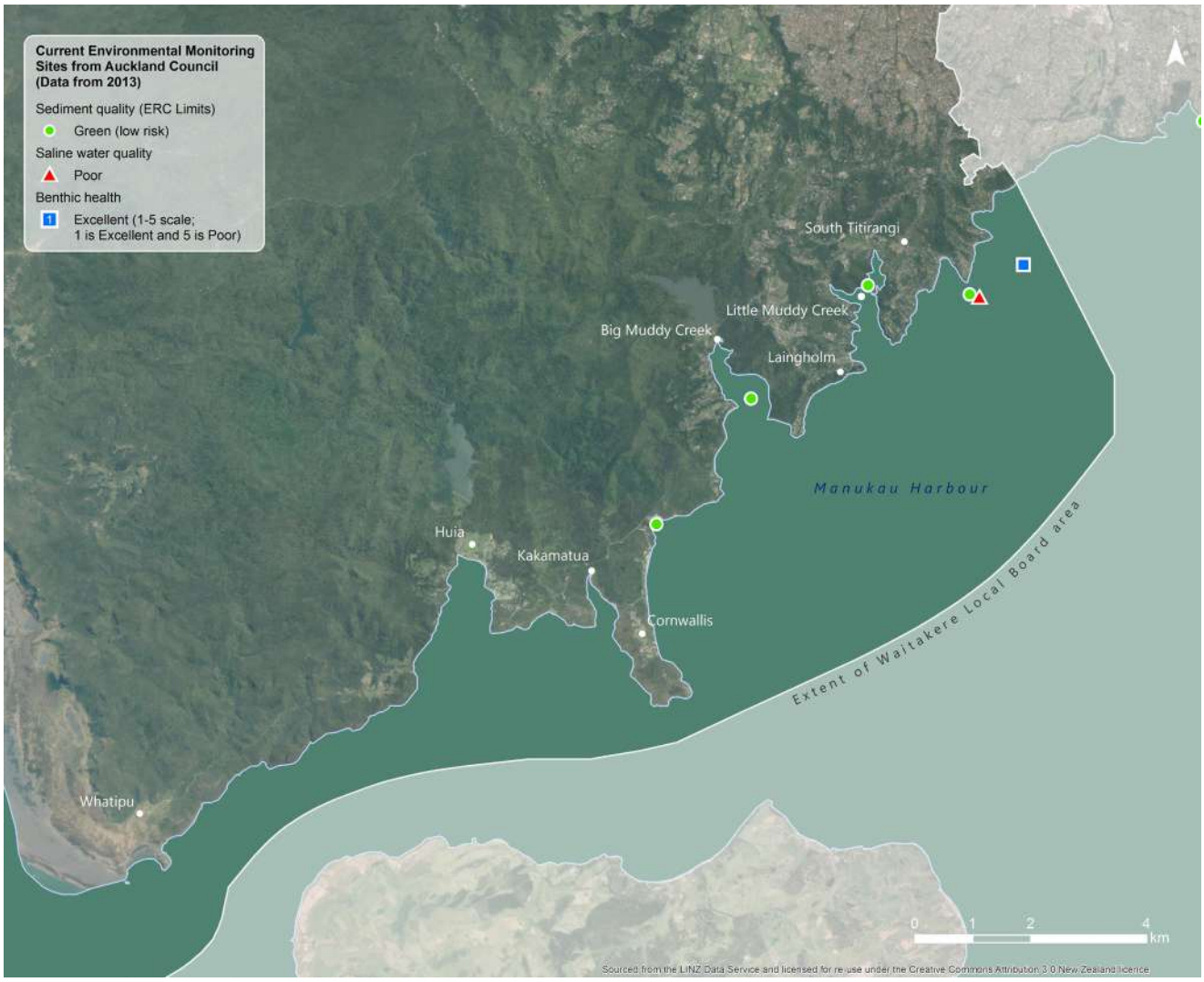


Figure 14: Environmental monitoring sites in the Manukau Harbour WRLB area.

Greenfield, Hewitt and Hailes, 2013 and Mills *et al*., 2012.

3.0 Nearshore

This chapter focuses on the near shore area. For the purpose of this study, the nearshore zone of the northern Manukau Harbour has been defined as approximated low tide to the edge of the Waitākere Local Board area (Figure 15).

This chapter provides an overview of:

- Habitat types,
- Water quality,
- Status of marine mammals,

3.1 Habitat types

Descriptions of habitats, physical and chemical variables provide a baseline for which ecosystem changes can be measured. DoC has grouped estuarine and marine habitats by depth, substrate, and exposure to inform marine protection and reserve areas. There are 118 marine and estuarine habitat types in New Zealand, 14 of these are present in the Waitākere Local Board nearshore area (DoC and MPI, 2011, Figure 16).

The majority of the Manukau Harbour is comprised of calcium carbonate sand which vary in habitat values due to exposure and current (Figure 16). The remainder is dominated by mudflats.

The unique mixture of exposed, deep water from the Tasman Sea and the sheltered harbour creates a unique habitat at the entrance to the harbour. In Kakamatua and the Omanawanui coast (Makaka Bay) there is an array of sponge gardens creating a diverse habitat and this area is considered to provide the best diving conditions (at slack tide) to view these subtidal communities (Hayward and Morley, 2004).

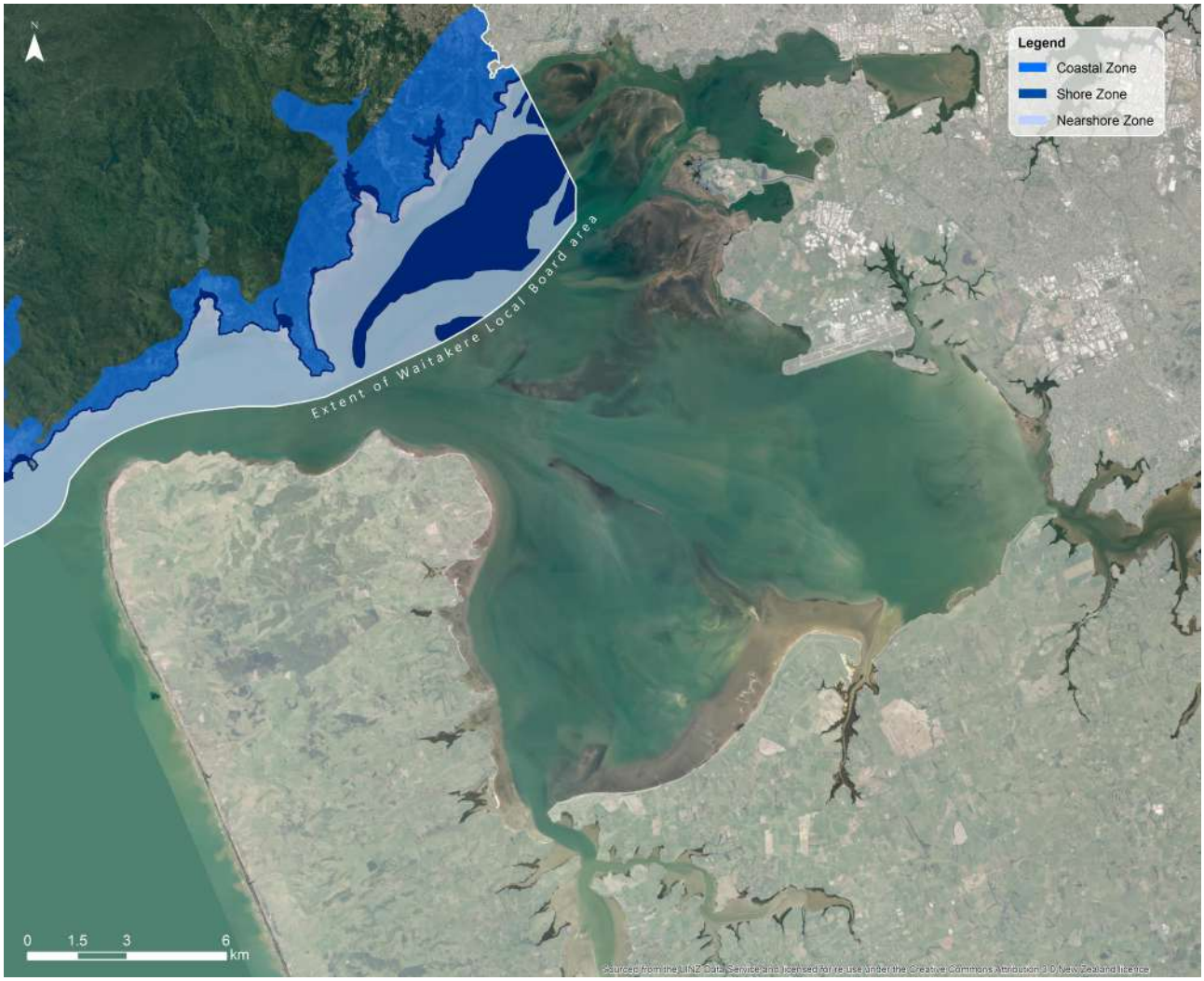


Figure 15: Zones of the northern Manukau Harbour.

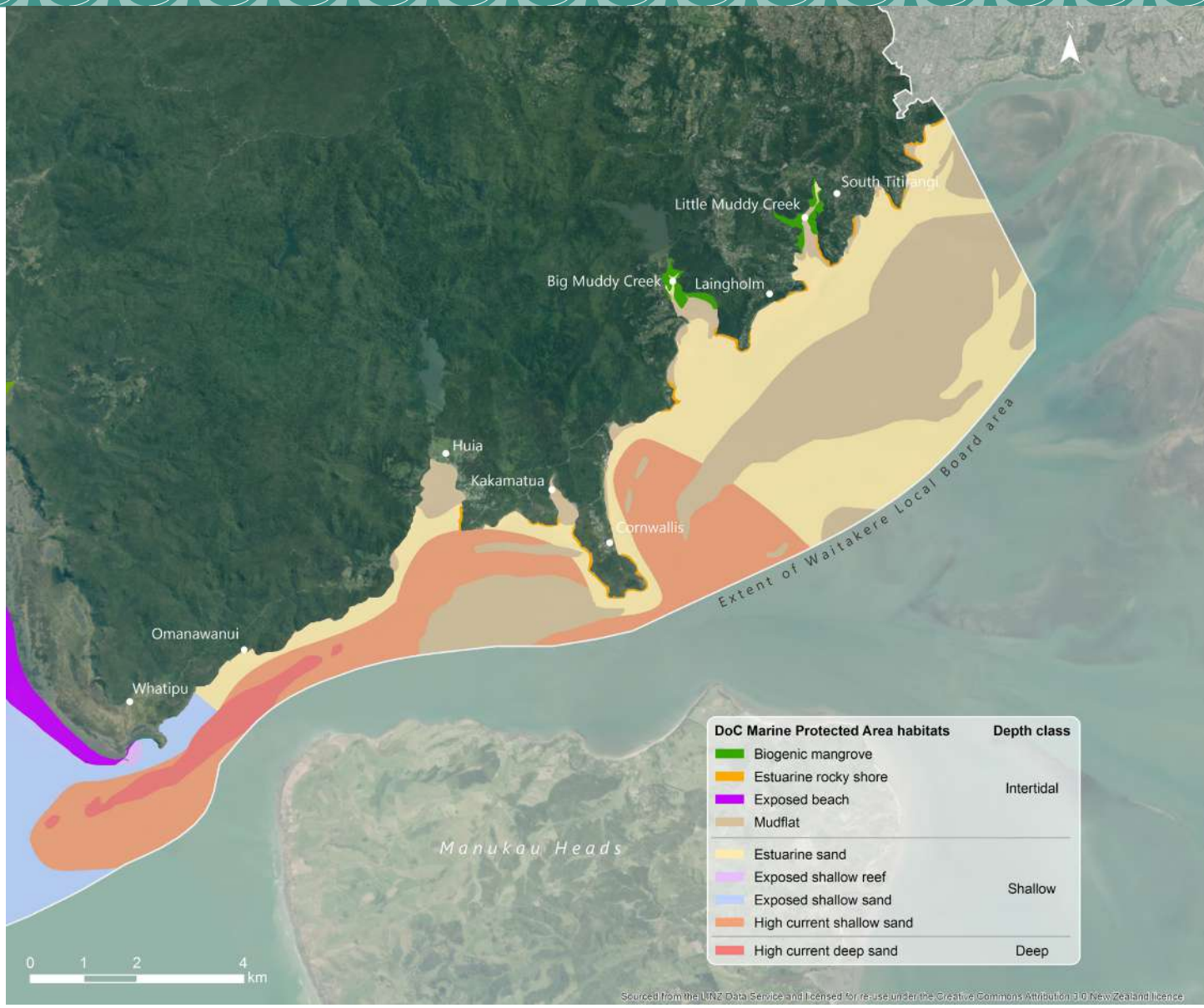


Figure 16: Coastal and marine habitats for the shore (intertidal depth) and nearshore (shallow) zone in the northern Manukau Harbour.

DoC and MPI, 2011.

3.1.1 Biogenic Habitats

A biogenic habitat is a 3D structure that is formed by animals or plants such as salt marshes, mangrove forests, seagrass meadows, kelp forests, bryozoan fields and shellfish beds, worm holes or sediments that are fused together by organisms (Morrison *et al*., 2014b). Biogenic habitats provide important ecosystem services which include; habitat, nutrient recycling, erosion protection, sediment trapping, biodiversity enhancement and provide linkages between the benthic and pelagic marine environments (Morrison *et al*., 2014b). Since these habitats are commonly made up of living organisms they are sensitive to changes in water quality, sedimentation, habitat destruction from bottom trawl and dredge fisheries and competition for space and resources from invasive species (Morrison *et al*., 2014a).

DoC habitat mapping identified the mangrove forests at Big Muddy Creek and Little Muddy Creek as the only biogenic habitats within the local board area of the Manukau Harbour (DoC and MPI, 2011, Figure 16). However, other unmapped biogenic habitats such as sea grass have been identified near the mouth of Big Muddy Creek, Mill Bay, Cornwallis and Huia (Hayward and Morley, 2004; and Turner and Schwarz, 2006).

Seagrass meadows (*Zostera* sp.) are an important primary producer in marine ecosystems and are biodiversity and productivity hot spots (Morrison *et al*. 2014b). They provide a habitat and nursery for many fish especially snapper and macrofaunal communities (Morrison *et al*., 2014b). They provide refuge, foraging and feeding ground, oxygenate the water, nutrient trap and transformer, sea bed stabiliser and promotes overall ecosystem health (Morrison *et al*., 2014b). The seagrass meadows at Big Muddy Creek were in a state of

decline in percentage cover and biomass resulting in reduced diversity and abundance in macrofauna community composition and associated fish assemblages (Kelly, 2008).

3.2 Water Quality

Coastal marine water quality has been monitored by Auckland Council since 1987 using the saline water quality index (Carbines *et al*., 2013). This programme examines contaminants related to erosion, nutrients, and biological wastes (organics and bacteria) in the water and provides a useful tool to capture patterns in land based discharges and climatic variables in an area. This approach takes into account the scope, frequency, and magnitude of key variables that exceed objective criteria defined by ranges observed at reference sites that represent the best achievable water quality in the Auckland region. Key variables that contribute to the assessment of water quality include; dissolved oxygen, nutrients (ammonia, nitrate and phosphorus), pH, chlorophyll a and turbidity or suspended sediment in the water column.

Eight sites are monitored in the Manukau Harbour (Table 2). The closest water quality monitoring sites to the Waitākere local board area are Shag Point and the Manukau Heads. The Manukau Heads are well flushed and consequently water quality is consistently better than at the other monitoring sites.

Poor water quality in the Manukau Harbour is primarily due to elevated nutrients and water turbidity (Walker and Vaughan, 2015). The harbour has been heavily affected by historic (and ongoing) discharges from the Mangere Wastewater Treatment Plant (Scarsbrook, 2008). However, water quality has improved dramatically since the decommissioning of the Mangere Oxidation Ponds in 2002 and the harbour has demonstrated marked decreases in levels of ammoniacal nitrogen, total phosphorus, and suspended sediments from 2002-2008 (Scarsbrook, 2008).

Comprehensive trend analysis is conducted approximately every five years (last completed in 2008; update currently being prepared).

A strong overlap in temporal trends observed in streams and estuaries over the Auckland Region based on long term data analyses indicates that stream water quality is a major driver of water quality at inner Harbour sites (Scarsbrook, 2008).

Table 2: Manukau Harbour Water Quality Index (Walker and Vaughn 2015).

	2010	2011	2012	2013	2014
Manukau Heads	Fair	Fair	Excellent	Fair	Excellent
Shag Point*	*Poor*	*Poor*	*Fair*	*Poor*	*Poor*
Puketutu Point	Poor	Poor	Poor	Poor	Poor
Mangere Bridge	Poor	Poor	Poor	Poor	Poor
Weymouth	Poor	Poor	Poor	Poor	Poor
Clarks Beach	Poor	Fair	Fair	Poor	Fair
Waiuku Town Basin	NA	NA	Poor	Poor	Poor
Grahams Beach	Poor	Fair	Excellent	Fair	Fair

** Shag Point is in the WRLB area.*

3.3 Marine Mammals

New Zealand has a diverse range of marine mammal species and subspecies, including whales, dolphins, seals, and sea lions. Marine mammals played an important part in New Zealand history; in the past whales and seals were hunted in great numbers. Now we have a rapidly-growing whale- and dolphin-watching industry.

Marine mammals are indicator species for the state of our marine environment because they are apex species (near the top of the food chain) and can thrive only if their ecosystem is healthy. Many of these species are endemic (only found in) to New Zealand. The conservation status of a species relates to its risk of extinction (Figure 16). A decreasing population can indicate that the ecosystem is degrading.

To understand and protect marine mammals it is important to know where they are, their biology, breeding and feeding behaviours. The Manukau Harbour is home to six species of marine mammals which are described below.

The majority of sightings of marine mammals in the Manukau Harbour are concentrated around the entrance to the harbour within the fishing restriction zones and in the deeper water of the channel (spread page 36-37). There are some sporadic sightings of orcas in the main harbour (spread page 36-37).

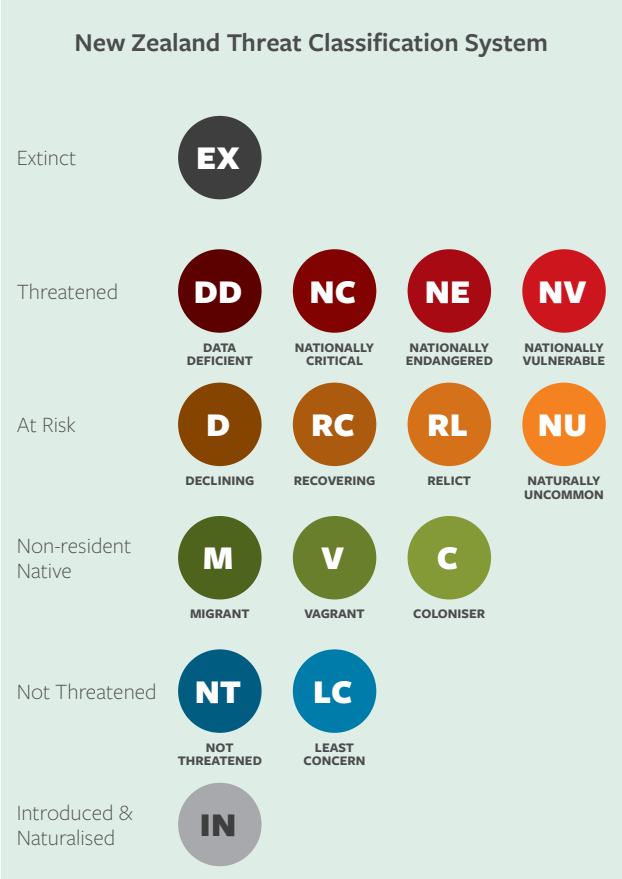


Figure 17: Threatened status of species by the New Zealand Threat Classification System (NZTCS).

Information taken from Hugh *et al*., 2013.

3.3.1 Not Threatened

NZ fur seal

NT

Historically, the New Zealand fur seal was common around the whole of New Zealand (Dix, 1993). However, the population was brought close to extinction in the early 19th century by commercial sealers (Dix, 1993). Up to 1970, breeding colonies (rookeries) were restricted to sub Antarctic islands and the South Island (Dix, 1993). More recently, North Island rookeries have been established by migratory, non-breeding males which move north after the breeding season (Dix, 1993). Rare occurrences of young female seals have been found as far north as Muriwai (Dix, 1993). No public sighting data is collected by DoC for the presence and location of seals.

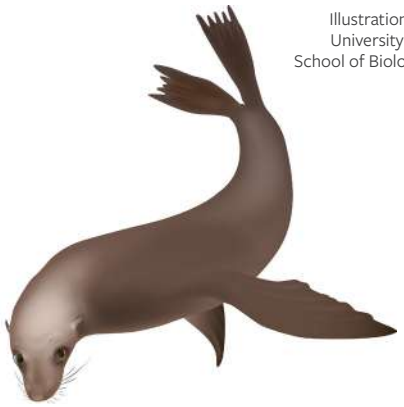


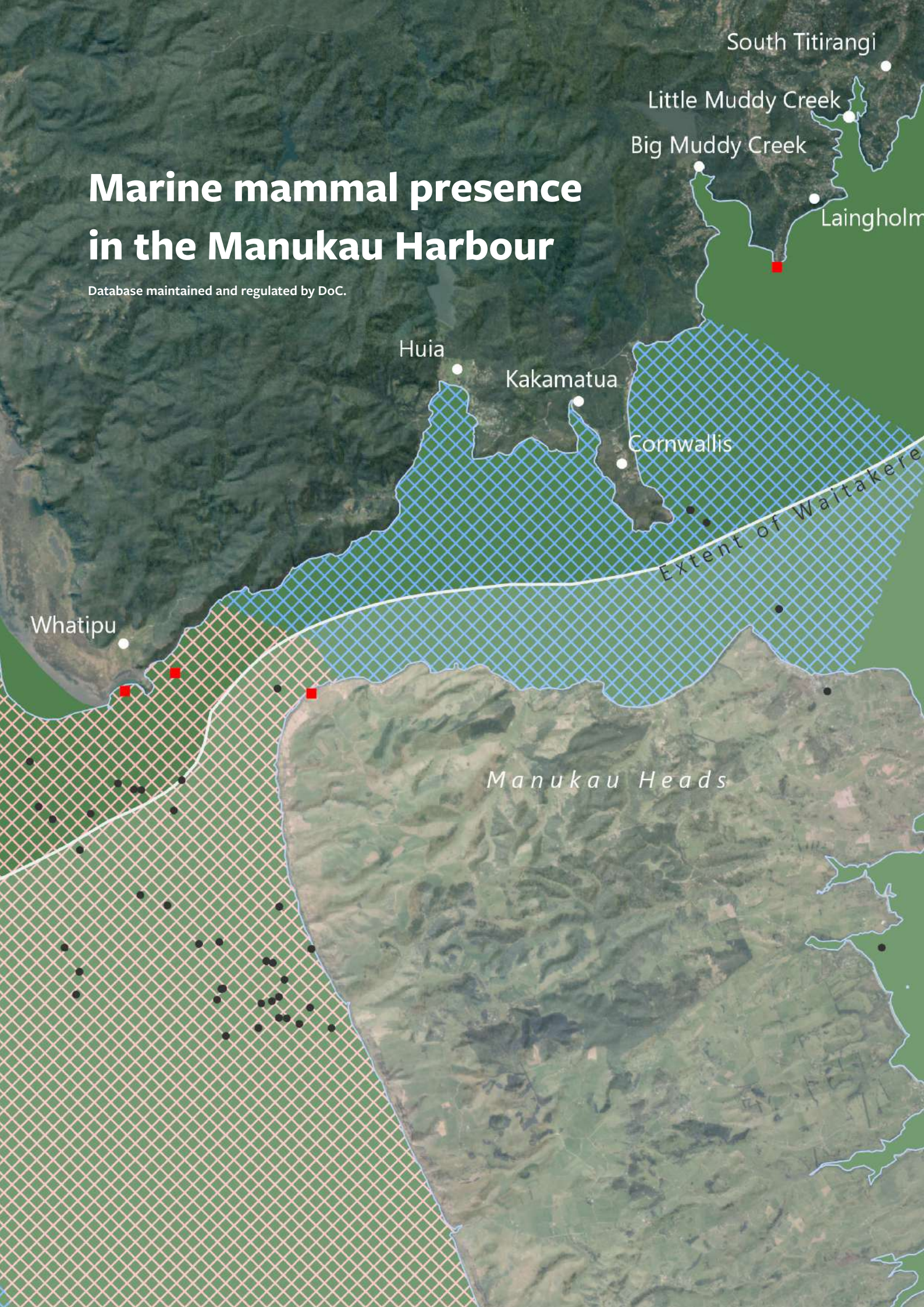
Illustration: Vivian Ward, University of Auckland – School of Biological Sciences

Common dolphin

NT

The common dolphin is classified as Not Threatened; Least Concern in the 2016 NZTCS update (Baker *et al*., 2016). There is a large population of this species in NZ which contributes to high genetic diversity which leads to increased reproductive potential and resilience to threats (Baker *et al*., 2016). There are no public sightings of common dolphin the Manukau Harbour but this area is within their potential range (spread page 36-37, NABIS, 2017).

Illustration: Vivian Ward, University of Auckland – School of Biological Sciences


Marine mammal presence in the Manukau Harbour
Database maintained and regulated by DoC.
South Titirangi
Little Muddy Creek
Big Muddy Creek
Laingholm
Huia
Kakamatua
Cornwallis
Extent of Waitakere
Whatipu
Manukau Heads


Local Board area
Manukau Harbour
DoC Marine Mammal Sightings (2006-2016)
Maui Dolphin
NC
NATIONALLY CRITICAL
Orca
DD
DATA DEFICIENT
Fishing Bans
Set Net Prohibition (7 nm)
Trawl Prohibition (2 nm and 4 nm)
Marine Mammal Sanctuaries
West Coast North Island
0
1
2
4
km

3.3.2 Threatened

The Māui dolphin and orca are both listed as Threatened; Nationally Critical (NC and DD) in the NZTCS (Baker *et al*., 2016).

Māui Dolphin NC

Māui dolphin is endemic to New Zealand and is a sub species of the Hector dolphin (Currey *et al*., 2012). Population estimates in 2016, suggest there are only 63 individuals (reduced from 55 individuals in a 2012 assessment) over one year of age that remain categorizing the species as nationally critical in the New Zealand (Baker *et al*. 2016b).

Due to low population numbers and the iconic nature of the Māui dolphin, extensive research has been undertaken into Māui dolphin habitat, migratory patterns and threats (Currey *et al*., 2012, Hamner *et al*., 2012; Derville *et al*., 2016; Baker, 2016b). Modelled habitat preferences indicate that with a larger population, it is likely that Māui dolphin would inhabit nearshore areas of the northern Manukau Harbour (Derville *et al*., 2016).

The 2012 MPI/DOC review of threats to the Māui dolphin identified that fishing related threats particularly associated with both commercial and recreational set nets, and commercial trawl nets posed the greatest risk (Currey *et al*. 2012).

Other significant risks identified included:
- Mining and oil activities;
- Vessel traffic;
- Pollution; and,
- Disease.

The Māui dolphin threat management plan (2012) suggests in order to protect the Māui population from further decline, the current set net fishing protection could be extended along this coast along with an improved information of presence of the Māui dolphin in the harbour (DoC and MPI joint discussion paper, 2012/8).

Orca DD

Orca also known as "Killer whale" are listed as a threatened species as there is a lack of information on population status including abundance, habitat range and population dynamics (Baker *et al*., 2013). It is likely that population size is small (estimated less than 250 mature individuals in NZ) further supporting this threat status (Baker *et al*., 2013).

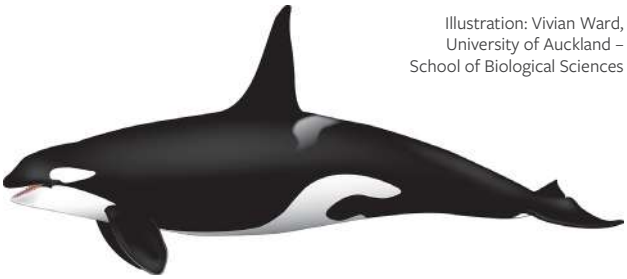


Illustration: Vivian Ward, University of Auckland – School of Biological Sciences

Bottlenose dolphin NE

Bottlenose dolphin is listed as "Nationally Endangered" with a predicted decline of 10-50% (Baker *et al*., 2016). The 2016 New Zealand population estimates predict that it is unlikely to exceed 1000 mature individuals (Baker *et al*., 2016). There are no recorded sightings of bottlenose dolphin in the Manukau Harbour, although this area is within their habitat range (spread page 36-37, NABIS, 2017).

Southern right whale NV

The threat status of southern right whale has recently changed from nationally endangered to nationally vulnerable due to a gradual population improvement. Population size is estimated at 250-1000 mature individuals with a predicted increase of 10% (Baker *et al*., 2016). There are no recorded public sightings in the Manukau Harbour but this area is within their habitat range (spread page 36-37).

3.4 Sharks and Rays

New Zealand has a diverse range of shark and ray species. These range in size; from the small demersal school shark to the great white shark which can grow up to 5 m in length (http://www.fishbase.org/ accessed on 20170230).

To understand and protect sharks and ray species it is important to know where they are, their biology, breeding, and feeding behaviours. There are 107 species of sharks and rays that are found in New Zealand waters (http://www.doc.govt.nz/get-involved/have-your-say/all-consultations/2015/new-listing-of-the-threatened-status-of-sharks-rays-and-skates/ accessed on 20170230). As these species are migratory or vagrant it is difficult to classify their presence into one region or area. Data is also deficient for many shark and ray species, so the separation of species into Manukau Harbour and west coast regions may not be accurate.

The greatest threats to sharks and rays are fishing pressure, by-catch, entanglement in nets and ingestion and entanglement with other marine debris.

The conservation status of a species relates to its risk of extinction (Figure 18) IUCN Red List Status has been used a classification system to assess the risk of extinction of shark and ray species in New Zealand. Currently the NZTCS is updating the threatened status of sharks, rays and skates are being updated (Figure 18).

3.4.1 Sharks

The Manukau Harbour is home to several species of sharks which are described below (NABIS, accessed on 27032017 and fishbase http://www.fishbase.org/ accessed on 27032017). However the current data on this is limited so this is not an exhaustive list. It is likely that the harbour is used as a nursery and feeding ground for shark and ray species but this is yet to be confirmed. The Department of Conservation are currently researching the importance of the Manukau Harbour for sharks including the Great White Shark and any shark sightings should be reported to DoC to support this research.

There are eight shark species that are listed as threatened (vulnerable) and seven species listed as not threatened under the IUCN Red List of threatened species. These are summarised in Figure 19 overleaf.

3.4.2 Rays

There are three common ray species that are found in are found in New Zealand waters. All three species are known to be present the Manukau Harbour (Le Port, 2009):

- Short tail stingray (least concern)
- Long tail stingray (data deficient)
- New Zealand eagle ray (least concern)

3.5 Bony Fishes

New Zealand harbours and coastal environments are home to a variety of fish species. They range in size, abundance, habitat preference, life history, behaviour and physiology. Most of the common species are fished under commercial, recreational and customary limits. Biodiversity of fish species can be used is an indicator of the pressures exerting on the ecosystem. For example, if an ecosystem has low fish diversity, it can be an indicator of a variety of factors such as poor water quality, fishing pressure, or habitat destruction. For further information on fisheries, see section 4.0.

There are 26 species known to be present in Manukau Harbour and surrounding west coast nearshore waters. This may not be an exhaustive list (Figure 19). The data was taken from NABIS (accessed on 20170215).

The threat status of marine fish has not been assessed for all fish, only species that were considered likely to be threatened have been included in threat classification frameworks (Hitchmough, *et al*. 2007).

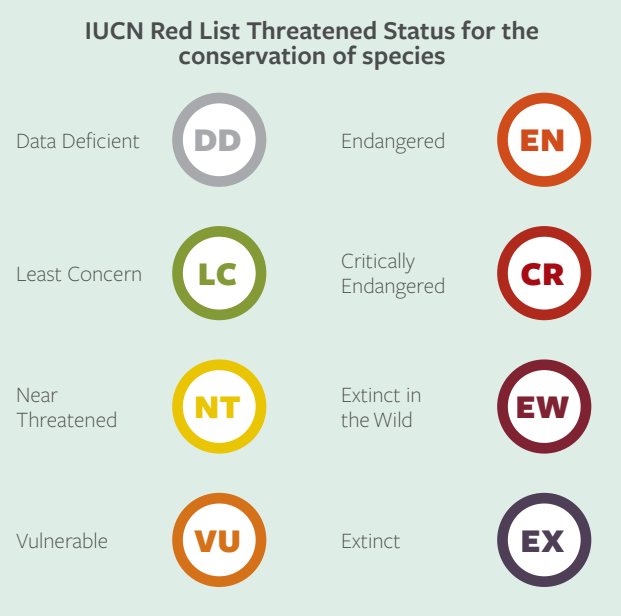


Figure 18: IUCN Red List Status for classifying the conversation status of species. This is an international classification system. In this case, this system has been used for the assessment of shark and rays as the current NZ system (NZ TCS system) is being updated for this group of animals.

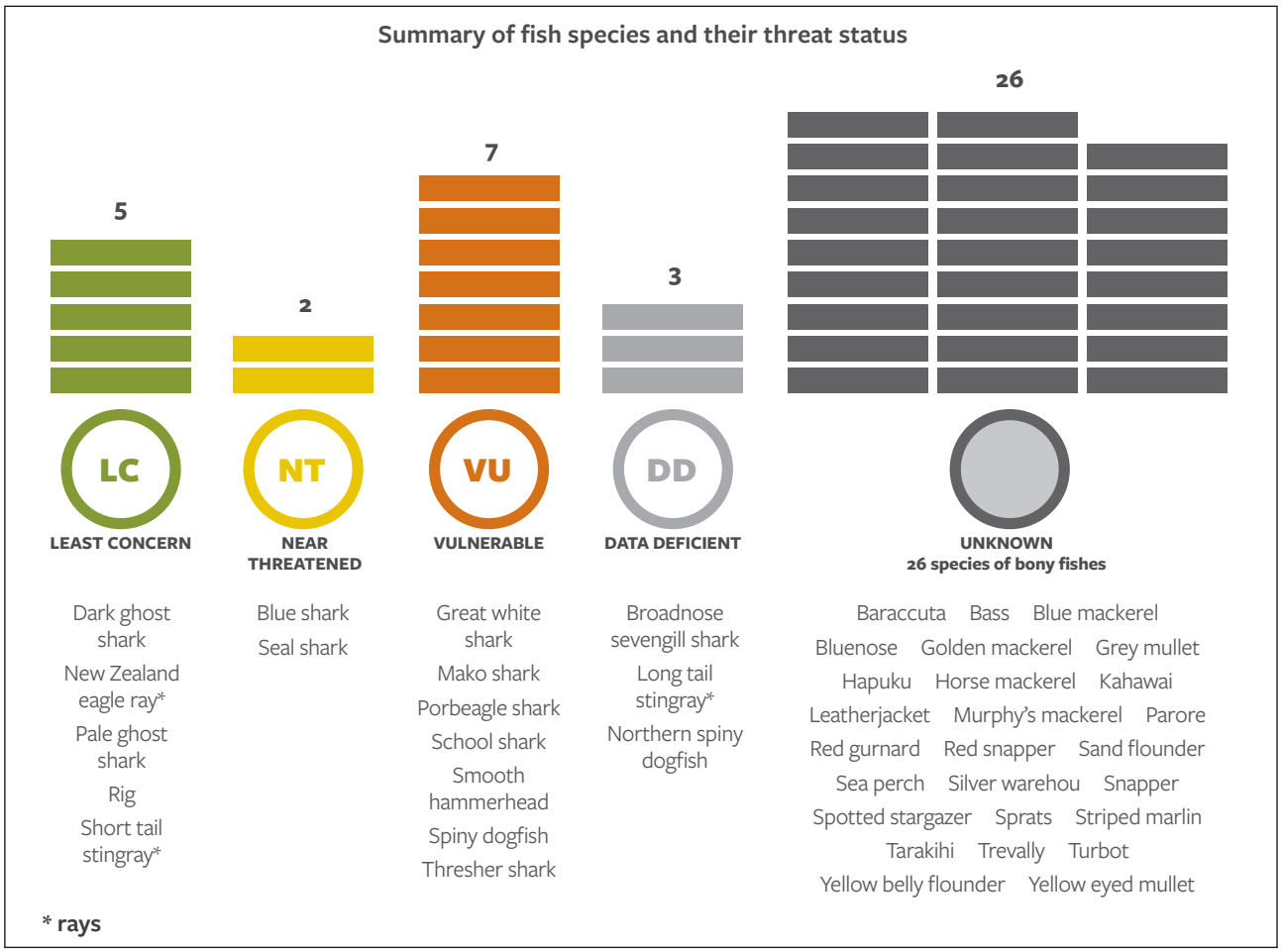


Figure 19: IUCN Red List status of threatened species for sharks, rays and bony fishes in the Manukau Harbour.

3.7 Nearshore Management

The charismatic marine mammals and sharks, rays, and bony fish are all threatened by fishing pressure including by-catch, and entanglement in nets. Issues and management actions associated with fishing are discussed in section 4.0.

Other key threats affecting these fauna include vessel traffic and pollution including poor water quality and other rubbish and debris. Issues associated with the quality of the water discharging from surrounding land use are discussed in section 1.0.

Objectives

1. To improve native species abundance and diversity.
2. To maintain coastal water quality, and enhance it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.[5]

Actions

1. Undertake mapping of biogenic habitats below MHWS in the Manukau Harbour.
2. Identify and/or support projects which enhance and restore current biogenic habitats below MHWS in the Manukau Harbour.
3. Support the initiatives of Universities, Crown Research Organisations (e.g. NIWA, Cawthron Institute), DoC, volunteers and community groups for the monitoring of marine mammals, large migratory fish e.g. kingfish, and rays and sharks in the Manukau Harbour.
4. Support community efforts to reduce plastic pollution and marine debris including;
   a. Support campaigns that educate consumers against single use plastics and encourage using recyclable plastics,
   b. Support campaigns that educate consumers against buying beauty and other household products that contain microbeads,
   c. Advocate for Local Board Area wide initiatives to avoid the use of single use plastic bags.

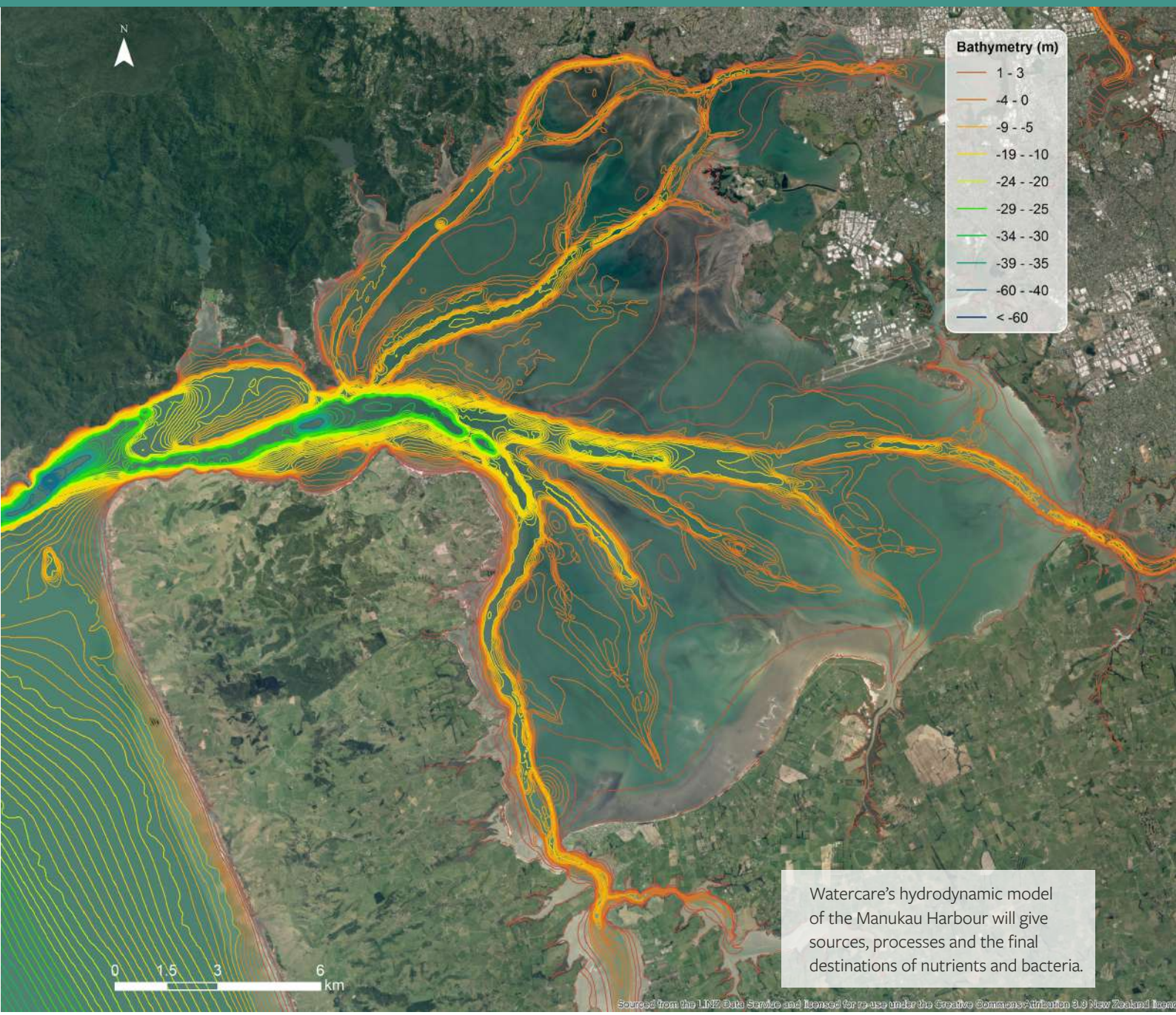


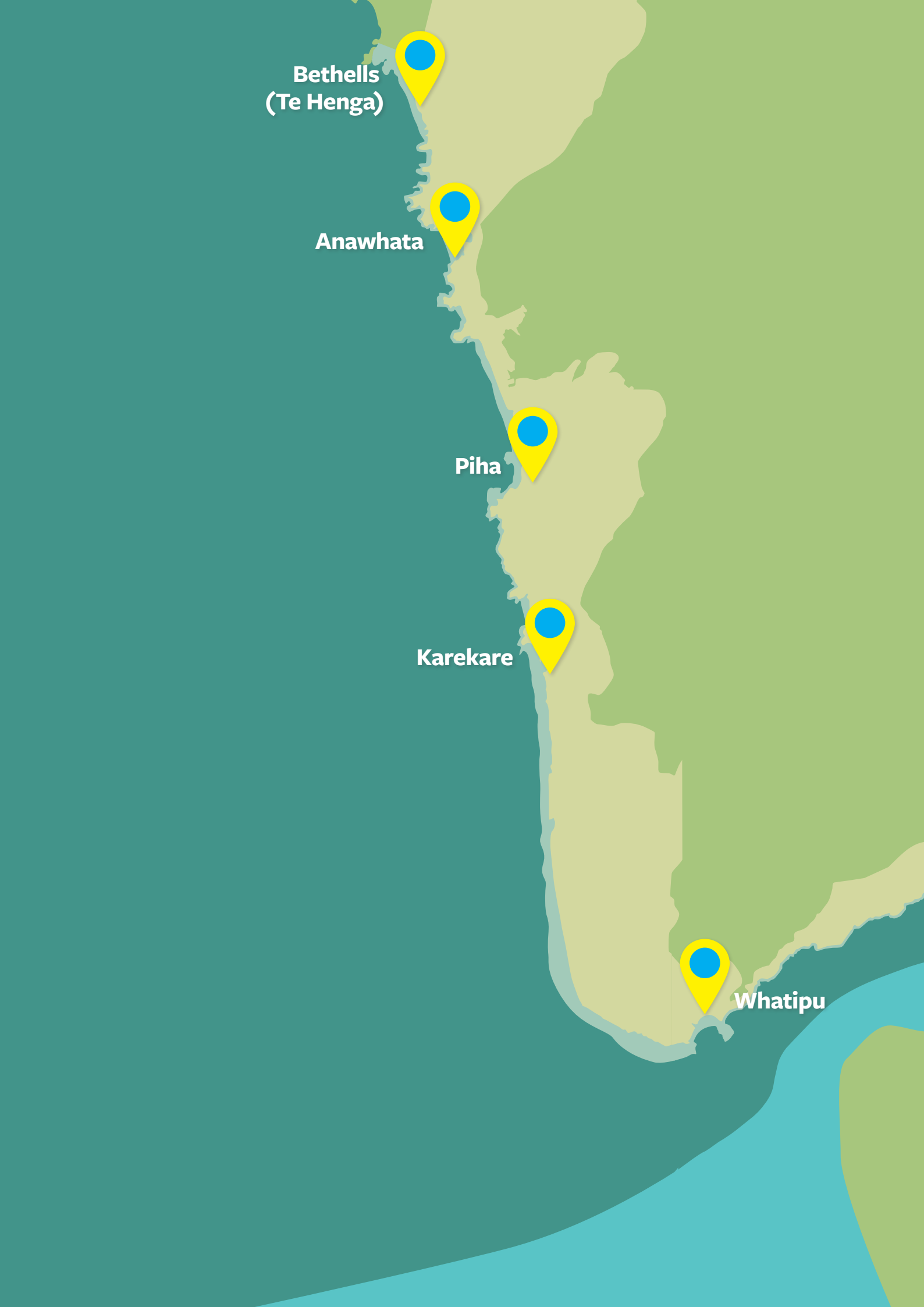
Figure 20: The bathymetry profile (depth) of Manukau Harbour. Estimated delivery June 2019.

This information is from the Manukau Harbour Forum Symposium, delivered on Friday 19th May, 2017.

5. From the New Zealand Coastal Policy Statement 2010.

Part B

West Coast


Bethells
(Te Henga)
Anawhata
Piha
Karekare
Whatipu

4.0 Coastal

The coastal zone of the northern Manukau Harbour has been defined as approximately 2 km landward of the Mean High Water Spring (MHWS) or land associated with the marine significant ecological areas identified in the AUP–OP schedule 4, 2016 (Figure 21). This chapter focuses on the catchments, streams and wetlands that influence the water quality of the west coast and coastal sea birds that utilise these habitats.

4.1 Streams and Catchments

There are three stormwater catchments within the Waitākere Local Board area that ultimately discharge to the west coast: Okititoto, Piha/Karekare and Waitākere (Figure 22). These catchments are predominately regenerating native bush (within the Waitākere Regional Park) with small pockets of residential areas in Bethells (Te Henga), Karekare and Piha.

4.1.1 Okititoto

A very small percentage of the Okititoto catchment is in the Waitākere Ranges Local Board Area. None of the streams in this catchment discharge into the immediate receiving environment of the Waitākere Ranges.

4.1.2 Piha/Karekare

Dominant streams in the Piha/Karekare catchment (8328ha) include (Figure 22):

- Anawhata
- Cannibal Creek
- Piha Stream
- Moana Stream
- Karekare Stream
- Marawhara Stream
- Parahara Whatipu Stream
- Taranaki Stream

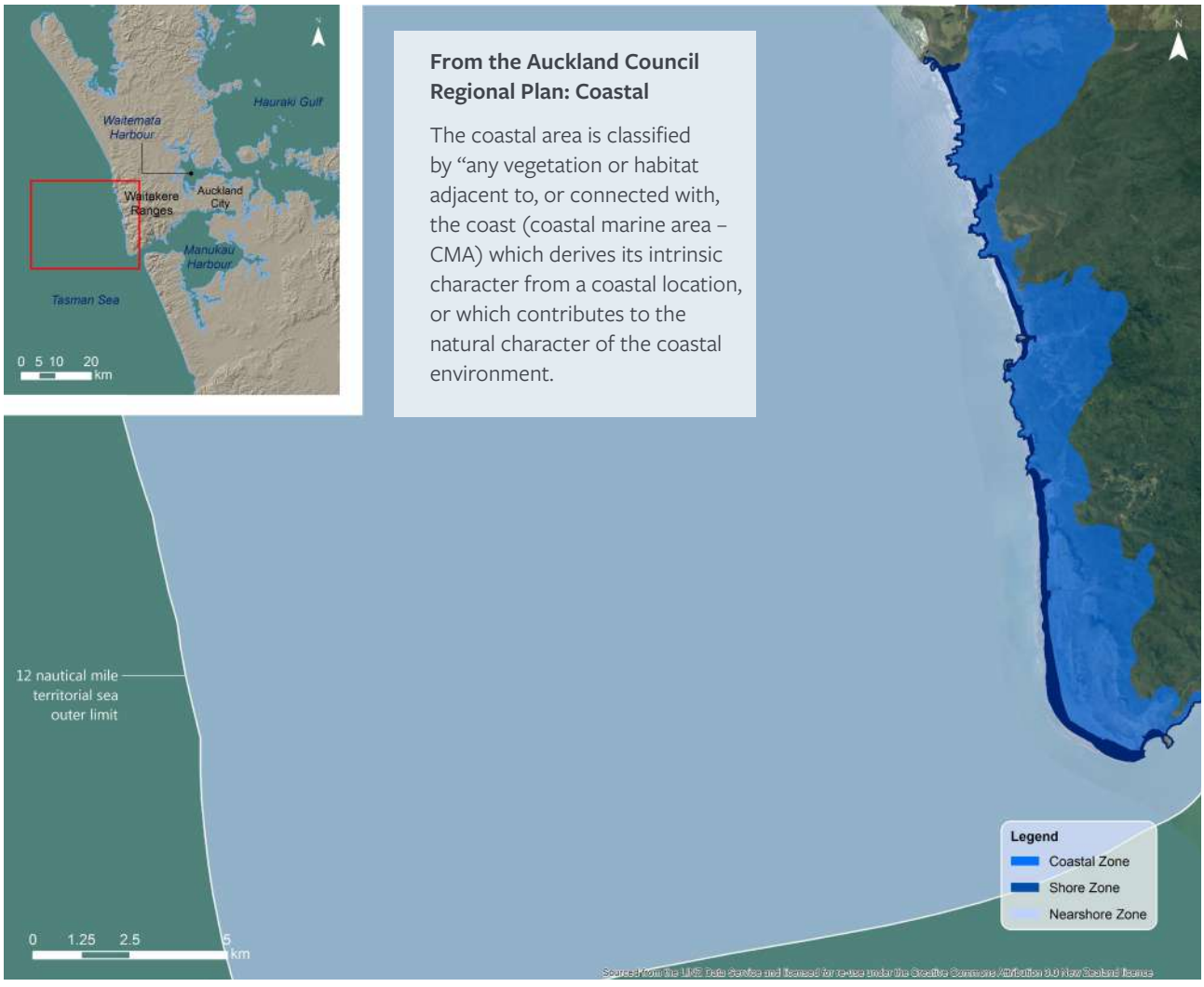


Figure 21: Zones of WRLB west coast (WC); Coastal Zone; from the Auckland Council District Plan: Coastal, Shore Area (MHWS to approx. low tide) and Nearshore zone (approx. low tide to the edge of the WRLB area).

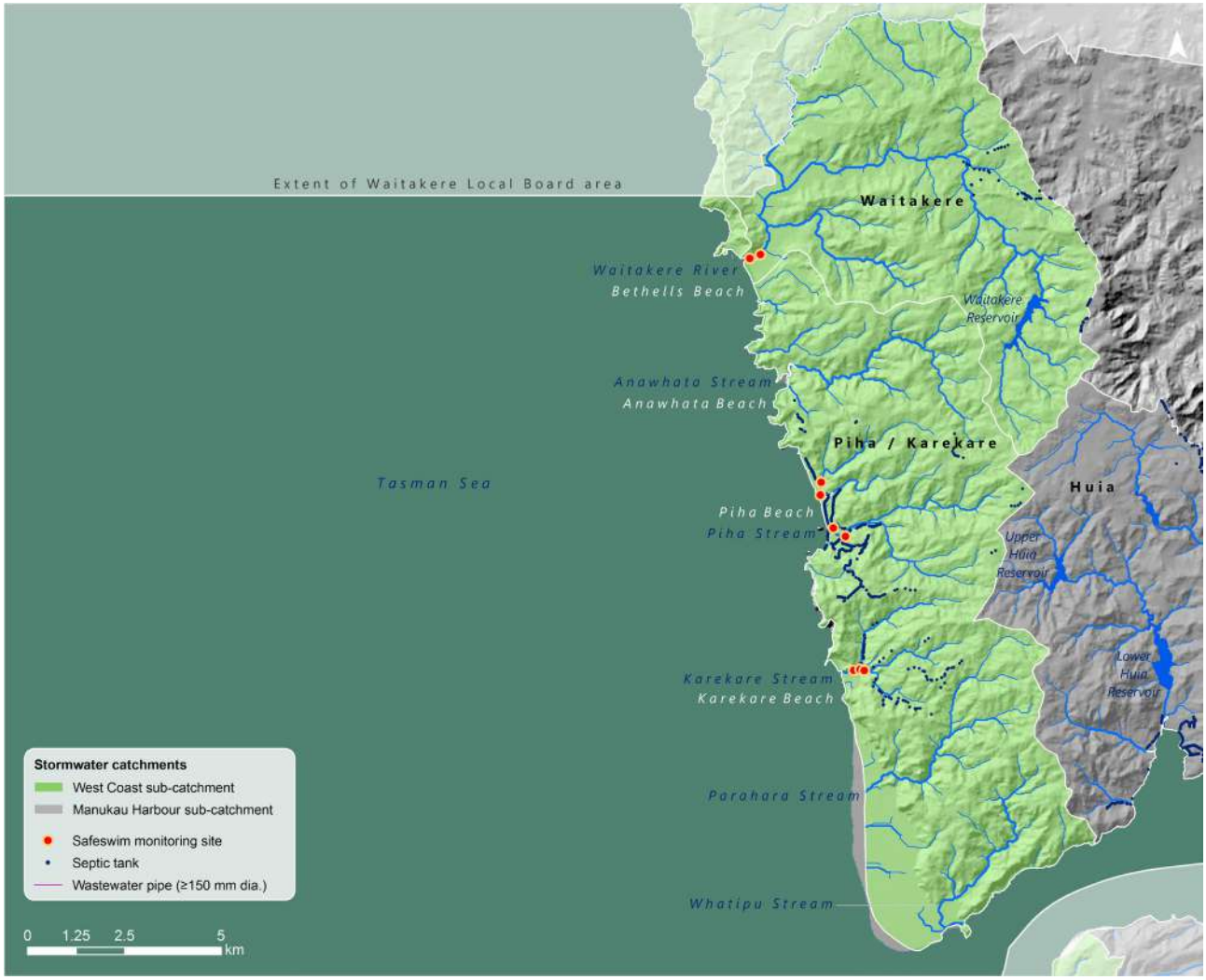


Figure 22: Catchments, streams, septic tank and wastewater network for the WRLB WC.

Each of these streams discharge into Anawhata Beach, Piha Beach, Karekare Beach and Whatipu respectively.

Gullies are mostly forested, with residential land use around the ridges and on the flat coastal areas in Piha and Karekare. The whole area is serviced by private on site wastewater networks.

The condition of a stream is affected by a combination of hydrologic, biogeochemical, and habitat provision functions including the following variables:

- Water velocity
- Water quality (DO, pH, organics, temperature)
- Water clarity
- Natural stream bed (e.g. bedrock or silt)
- Riparian vegetation
- Surrounding land use and vegetation

The majority of these streams in these catchments are considered to be in excellent condition except for in Piha and Karekare which are impacted by sewage, loss of riparian cover, and channelization (Waitākere SW management plan, 2000).

Due to specific coastal topography, some areas such as Piha and Whatipu stream mouths form coastal lagoons before reaching the ocean (for more details on coastal lagoons go to 1.0).

4.1.3 Waitākere

The two main streams in the Waitākere catchment (6,603 ha) are Waitākere River which discharges into Bethells (Te Henga) and the Taimana Stream. The Waitākere River is restricted by the Waitākere Reservoir that is present in the headwaters in its main channel. This catchment is

also impacted by grazing, the introduction of pest fish species and several aquatic weeds throughout the catchment (Ministry for the Environment, Waitākere City Council and EcoWater Solutions. September 2000).

Dams and reservoirs are known to have an impact on fish passage and sediment transport which are discussed in section 1.1.2.

4.2 Current Status of Habitats and Resources

Auckland's western coastal environment is classified in AUP–OP schedule 4, 2016 as outstanding for its special character in terrestrial, freshwater and brackish ecosystems (AUP – Schedule 4, 2016). This coastline includes natural and uninterrupted sequences of Kauri podocarp broadleaved forest, large areas of cliff threatened Pohutukawa treeland/flaxland/rockland (vulnerable) with pockets of hebe, whahariki flaxland/rockland.

There are threatened wetland and dune systems with intact ecological sequences from terrestrial, freshwater to saline (Singers *et al*., 2016). The vegetation of the west coast is varied from grasses such as spinifex and the nationally rare (classified as gradual decline) pingao sedge to the large native Pohutukawa (AUP – Schedule 4, 2016). The main bio-regions on this coastline are;

- Coastal cliffs
- Coastal Lagoons
- Wetlands
- Dunes

Figure 23: Steep coastal cliffs at Bethells (Te Henga). Photo: Cameron McPhee.

Figure 24: Sea caves at Mercer Bay, north of Karekare. Photo: Morphum Environmental.

4.2.1 Coastal Cliffs

The coastal cliffs along the west coast provide a diverse number of habitats for animals and plants (Figure 23). These are split into two ecosystem classes; the vulnerable Pohutukawa treeland/flaxland/rockland (CL1) and Hebe, whahariki flaxland/rockland (CL6) (Singer *et al*., 2016).

The unique consolidated sand forms steep cliffs which are susceptible to erosion. The cliffs host a number of threatened salt tolerant cliff plants such as a creeping perennial herb (AUP-OP schedule 4, 2016). These cliffs also support a number of coastal and sea birds which roost and breed on the cliffs and islands (AUP–OP schedule 4, 2016) (Figure 32).

4.2.2 Lakes and Lagoons

The coastal zone of the west coast includes several dynamic habitat types including dune lakes, coastal lagoons, wetlands, and dunes. An overview of these habitat types is described below followed by a summary of the dune to lagoon systems present at each of the main beach areas from Whatipu to Bethells (Te Henga). There are 13 dune lakes, lagoons and wetlands in the Waitākere Local Board area (Table 3). Bethells (Te Henga) is the largest remaining freshwater wetland in the Auckland region and supports a diverse range of bird, fish and invertebrate species (Envirologic Ltd. 2007).

Dune Lakes

The west coast dune lakes are typically backed by steep sea cliffs cut into the Waitākere Ranges (Dahm, 2013) forming native vegetation sequences from exposed beach to dune hinterland to coastal forest. The main threats to dune lakes are pest fish, weeds, and sedimentation from land (Champion and Winton, 2005; Craw, 2015).

There are three dune lakes in the Waitākere ranges: Lake Wainamu, Lake Kawaupaku and Lake Waiataru. These are all located at Bethells (Te Henga). Lake Wainamu is classified as poor, or 'eutrophic' on the TLI index as the lake is green and turbid with a high percentage of nutrients and algae. It has limited ability to support a high diversity of life (Table 3). Lake Wainamu also has a high percentage of invasive plants (85%) so it is classified as poor on the SPI. The introduction of grass carp in the early 2000's rapidly eradicated the majority of the invasive emergent weed species (Hofstra, 2014).

Lake Kawaupaku is known as the horseshoe lake and is next to Lake Wainamu, Bethells Beach and Te Henga wetland (Figure 28). Lake Kawaupaku has a poor LakeSPI factor as it has a high percentage of invasive plants (92%) (Table 3).

Freshwater Coastal Lagoons

Lagoons are sometimes opened to the ocean so they receive both freshwater and saltwater inputs (Kirk and Lauder, 2000). The salinity of a lagoon depends on the frequency of saltwater inundation by tidal, seasonal and storm conditions (Kirk and Lauder, 2000). The majority of the coastal wetlands on the western coastline of the Waitākere Ranges are brackish with some saline intrusion. There are freshwater coastal lagoons at Piha, Karekare and Bethells (Te Henga) (Figure 28).

Figure 25: Piha Domain coastal lagoon. Photo: Morphum Environmental.

Submerged Plant Indicators (SPI) is a measure of ecological condition of lakes. This is based on native and invasive plants that are found in the lake.

Water quality in lakes can be measured by a Trophic Level Index (TLI). TLI measures four water quality factors of water clarity, chlorophyll content, total phosphorus and nitrogen. This is measured on a scale from very good to very poor.

https://lakespi.niwa.co.nz/

The main threats to coastal lagoons are the replacement of native wetland vegetation species such as oioi rushland with grey willow, Japanese walnut and Manchurian rice grass which convert whole habitats into communities dominated by introduced species (Singers *et al*., 2016).

Table 3: The size and ecological conditions of the main dune lakes and wetlands in the Waitākere Local Board area

Name	Size	Ecological Condition
Lake Wainamu	78,000 m²	Poor – LakeSPI* Poor – TLI*
Lake Kawaupaka	97,700.54 m²	Poor – LakeSPI* No data for TLI*
Lake Waiataru (Beach)		No data
Ohaka Head Lake		No data
Piha Lagoon		Poor – microbial
Karekare Lagoon		Poor – microbial
Karekare car park		No data
Te Henga wetland		
Te Henga dunes	98,000 m²	Poor*
Piha Stream Swamp		No data
Pararaha Swamp and Stream		No data
Taranaki Bay Swamp		No data
Whatipu Beach		No data

*based on NIWA LakeSPI – submerged plant indicators for assessing the ecological condition of NZ lakes. https://lakespi.niwa.co.nz/. Microbial information is sourced from www.lawa.org.nz.

4.2.3 Wetlands

For a summary of background information on wetlands see 2.1.2.

Whatipu

The Whatipu area is designated as a scientific reserve and is managed by DoC on behalf of Auckland Council Regional Parks. The southern tip of Whatipu is characterised by saline herbfield/coastal turf which is considered to be a critically endangered habitat type (Singer *et al*., 2016). High numbers of threatened bird species live on the sand flats and feed in the surrounding intertidal areas (Singer *et al*., 2016). These include secretive and threatened coastal fringe birds including NZ dotterel and variable oyster catcher use the freshwater habitats (Singer *et al*., 2016).

This area has been identified as the highest priority for pest plant management in the Waitākere Heritage area due to the national importance of the ecological values of the site and threats to dune structure and rare native plants (Craw, 2015).

Karekare

Karekare has an extensive back dune wetland and natural uninterrupted coastal vegetation sequences from marine to freshwater, coastal to terrestrial (Figure 27).

Figure 26: Karekare stream and salt marsh wetland with base of dunes in the background. Photo: Cat Davis.

Figure 27: North Piha back dune looking south towards Lion Rock taken from Les Waygood Park. Photo: Morphum Environmental.

Karekare also has biogenic salt marsh present in the intertidal zone above the MHWS (Figure 26). These habitats are rare for the region and a good example of natural habitat sequences that are largely unaltered from their natural state.

Piha

Piha has threatened coastal saline wetland ecosystems; the critically endangered herbfield- coastal turf (SA5) and the critically endangered iceplant, glasswort herbfield/ loamfield (SA7) at the southern end around Taitomo Island (Figure 28). This area is also an SEA (M1-13k) in AUP–OP schedule 4, 2016 (Figure 38).

Anawhata

Anawhata has biogenic salt marsh present in the intertidal zone above the MHWS (Figure 37).

Te Henga Wetland

Te Henga wetland is the largest freshwater swamp in the mainland of the Auckland region. Extensive predator control and restoration planting is being undertaken in this area including the release of the rare and threatened Pāteke (brown teal).

The spread of pest plants has been identified as the greatest threat to biodiversity, water quality, public safety, and infrastructure at Te Henga wetland (Craw, 2015).

Figure 28: Coastal wetland habitat types and management areas in the Waitākere Ranges.

AUP–OP schedule 4, 2016, Singers *et al*., 2016.

4.2.4 Dunes

Dunes form directly landward of sandy beaches where windblown sand is captured by vegetation (Singers *et al*., 2016). These dynamic and mobile sand dunes support native sand binding vegetation like pingao (a golden grass-like plant) and spinifex. Where there is little human disturbance, dunes provide nesting habitat for New Zealand dotterel and white-fronted tern. Unfortunately, coastal dune systems are one of the most degraded and threatened ecosystems in New Zealand due to damage from trampling from humans and stock, complete replacement to form exotic grassland recreational areas and/or introduced plants (Dalm *et al*., 2011).

Natural zonation and succession of vegetation across the dune from land to sea is important for dune restoration as each species is perfectly adapted to the physical factors of that zone (Dalm *et al*., 2011). The zonation of species depends on the variables in the natural environment e.g. the amount of sand deposition, burial, exposure to salt, sand movement, wind velocity and sand blasting (Dalm *et al*., 2011). A typical dune vegetation sequence is demonstrated in Figure 30 overleaf.

Native dune vegetation is important for dune function and formation for the following reasons (McAlpine and Wotton, 2009):

- Marram grass and other exotic vegetation species (ice plant and kikuyu) have shallow root systems and are not efficient at trapping sand compared to the deep rooted native species of spinifex and pingao,
- To trap windblown sand and stop it moving further landwards,
- To prevent erosion damage to dunes.

Dunes provide the following important ecosystem services;

- Protection from storm surge and other natural hazards,
- Sand reservoir- coastal and beach sediment processes,

Figure 29: Frontal dune erosion at Karekare. Photo: Cat Davis.

- Ecosystem function.

Coastal dune restoration efforts and management plans have considerably improved natural dune character in Bethells (Te Henga), Piha, Karekare and Whatipu.

Whatipu

The dunes at Whatipu have been prograding successively over the last 150 years (Figure 30). This dynamic sand environment is a bird breeding and roosting area for a number of threatened shore bird species such as white fronted terns and the NZ dotterel.

Figure 30: Whatipu Scientific Reserve. Photo: Daniel Armstrong.

Karekare

Karekare has slightly retreated over the last 70 years (Blue and Kench, 2016). The frontal dunes are under threat from storm surge or high beach erosion (Figure 29, pers. obs.).

4.3 Seabirds

A number of coastal and shorebirds breed and live in the coastal cliffs, dune and beach habitats in the Waitākere region. While they nest in coastal areas, they often feed on fish, crustacea and plankton in the nearshore and offshore coastal waters. For simplicity, all seabird species found on the northern west coast are discussed in this section rather than splitting out into zones. Seabird data is fairly extensive for the west coast with monitoring programmes planned for Bethells (Te Henga) for grey-faced petrel and little penguin. There are 34 species of native or endemic birds that have been identified in Auckland west coastal waters through citizen science data collection programme (New Zealand Birds Online, http://nzbirdsonline.org.nz/). Seven of these species have known coastal breeding habitats on the west coast of Auckland (AUP–OP, schedule 4, 2016, pages 52-53). Whatipu (41 species), Karekare (41 species), Piha (27 species) and Bethells (Te Henga) (40 species) are hot spots for birds on the west coast.

The conservation status of New Zealand birds (2012) can be summarised to group native and endemic birds into three broad categories of "threatened", "at risk" and "not threatened".

The biggest threats to bird populations in the Waitākere coastal region are disturbance from predators and humans, fishing entanglement, and habitat loss.

4.3.1 Threatened

There are three species of seabirds that are classified as threatened in this zone.

Black-billed gull NC

Black-billed gulls are endemic to New Zealand and globally are the most threatened gull species. They are often found in coastal shell banks and sand spits. Migration routes are poorly understood for this species.

White tern

NC

White terns are native to New Zealand and are one of the rarest seabirds. They do not create nests, instead they lay one egg in a depression in a branch.

Flesh-footed shearwater

NV

The Flesh-footed shearwater is native to New Zealand. They are often found in coastal waters and are attracted to recreational and commercial boats to retrieve bait and fish scraps. Flesh-footed shearwaters migrate to pacific islands and Japan in the NZ winter.

New Zealand dotterel

NV

New Zealand dotterel are endemic to New Zealand. They rarely breed on the west coast however they may be found between Muriwai and Whatipu and known nesting sites occur at Piha near the Marawhara and Wekatahi Stream and at Bethells (Te Henga). They usually nest on sandy beaches among shells and driftwood above the high tide mark.

4.3.2 At Risk

There are eleven species of seabirds that are classified as at risk in this zone.

Little penguin

D

The little penguin (known also as blue penguin) is the smallest species of penguin. Predominately nocturnal on land, they often nest in burrows under or around coastal infrastructure or in cliffs, caves or crevices. They are most prevalent on offshore islands that are pest free.

Eastern bar tailed godwit

D

Eastern bar tailed godwit is native to New Zealand and its brown grey feathers camouflage it perfectly onto the mudflats where it forages. These species breed in Alaska and following this season, travel non-stop for 8-9 days and arrive in sheltered Harbours of the North Island to feed over the summer months.

South Island pied oyster catcher

D

South Island pied oyster catcher is an easily recognisable species with its black and white plumage and long red bill. It is found in estuaries, coastal waters and shallow harbours during the summer and migrates to the south island in the winter to breed.

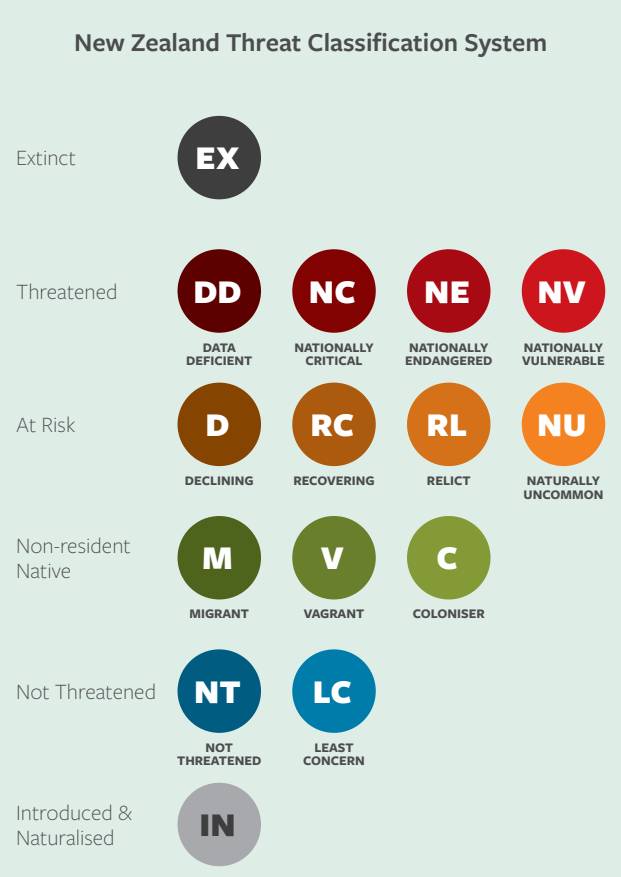


Figure 31: Threatened status of species by the New Zealand Threat Classification System (NZTCS).

Information taken from Hugh *et al*., 2013.

White-capped mollymawk

D

White-capped mollymawk is an albatross species that is native to New Zealand. This species breeds mainly off the coast of Tasmania and migrates towards South Africa and Namibia to forage.

White fronted tern

D

White fronted terns are native to New Zealand and are mainly a marine species that is found close to the coast. This species breeds in river beds, estuaries, sand dunes and river mouths often on the bare ground.

Sooty shearwater

D

Sooty shearwater is native to New Zealand and is also known as “mutton bird”. They are found in coastal waters where they feed on aggregations of crustaceans and bait fish.

Figure 32: Sea birds on the coastal cliffs of Mercer Bay, north of Karekare. Photo: Morphum Environmental.

Black shag NU

Black shag is native to New Zealand and is common around harbours and estuaries. They breed in coastal and inland sites often on swamps, coastal cliffs and steep headlands.

Buller's mollymawk NU

Buller's mollymawk is an albatross species that is endemic to New Zealand. They are easily distinguishable with a bright yellow and black coloured bill.

Buller's shearwater NU

Buller's shearwater is endemic to New Zealand and breeds only in the Poor Knights islands. They feed on aggregation of fish, plankton and crustacea near the surface.

Little black shag NU

Little black shags are native to New Zealand and are found mainly on lakes, harbours, coastal inlets, as well as freshwater ponds, lakes and stormwater ponds. They forage collectively as a group, herding and trapping small schools of fish.

Westland petrel NU

Westland petrel is endemic to New Zealand. This species breeds in coastal broadleaf forest on the west coast. In the non-breeding season, most of the population migrates to South America.

4.3.3 Migrants

New Zealand has a large number of migrating bird species, many which are native to New Zealand and breed in continents across the globe or international visitors who travel to New Zealand to breed and feed (Williams *et al*., 2006). The majority of migrating birds arrive to New Zealand via Australia so arrive over western coastal waters. There are two species that are migrants to the west coast. These are;

- Arctic skua
- Short-tailed shearwater

4.3.4 Not Threatened

There are six species of seabird that are classified as not threatened in this zone.

Diving petrel NT

The common diving petrels are native to New Zealand and are often found in congregations on the surface of the ocean. They dig burrows on steep coastal environments with dense ground cover.

Grey faced petrel NT

Grey-faced petrel is native to New Zealand. They dig burrows in coastal forests under forests, shrubs and coastal cliffs. Major threats to grey-faced petrel are cats and rats which predate on the eggs.

Figure 33: Coastal cliffs at Anawhata. Photo: Javed Khan.

Spotted shag NT

Spotted shags are endemic to New Zealand. They feed on squid and plankton in oceanic waters, sometimes out to 16km offshore. They often fly in groups close to the surface of the water in a V formation.

Australasian gannet NT

Australasian gannet are native to New Zealand and are common in most coastal waters. They breed in dense colonies along the coastal cliffs on the west coast and feed on coastal waters all the way out to the continental shelf.

Black winged petrel NT

Black winged petrel is native to New Zealand. They feed on crustacea and squid in the pelagic waters off the west coast. They nest in burrows under forests, shrubs and other vegetation.

Southern black-backed gull NT

Southern black-backed gull is native to New Zealand and is a common seabird in the coastal waters. They are found in a variety of habitats from open ocean to ports and even landfills.

4.5 Coastal Management

Overall, the greatest threats to the diversity and resilience of habitats and fauna and flora in this zone include anthropogenic land use pressures and impacts on streams draining to the coastal environment, predator and human disturbance of nesting seabirds, and damage to coastal dunes systems due to weed invasion, anthropogenic trampling or complete removal (during capping to form amenity areas).

In consideration of these issues, the following three management objectives and six management actions have been identified for the Manukau Harbour coastal WRLB area.

These objectives and actions are summarised with the environmental benefits in section 10.0.

Objectives

1. To improve water quality and clarity in the streams, estuaries and harbour environment.
2. To maintain and improve water quality and clarity in the streams, estuaries and harbour environment.
3. To preserve the natural character of the coastal environment and protect natural features and landscape values.

Actions

1. Support projects aimed at improving water quality and reducing contaminant inputs to the west coast lagoons such as 'Love Your Lagoons' (Ecomatters and Auckland Council).
2. Investigate sources of wastewater contamination including; cross connections, illegal wastewater connections and non-compliant onsite treatment systems.
3. Enhance degraded watercourses in the catchments by;
   a. Enhancing native riparian vegetation to a minimum corridor width of 15 m where possible including Piha Stream and Karekare Stream.
   b. Investigating potential naturalisation options for modified and lined channels.
   c. Investigating erosion prevention and mitigation works.
   d. Undertake a review and assessment of in stream structures to improve fish passage upstream particularly near stream mouths.
4. Advocate for improvements to the stream flow regime through the Waitākere Reservoir consent application process.
5. Continue to support the initiatives of landowners, volunteers and community groups that enhance the ecology of the area through pest control, pest plant control, and coastal and riparian planting.
6. Support/ implement predator control initiatives on coastal cliffs, wetlands and other habitats to protect native shore and coastal birds including colonies of grey-faced petrel, little penguin, and dotterel.
7. Prepare integrated management plans to protect the coastal wetlands, dune systems and lakes/lagoons including:
   a. Pest control, including pest plants and animals.
   b. Appropriate native dune planting to trap sand to build dune stability and minimise erosion.
   c. Avoiding trampling and human disturbance of dunes with fencing.
   d. Back dune planting and amenity provision.
   e. Minimisation of human built infrastructure in dynamic dune environments.
8. Control exotic fish species and their potential adverse effects. Specifically, the revaluation of the purpose of grass carp in Lake Wainamu.
9. Engage with Universities and/or other institutes to investigate the research potential of exclusion experiments to assess the impact of grass carp in lake environments.
10. Undertake freshwater and brackish fish surveys of the Whatipu scientific wetland area.

Seabird habitats on the west coast

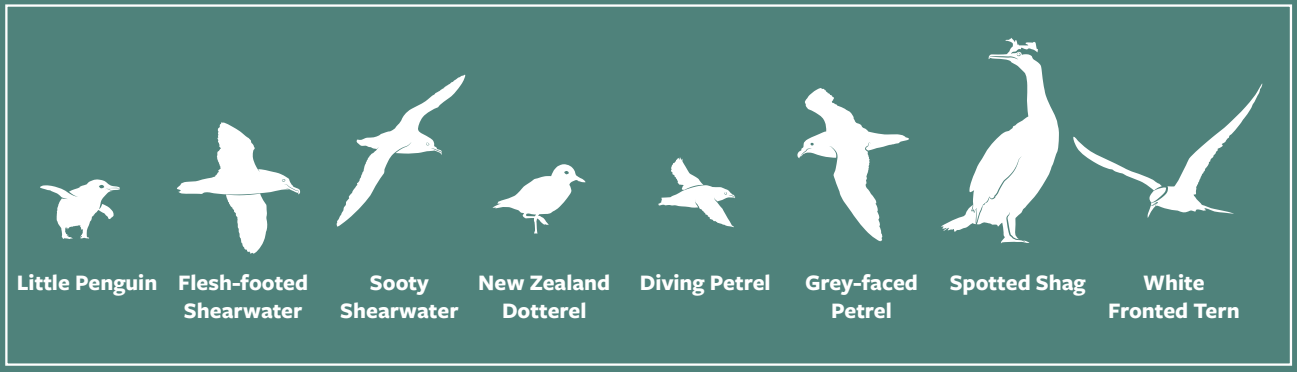
Breeding colonies and known habitats for coastal and shore birds on the west coast of Auckland (AUP–OP, schedule 4, 2016; University of Auckland, School of Biological Sciences Monitoring – Dr James Russel).

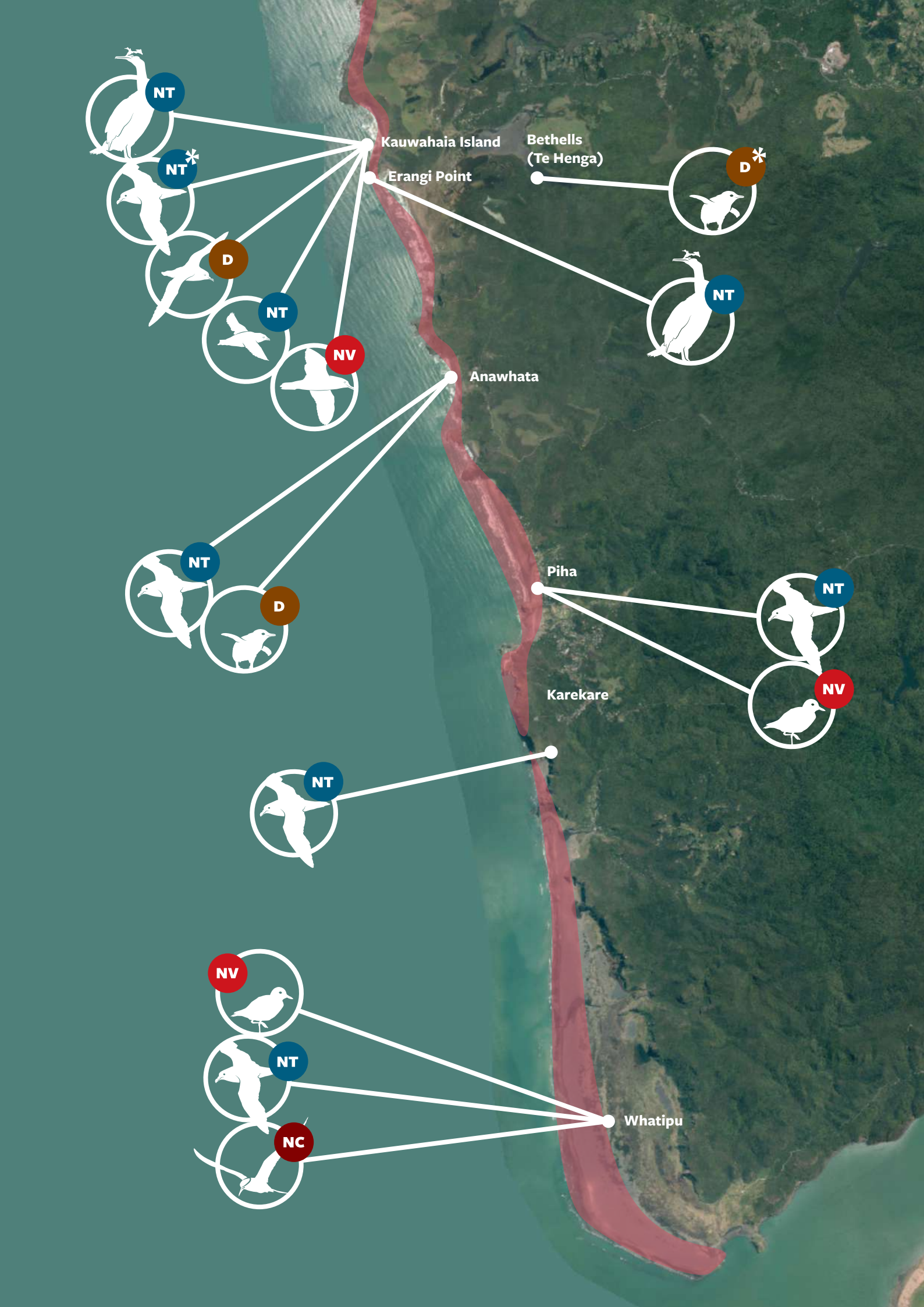
The locations on this map are meant to be used as a guide, and have been designated using LINZ place naming conventions and may not represent actual breeding location per site.

NC	NV	D	NU	NT
NATIONALLY CRITICAL	NATIONALLY VULNERABLE	DECLINING	NATURALLY UNCOMMON	NOT THREATENED

* Indicates current monitoring programme (for presense/absence)

Indicates likely blue penguin presence (anecdotal evidence)




NT
NT*
D
NT
NV
Kauwahaia Island
Erangi Point
Bethells
(Te Henga)
D*
NT
Anawhata
NT
D
Piha
NT
NV
Karekare
NT
NV
NT
NC
Whatipu

5.0 Shore and Beach

For the purpose of this study, the shore and beach zone of the west coast has been defined as mean high water springs to estimated low tide line (see section 2.0 for method calculation).

This chapter focus on the status of intertidal, beaches including coastal processes.

The beaches of the west coast of Auckland are remarkably different to the East Coast. The water temperature is generally colder and nutrient rich, due to upwelling from the Westland and Tasman currents (Heath, 1985). High wave energy and dynamic sand movement create a rugged coastline. The sandy mouths of several streams flowing into the Tasman Sea on the west coast of the Waitākere Ranges are tidally inundated and are effectively small estuaries.

5.1 Coastal Processes

Sand moves in a large interconnected system along the west coast of the North Island. The northern west coast beaches are part of this system which extends from Taranaki to North Cape. The Northern west coast beaches are also close to the Manukau Harbour entrance which interrupts the northern longshore movement of sediment. This means that the sediment tends to accumulate at Whatipu and embayments to form the iconic beaches of Piha, Karekare and Bethells (Te Henga) and bypass the entrance of the harbour in large volumes at a time (Dahm *et al*., 2013).

With the widespread accumulation of sand along many stretches of the west coast in recent years, many rocky

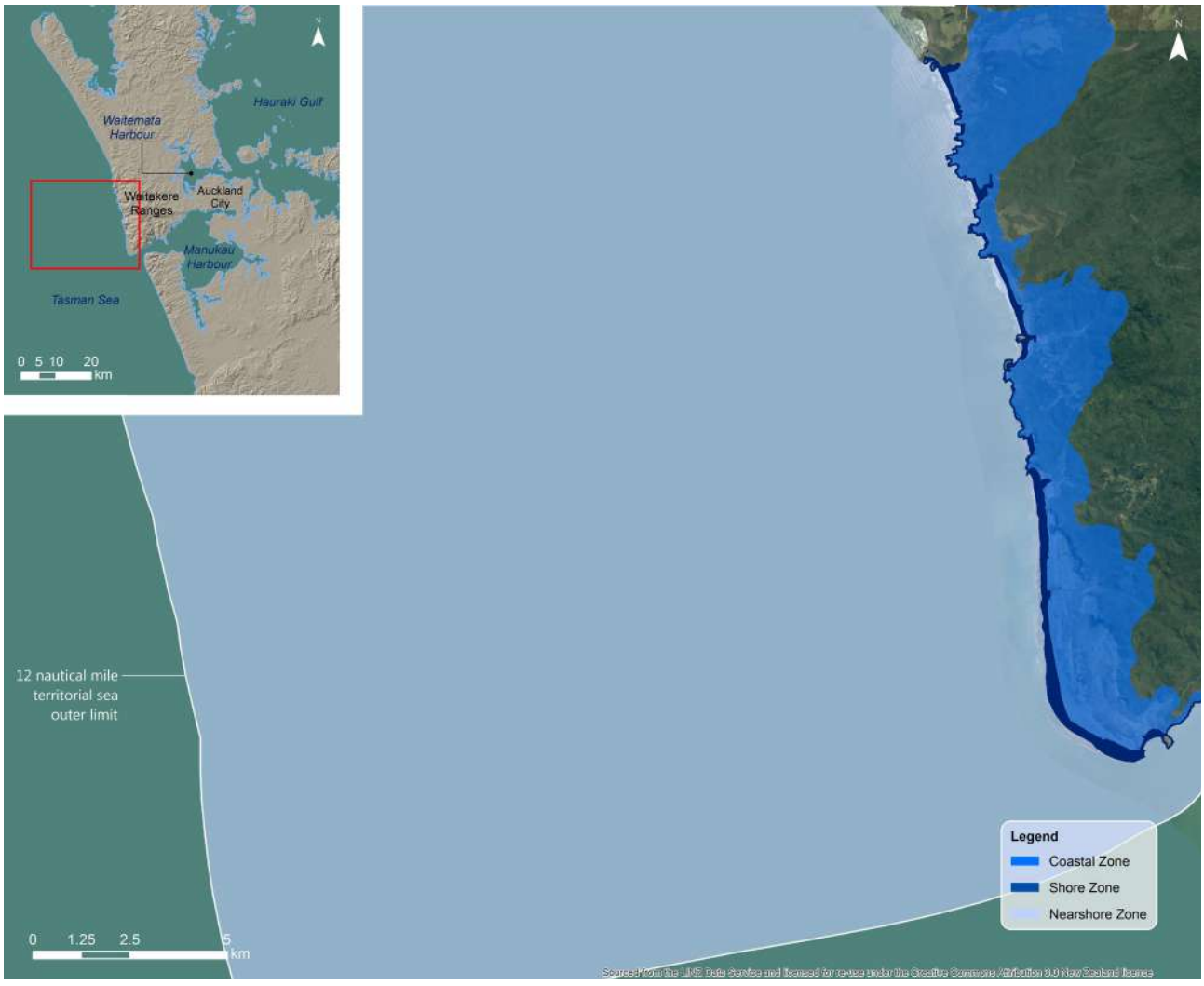


Figure 34: Waitākere Local Board coastal and shore zones of the west coast of Auckland.

shores and boulder beaches have been buried, or partially buried by sand (Hayward and Morely, 2004).

This zone faces many management issues such as erosion, accretion, water quality, wind borne sand drift and coastal hazard protection (Morgan *et al*. 2015).

Beach profile monitoring is undertaken by Auckland Council at Muriwai and South Piha (Carbines *et al*., 2013, TR2013/025). This programme measures long term changes in the landward or seaward position of the beach, sand volume changes over time, beach width and overall change for the whole beach (Carbines *et al*., 2013, TR2013/025).

Bethells (Te Henga), Piha, Karekare and Whatipu have been accreting (growing seaward through progressive deposition of sediment) since the 1930's and while there have been times of erosion, the overall trend has been coastal progradation (Dahm *et al*., 2013, (Blue and Kench, 2016).

5.2 Habitat Types

The main intertidal/shore habitat types that have been classified by DoC in the west coast shore zone are shown in Figure 36. These are:

- Exposed beach
  - Whatipu, Karekare, Anawhata, Piha and Bethells (Te Henga)
- Exposed rocky shore;
  - Raetahinga Point just north of Bethells (Te Henga) to the southern end of Anawhata,

Earlier research in this area was undertaken in 1998-2002 where the intertidal communities of the west coast were comprehensively surveyed (Hayward and Morley, 2004 - TP298).

5.2.1 Exposed Beach

On the west coast, exposed beach is the most common habitat type area (90.3%) including the main beaches at

Figure 35: The shore and beach environment at Piha.

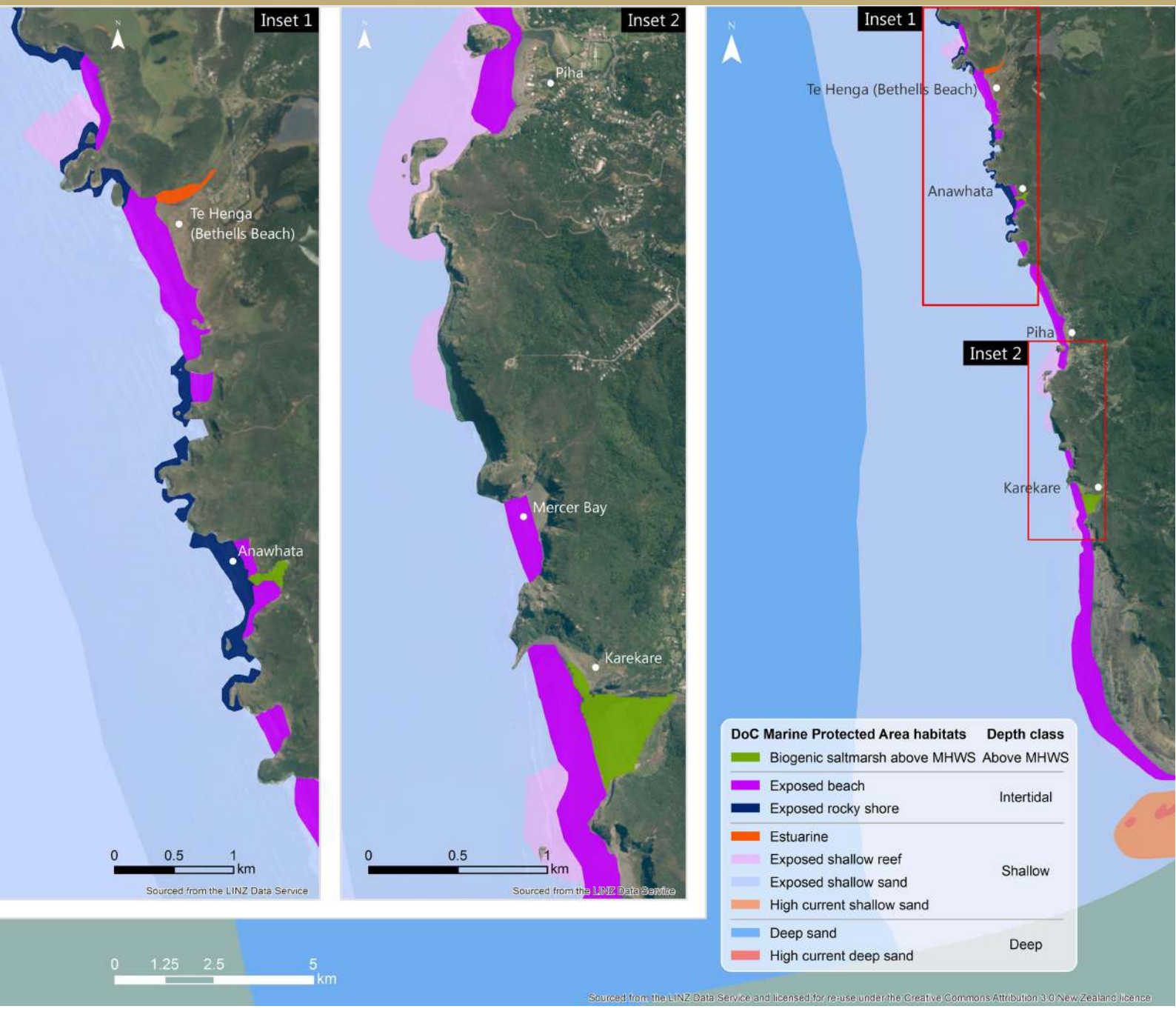


Figure 36: Habitat mapping of the shore and nearshore environment on the west coast of Auckland.

DoC and MPI, 2011.

Bethells (Te Henga), Anawhata, Piha, Mercer Bay, Karekare, and extending around the entrance of the Manukau Harbour from Whatipu (Figure 36). Globally, sandy beaches are the most common intertidal habitat (Dexter,1992). The species present on exposed sandy beaches, must be adapted to withstand an extreme energy environment and the changeable intertidal zone. This environment is very hostile and few species live there except for the sand beach isopod which lives in burrows near the high water line, and the upper range of distribution of tuatua (Quilter and Lewis, 1989 and Hayward and Morley, 2004).

Brackish water estuarine organisms are essentially absent however, from most of these small sandy west coast estuaries (e.g. Waitākere River estuary, Anawhata Stream "estuary", Karekare Stream estuary). The Piha Stream estuary is the only west coast exception however, in that it supports small numbers of estuarine species, such as the estuarine mussel and brackish snail, which live attached and beneath cobbles and water-logged logs on the near permanently drowned floor of the beach sand-dammed Piha Estuary. Also present in this estuary is the burrowing crab and around high tide level small numbers of the mud snails, pacific oysters also live permanently submerged attached to cobbles in the estuary's entrance.

5.2.2 Exposed Rocky Shore

Approximately 9.7% of the western coastline from Raetahinga Point just north of Bethells (Te Henga) to the southern end of Anawhata is made up of intertidal rocky shore and overall, this area represents the area of highest biodiversity in the west coast (Hayward and Morley, 2004).

Probably the safest, and most accessible area for groups to study these rocky shores is the reef at the north end of North Piha (Hayward and Morley, 2004).

The intertidal zone is a harsh environment where inhabitants undergo significant changes in temperature, salinity, exposure and desiccation with the rise and fall of the tide. The intertidal zone is exposed to the air at low tide and the covered with water at high tide. This results in distinct zonation of organisms (plants and animals) vertically along the intertidal zone.

On the western coastline the high splash zone characterised by vascular plants such as flax and Pohutakawa which changes into lichens closer to the splash zone (Hayward and Morley, 2004). Further down on bare rock from 2-4 m above high tide to the high tide mark is occupied by small marine snails, periwinkles and limpets which graze microalgae growing on the rocks. A general marker for the high tide line is a narrow band of barnacles, followed by small numbers of Pacific oysters living in tidal pools and the green sea lettuce on the fringes of these pools.

The mid tide zone is characterised by chitons, limpets, and ribbed barnacle often associated with small black mussel. The predator, oyster borer feeds on the dense barnacle beds present at this level on the intertidal zone. In the area between mid to low tide, an area which is more frequently covered by the tide, dense beds of green-lipped mussel Perna canaliculus are found alongside its predators, white rock shell and the orange reef star (Hayward and Morley, 2004).

Below mid tide, an area that is frequently covered by the tide, are sea weeds in distinct bands of red seaweeds as well as sporadic shelly tube worm and sand tube worm. Between neap and spring tide zones, the rocky platform is mainly covered in pink algae known as corallina paint which is grazed on by chitons and limpets (Hayward and Morley, 2004).

In the low tide/subtidal zone, the edge of this shore zone, there are a variety of seaweeds. However the most common and most iconic for the west coast is the huge bull kelp which can grow to 10 m in length and live up to 10 years (Smith and Bayliss- Smith, 1998).

Bull kelp forests are highly productive habitats; they contribute nutrients and organic matter to coastal food chains and are well adapted to the high energy coast (Adams, 1994) They have flexible fronds with a strong hold fast at the base of the plant to withstand high water velocities (Smith and Bayliss- Smith, 1998). Bull kelp forests attenuate wave energy on the coast and capture sediment (Smith and Bayliss- Smith, 1998). These only occur between Bethells (Te Henga) and Piha and are otherwise rare in the region (Hayward and Morley, 2004).

Bull-kelp forests on the west coast have been affected by major die off events such as in 1998. This is thought to be associated with elevated summer sea surface temperatures (Hayward and Morley, 2004).

5.4 Shore and Beach Management

Key threats and management issues affecting this zone are related to the quality of the water discharging from surrounding land use and how this affects sediment, benthic health, and water quality of the intertidal environment, and impacts on coastal and seabirds (including dotterel), these issues and management actions are discussed in section 5.0.

Coastal hazards and coastal processes including erosion, accretion, and sand drift also present management issues including risks to coastal infrastructure (Morgan *et al*. 2015). Monitoring and further research are already underway to inform future management of these issues.

Further management actions have been identified to digitise existing comprehensive habitat mapping to inform subsequent management and monitoring programmes.

These objectives and actions are summarised with the environmental benefits in section 9.0.

Objectives

1. To maintain or enhance natural biological and physical processes in the shore and beach environment and recognise their dynamic, complex and interdependent nature.[6]
2. To preserve the natural character of the coastal environment and protect natural features and landscape values.[6]
3. To enhance habitats to improve native species abundance and diversity

6. From the New Zealand Coastal Policy Statement 2010.

Actions

1. To review and communicate results of monitoring and research on coastal processes including consideration of adaptations to existing management actions (such as dune planting) in accordance with these findings.
2. Digitise and map baseline intertidal survey data (Hayward and Morley 2004) and integration with existing habitat mapping (DoC and MPA, 2011) to inform management of this area.
3. Improve resiliency for projected sea level rise scenarios including adaptive planting plans, and investigate potential engineering solutions to protect freshwater wetlands.

Figure 37: Significant Ecological Areas (SEA) and dominant ecosystem values in the WRLB WC.

Modified from the AUP OP, schedule 4 2016.


Board area
SEA-M1-13h
SEA-M1-13i
Te Henga (Bethells Beach)
Anawhata
SEA-M1-13m
SEA-M2-13a
SEA-M1-13k
Piha
Karekare
SEA-M1-14
Whatipu

6.0 Nearshore

For the purpose of this report, the west coast nearshore zone is defined as approximate low tide to 12 NM (Figure 38).

This chapter provides an overview of:
- Current habitat types and status
- Status of marine mammals
- Overview of the marine mammal sanctuary

The nearshore zone of the west coast of Auckland is fairly uniform to the 12 NM territorial sea outer limit. In most places, the surf zone and exposed beach habitat extends 200 to 300 m from near MHWS which grades into exposed shallow sand with pockets of exposed shallow reef four km from the coast. There are pockets are exposed shallow reef around the southern edge of Piha.

6.1 Marine Mammals

The Waitākere Ranges Local Board area has six species of marine mammals and 28 species of sea and shorebirds that are known to be present within its waters (NABIS, 2016).

Public, marine mammal sightings recorded over the past 38 years from the Department of Conservation are concentrated where there are more people, in Karekare, Piha, and Bethells (Te Henga) (Spread pages 64-65). Seal sightings are not recorded in this database. For summaries on species and threat status refer to section 3.2.

6.1.1 Marine Mammal Sanctuary

Marine mammal sanctuaries are implemented to protect marine mammals, particularly threatened species from human induced impacts. These sanctuaries are administrated by DOC and include the following;
- Auckland Islands
- Banks Peninsula
- Catlins Coast
- Clifford and Cloudy Bay
- Te Waewae Bay
- West coast North Island

The west coast North Island Marine Mammal sanctuary extends from MHWS to 12 NM (DoC, accessed on 18/01/2017). This sanctuary was put into action in 2008 as a management outcome of the Hector's and Māui dolphin Threat Management Plan (DoC, accessed on 18/01/2017).

Originally regulations were put onto seabed mining activities and acoustic surveys which are thought to disrupt the navigational, communication and feeding abilities of marine mammals (Tyack, 2008).

It is now understood that fishing pressure is currently the biggest anthropogenic threat to Māui dolphin and the severity of this threat is dependent on the fishing method and overlapping of Māui distribution and fishing activity (Currey *et al*., 2012). This risk is greatest off the Taranaki coastline out to 7 NM offshore and close to the entrance of the Manukau Harbour (Currey *et al*., 2012).

Subsequent variations to the west coast North Island sanctuary have been implemented to extend the prohibition of commercial and recreational set netting between two and seven nautical miles (DoC) (Spread pages 64-65).

These fishing restrictions overlap with the highest concentration of marine mammals sightings (Figure 40).

6.2 Sharks and Rays

The following species are found in the nearshore and offshore west coast marine environment however this is not an exhaustive list.

QMS Species
- Blue shark
- Elephant fish
- Ghost shark
- Mako shark
- Pale ghost shark
- Porbeagle shark[7]
- Rig
- School shark
- Spiny dogfish

Protected Species
- Basking shark
- Great white shark
- Oceanic whitetip shark
- Deepwater nurse shark
- Whale shark

CITES Listed Species[8]
- Porbeagle shark[7]
- Smooth, scalloped and great hammerhead sharks

Ray Species
- Rough skate
- Eagle ray
- Short-tail stingray
- Electric ray

7. Landings of the Porbeagle shark require a permit as it is now listed as a CITES protected species.
8. Convention on International Trade in Endangered Species (CITES) is an agreement that manages the trade of animal and plant species.

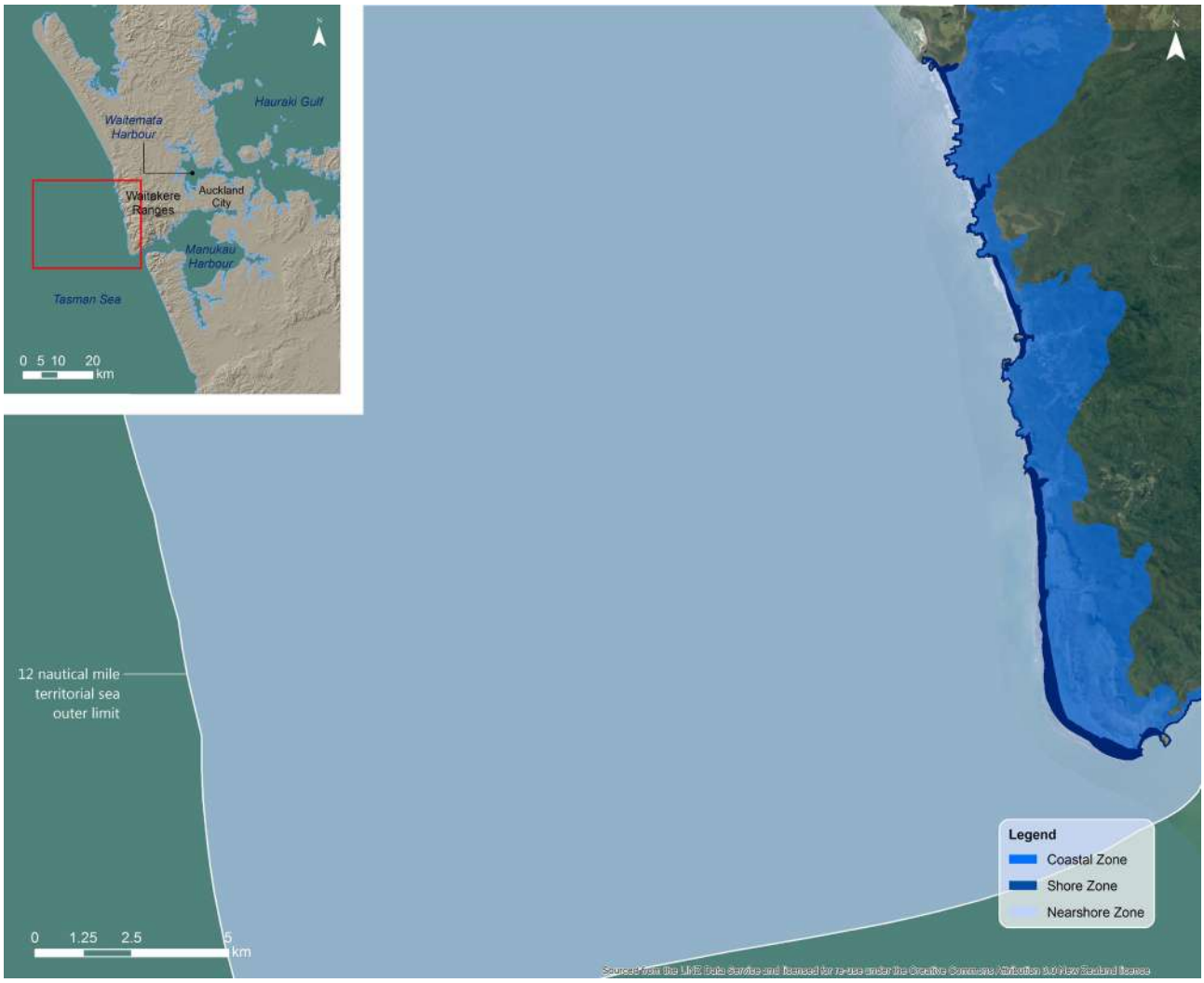
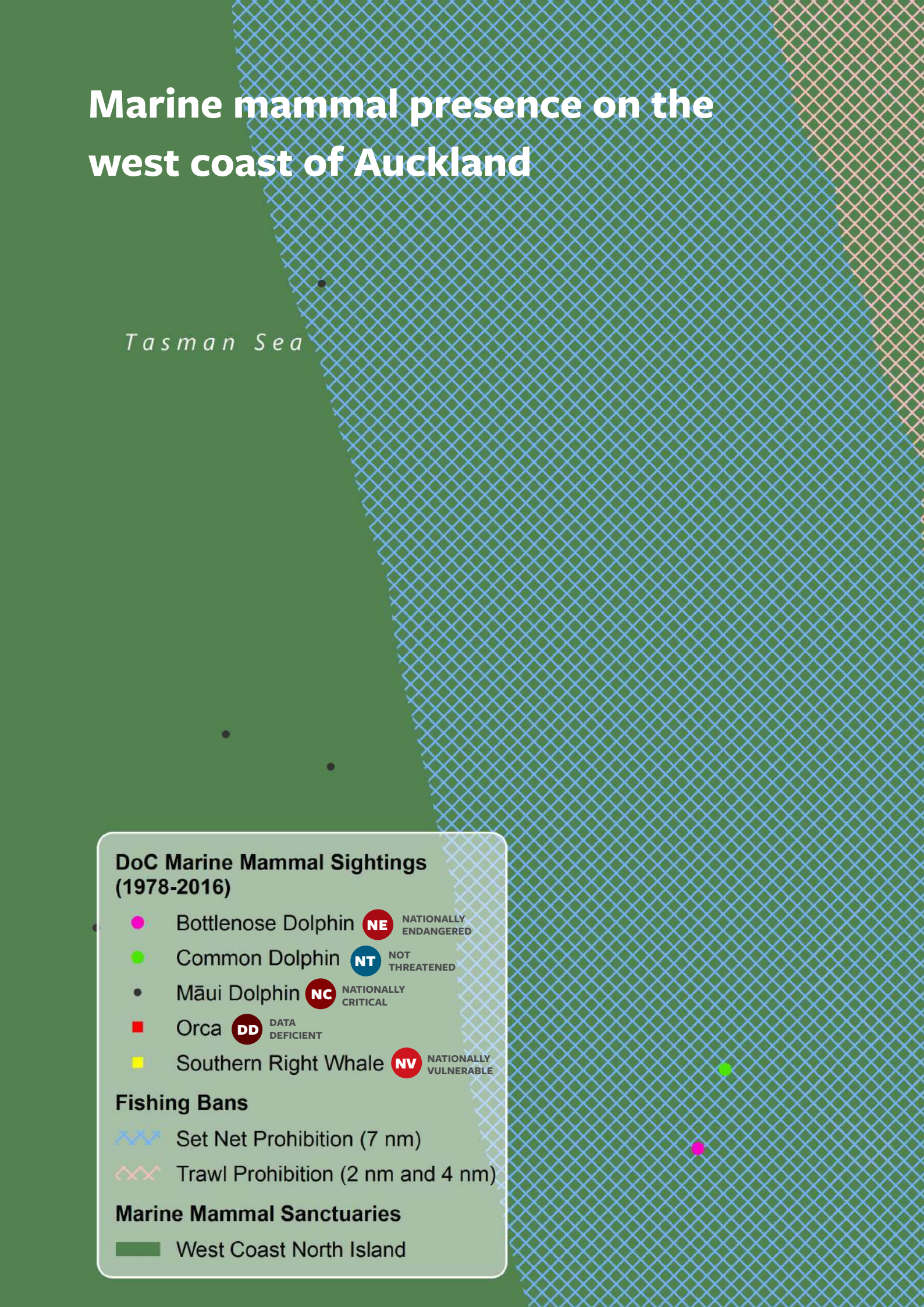
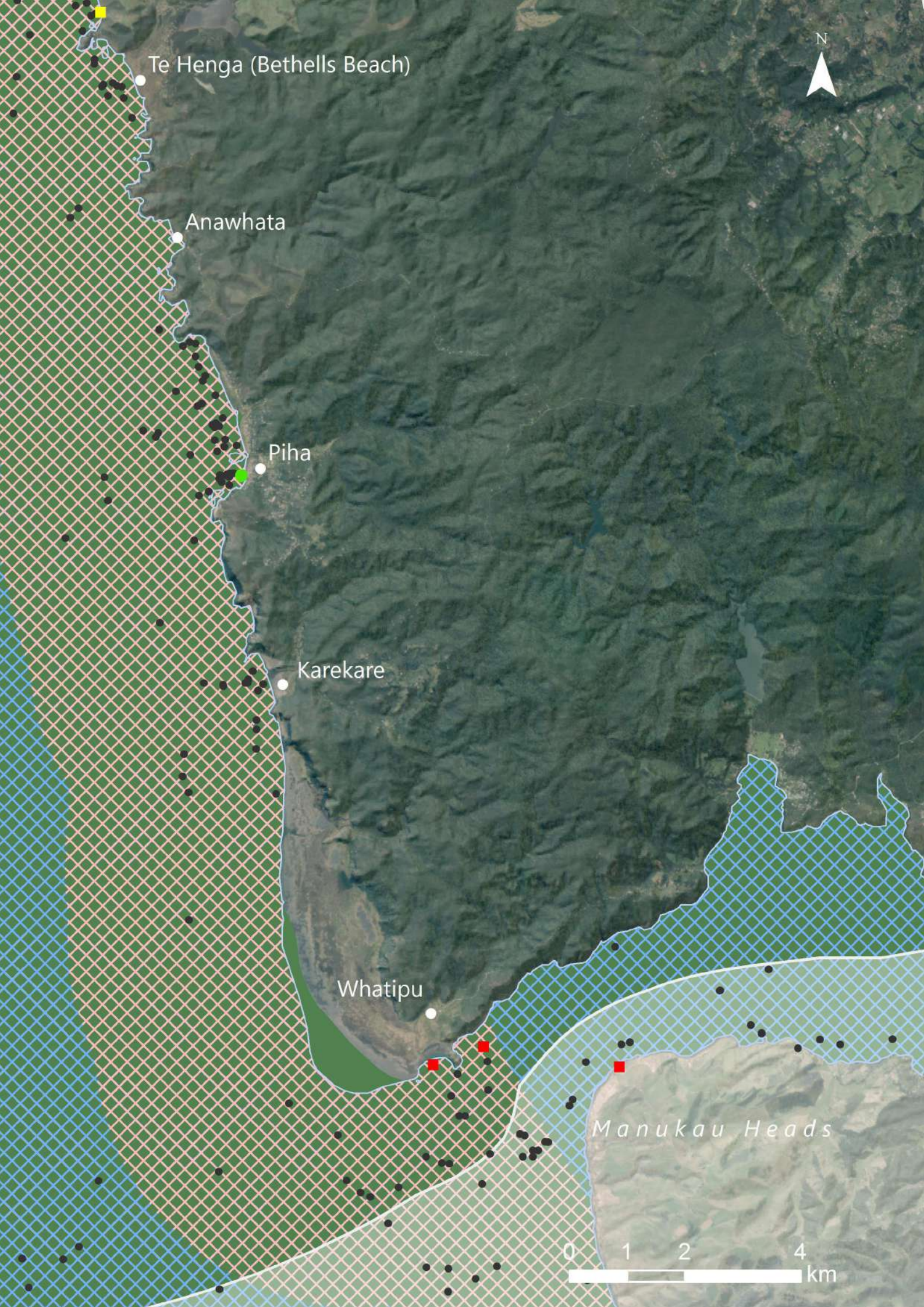


Figure 38: Zones of WRLB west coast; Coastal Zone; from the Auckland Council District Plan: Coastal, Shore Area (MHWS to approx. low tide) and Nearshore zone (approx. low tide to the edge of the WRLB area).

Marine mammal presence on the west coast of Auckland




Te Henga (Bethells Beach)
Anawhata
Piha
Karekare
Whatipu
Manukau Heads
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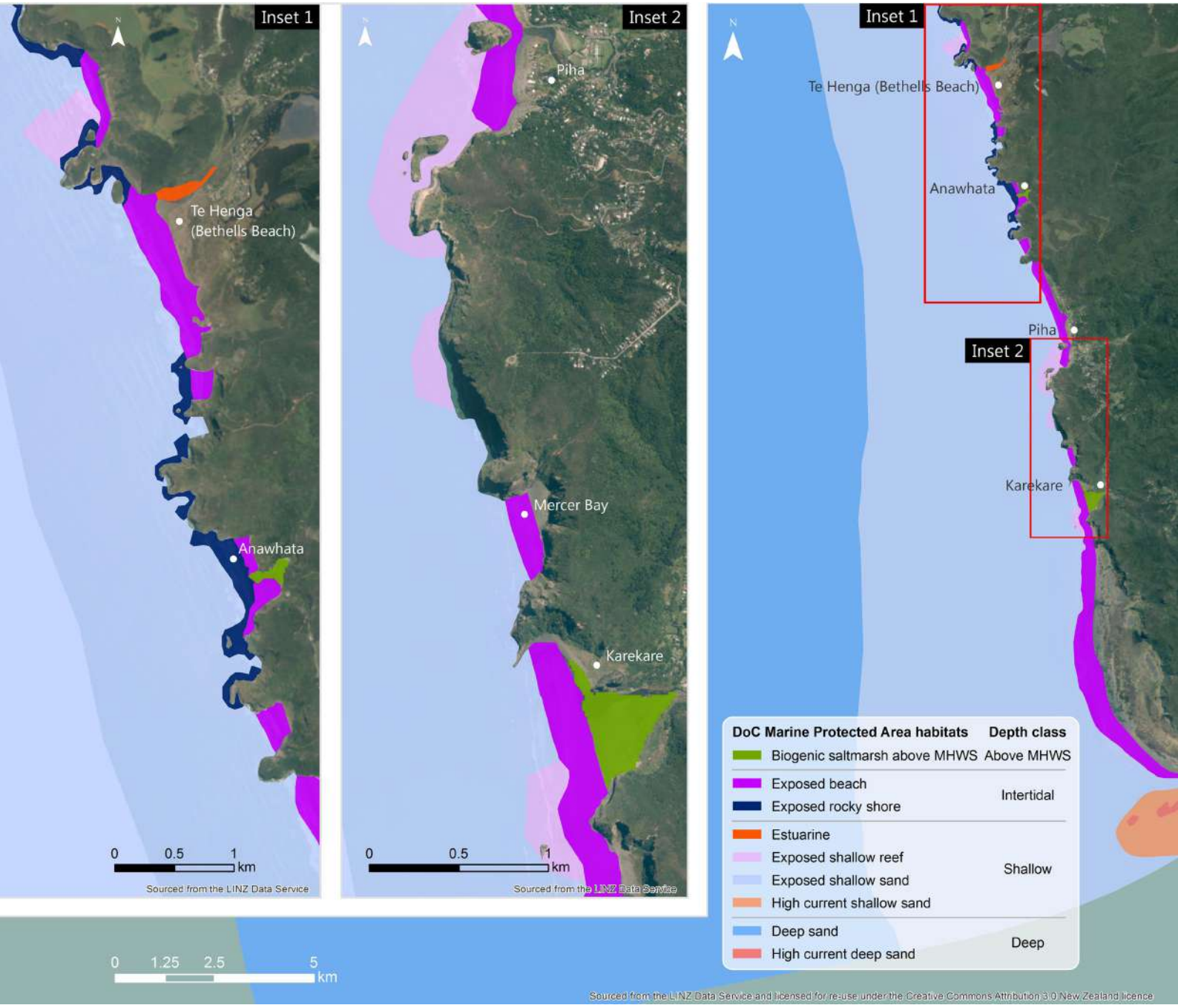


Figure 40: Coastal and marine habitats for the shore (intertidal depth) and nearshore (shallow) zone in WRLB WC.

DoC and MPI, 2011.

6.3 Habitat Types

The nearshore zone of the west coast of Auckland is influenced by the Westland Current and occasionally by the West Auckland Current. Surface currents are weak and strongly dependant on local winds; the prevailing winds are southwest. This is an exposed, high wave energy coast with waves of 1.5–2.5 m on average. There is littoral sand movement longshore to the north largely driven by a Southern Ocean derived swell. Heavy storm wave action often causes beach erosion, moving sand to offshore bars.

There are two main habitat types in this area; these are exposed rocky shore and exposed shallow sand (Figure 41).

There are also pockets of exposed shallow (max 9 m) reef around the northern part of Whatipu, (Panatahi Island shown in light pink on inset 2 on Figure 40) to the Southern edge of Piha and Bethells (Te Henga). The rocky platform stretches latitudinally from the island.

At the southern end of Piha, the exposed shallow rocky shore extends 240 m offshore and 6 m deep off Taitomo Island and 12 m offshore from Lion Rock to about 1 m deep. These areas of shallow reef and the interface with the intertidal zone are characterised by bull kelp (mentioned above in section 6.0), the large orange golf ball sponge, and various crabs and brightly coloured anemones (Hayward and Morley, 2004).

The majority of the nearshore habitat is exposed shallow sand extending out to about 30 m deep and 4.5 km offshore. This harsh environment has a low diversity of benthic fauna except for surf clamms which are found in the breaker zone of exposed beaches.

Between 4.5 km to the 12 NM territorial limit, the habitat changes into exposed deep sand. Deep water tuatua, dosinia and frilled venus shellh can be found up to depths of 10 m (NIWA website, accessed on 18/01/2017).

6.5 Nearshore Marine Management

The charismatic marine mammals are protected in this zone through the provisions of the Marine Mammal Sanctuary. However, this does not provide complete protection from fishing pressure and protection does not extend beyond 7 NM. Sharks, rays, and bony fish are all threatened by fishing pressure including by-catch, and entanglement in nets and benthic habitat destruction. Issues and management actions associated with fishing are discussed in section 4.0.

Other key threats affecting these fauna include vessel traffic and pollution including poor water quality and other rubbish and debris. Issues associated with the quality of water discharging from surrounding land use are discussed in section 1.0.

Overall, further consideration may be given to the potential role of the west coast of the Waitākere area within a national framework of marine protected areas.

Objectives

1. To maintain coastal water quality, and enhance it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.[9]
2. To preserve the natural character of the coastal environment and protect natural features and landscape values.[10]
3. To protect habitats to improve native species abundance and diversity.

Actions

1. Investigate further potential protection measures for the west coast of the North Island.
2. Support the initiatives of Universities, Crown Research Organisations (e.g. NIWA, Cawthron Institute), DoC, volunteers and community groups for the monitoring of marine mammals, large migratory fish e.g. kingfish, and rays and sharks, and benthic habitats.
3. Support community efforts to reduce plastic pollution and marine debris by;
   a. Support campaigns that educate consumers against single use plastics and encourage using recyclable plastics,
   b. Support campaigns that educate consumers against buying beauty and other household products that contain plastic microbeads,
   c. Advocate for Local Board Area wide initiatives to avoid the use of single use plastic bags.
4. Support MPI surveillance and public reporting programmes for introduced marine pests and diseases.

9. From the New Zealand Coastal Policy Statement 2010.
10. From the New Zealand Coastal Policy Statement 2010.

7.0 Offshore

Key Words and Definitions

EEZ	Exclusive Economic Zone
Pelagic	The water column in the open ocean
Benthic	The ocean seafloor

The offshore zone is defined as the area from 12 NM to the 200 NM offshore boundary of the New Zealand Exclusive Economic Zone (EEZ).

New Zealand's EEZ is the fourth largest in the world, and 15 times larger than the NZ terrestrial environment (LINZ, accessed on 18/01/2017). The Extended Continental Shelf is where the New Zealand seabed submerges and meets the Australian boundary and EEZ. The EEZ and Continental Shelf (Environmental Effects) Act 2012 governs the use and management of natural resources within this zone including;

- Exploration of petroleum and minerals
- Extraction of petroleum and minerals
- Discharges from offshore infrastructure and sediment from prospecting and mining.
- Dumping of waste
- Seismic surveying
- Marine scientific research, prospecting and exploration
- Submarine cabling
- Burials at sea

7.1 Physical and Ecological Characteristics

The physical characteristics of the ocean are important for monitoring spatially localised change over time as well as global trends in sea surface temperature to inform climate change research and overall ocean health. Changes in the physical factors in the ocean may affect where transient animals like pelagic fish and marine mammals are likely to be found.

Global ecological and physical characteristics of the ocean were mapped by ESRI in 2016 (in collaboration with several international marine research institutes). This map categorises the ocean into systematic units called Ecological Marine Units (EMU) which summarise the physical and ecological features of that area.

This map improves access to global data to inform ecosystem based management for marine conservation i.e. marine protected area management (MPAs) and fisheries science.

In this global context, the west coast (EMU11) can be characterised as moderate to cool with low nutrients.

The EMU explorer can be accessed through this URL: http://livingatlas.arcgis.com/emu/

7.2 Benthic Species

The benthic zone is an ecological region at the lowest level of a body of water or lake. This includes the animals and plants living on the seafloor and buried in the sediment.

The Benthic-Optimised Marine Environment Classification (BOMEC) used distribution data from eight groups of bottom dwelling species (starfish, filter feeding colonial species (bryozoan and benthic forminifera), corals, worms, sponges and benthic fish to classify habitat types from MHWS out to the 200 nautical mile (NM) EEZ (Figure 41, Leathwick *et al*., 2012). The sea floor has been condensed into four main groups; Inshore and shelf, upper slope, northern mid depths and deeper waters. This classification has been carried out for the whole of New Zealand but for the purpose of this study we have chosen to focus only on the western North Island.

In Auckland, local boards have a jurisdiction out to the 12 NM limit.

Determining the distribution of benthic species is necessary in order to understand the ecosystem impacts of bottom trawling, mining and other anthropogenic seafloor activities (Tracey *et al*., 2011). Data collected about offshore deep benthic species is collated from research trawls, commercial fishing bycatch and more recently biodiversity studies (Tracey *et al*., 2011). This is particularly important for identifying the distribution of habitat forming species such as deep water corals, (occupying benthic areas from 180 m to 976 m deep) (Tracey *et al*. 2011). Deep coral reefs Rises, ridges, slopes and deep sea seamounts are important geological formations that predict the presence of habitat forming corals (Tracey *et al*. 2011).

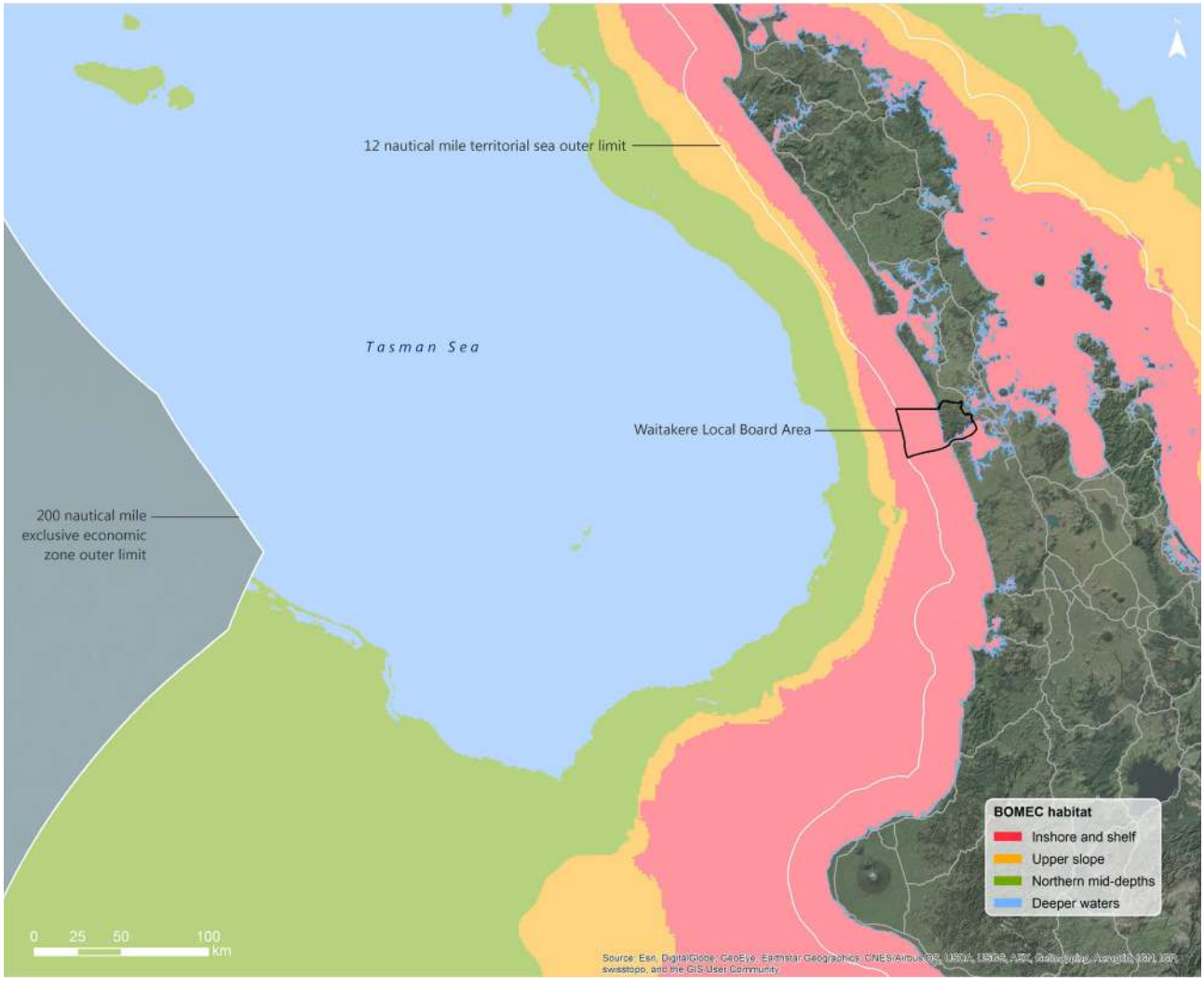


Figure 41: A Benthic-Optimised Marine Environment Classification (BOMEC) habitat types for the North Island of New Zealand. The WRLB offshore area is to only be used for discussion purposes and does not outline any real jurisdiction.

Data from Leathwick *et al*., 2012.

7.3 Pelagic and Migratory Species

The pelagic zone includes the water column between the ocean's surface and seafloor. This zone includes zooplankton and salps, schools of fish, large sharks and rays and marine mammals. Oceanic pelagic species are migratory both over distances and over depth.

Māui Dolphin are typically found within the 12 NM nearshore area with the greatest abundance between 0-2 NM (Currey *et al*. 2012) however they may be found off shore. It is likely that other marine mammals present in the nearshore zone are also found offshore. The threats to marine mammals in the offshore are similar those in the nearshore with the added impacts from sand mining and petroleum mining mentioned in section 8.4.

There are eleven shark species that have annual distributions that are in the northern offshore zone off the west coast of Auckland (NABIS, 2017);

- Blue shark
- Dark ghost shark
- Hammerhead shark
- Mako shark
- Northern spiny dogfish
- Pale ghost shark
- Porbeagle shark
- Rig
- School shark
- Seal shark
- Spiny dogfish
- Thresher shark

The following six bird species have annual ranges or migratory paths that cross over the offshore zone off the west coast of Auckland (NABIS, 2017). These are listed in Table 4.

Table 4: Migratory bird species present in the offshore marine environment.

Species	Threatened Status	
Sooty shearwater	Declining	D
Buller's shearwater	Naturally uncommon	NU
Flesh-footed shearwater	Nationally vulnerable	NV
Mottled petrel	Relict	RL
Australian gannet	Not threatened	NT
Banded dotterel	Nationally vulnerable	NV

There is data on the following 31 fish which can be found in the deep pelagic waters offshore and are likely to be present in the offshore zone off the west coast of Auckland NABIS, 2017). This is not an exhaustive list;

- Albacore tuna
- Alfonsino
- Barracouta
- Bass
- Bigeye tuna
- Black cardinal fish
- Blue mackerel
- Blue marlin
- Bluenose
- Broadbill swordfish
- Golden mackerel
- Hake
- Hapuku
- Hoki
- Horse Mackerel
- Javelinfish
- Murphy's mackerel
- Orange roughy
- Pacific Bluefin tuna
- Ray's bream
- Red cod
- Ruby fish
- Silver dory
- Silver warehou
- Skipjack tuna
- Striped marlin
- Tarakihi
- Trevally
- White warehou
- Yellow eyed mullet
- Yellowfin tuna

The biggest threats to these fish are fishing pressure; target and non-target fisheries, food web effects and habitat destruction. For more details on these see section 4.4.

7.4 Petroleum

Currently the entire sea area from Whanganui to the Pandora Banks near Cape Reinga, out to the 12 NM zone, is covered by either prospecting or exploration block offers for petroleum (Figure 44). Other permits extend from the 12 NM zone to the edge of the EEZ. These permits are held by a wide range of corporate entities, ranging from shelf companies to multinationals. The seabed is split into uniform areas or blocks for resource management (NZP&M, 2017).

Mana whenua are consulted annually to identify areas within the blocks which have cultural significance or sensitivity (NZP&M, 2017). Following consultation, companies are invited to bid for permits to explore for oil and gas in specified blocks (NZP&M, 2017). Permits are granted on the basis of technical and financial capabiltiy, history and record of compliance with other permits and likelihood of compliance with reporting obligations and payments of fees and royalities (Crown Minerals Act, 1991-the Minerals Programme for Programme 2013).

Permit types cover three main categories; prospecting, exploration, development and productions which cover a range of activity types (Table 5).

In 2016, 168 permits were granted to enable prospecting of petroleum resources within the west coast of the north island, these are mainly concentrated off Taranaki (Figure 44).

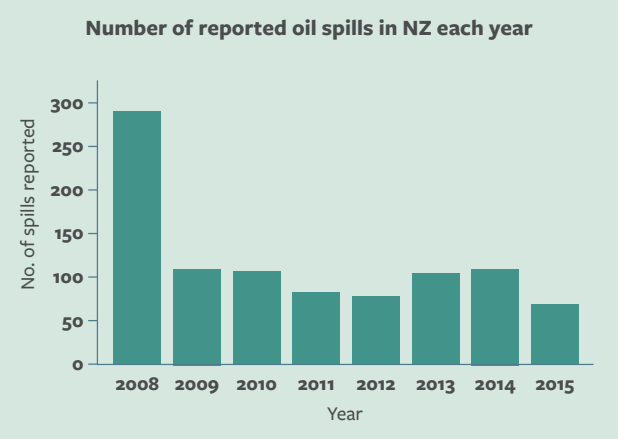
An exploration permit enables the permit holder to explore for reserves of oil or gas in a speficied location. It does not give the permit holder permission to extract or produce the oil commerically. If commercial quantities of oil are found, the permit holder must apply for a Development and Production permit.

A permit was granted in 2016 for one petroleum production well in the marine area on the west coast of the North Island.

Table 5: Petroleum permits and the types of activities on the west coast of the North Island.

Permit type	General activities	Quantity issued*
Prospecting	• Geological and geophysical data collection/surveying • No drilling allowed	• 168 wells
Exploration	• Geological and geophysical data collection/surveying • Sampling • Aeromagnetic surveys • Seismic surveys • Well drilling	• 89 wells
Development and productions	• Extraction, separation, treatment and processing of petroleum	• 100 development • 1 production well

* No. of marine permits issued for blocks within the west coast of the North Island (2016).



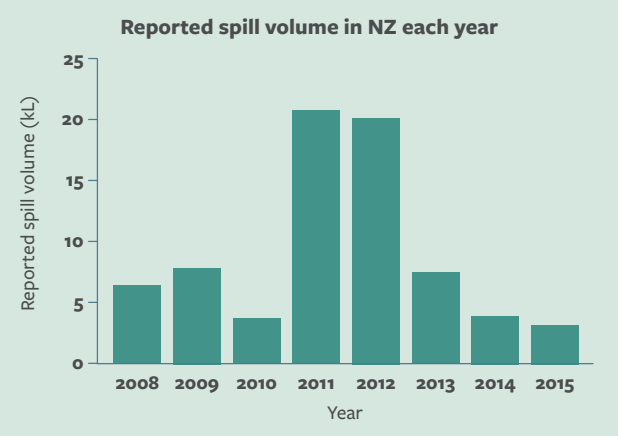


Figure 42: Marine oil spills (volume and number of spills) from 2011 to 2015. Data updated on 21/09/2016. The 2011 figure does not include the Rena incident.

Data from Ministry of Transport and Maritime NZ.

7.4.1 Impacts

Under the Resource Management Act 1991, Auckland Council are responsible for managing the environmental effects of any mining activity including ecological impacts. The effects associated with exploration and extraction depends on the location, techniques used, and the resource involved.

AUP–OP schedule 4, 2016 has an overarching objective to ensure any extraction activities are managed to avoid significant adverse effects on the coastal marine and near shore environments.

The actual and potential impacts of well drilling and extraction and processing activities include both localised impacts associated with the physical structures and operation of the facility, and potential wide spread impacts in the event of an oil spill.

The localised impacts associated with petroleum exploration are summarised in the below in Table 6.

Table 6: Overview of impacts of petroleum well activity.

Activity	Impacts
Geological and geophysical data collection/surveying	Low impact.
Seismic and aeromagnetic surveying	Acoustic disturbance and damage to marine mammals, fish and other marine life.
Extraction, separation, treatment and processing of petroleum	• Collisions with structures • Acoustic disturbance • Destruction of benthic ecology • Provision of habitat for invasive species • Ship strike • Sediment disturbance

Significant oil spill events are rare but have the potential to cause widespread damage including a range of impacts on fauna including:

1. Mortality of fauna,
   a. Loss of insulation in marine mammals and birds.
   b. Affect predator prey relationships e.g. physical ability to feed, inability to swim makes some animals more susceptible to predators.
   c. Internal damage and poisoning from ingesting oil.
   d. External damage to respiratory surface and irritations to skin.
2. Stress and behavioural effects;
   a. Loss in the drive to breed.
   b. Reduction in the ability to navigate and impacts on migratory behaviours.
   c. Erratic or reduced feeding behaviours.

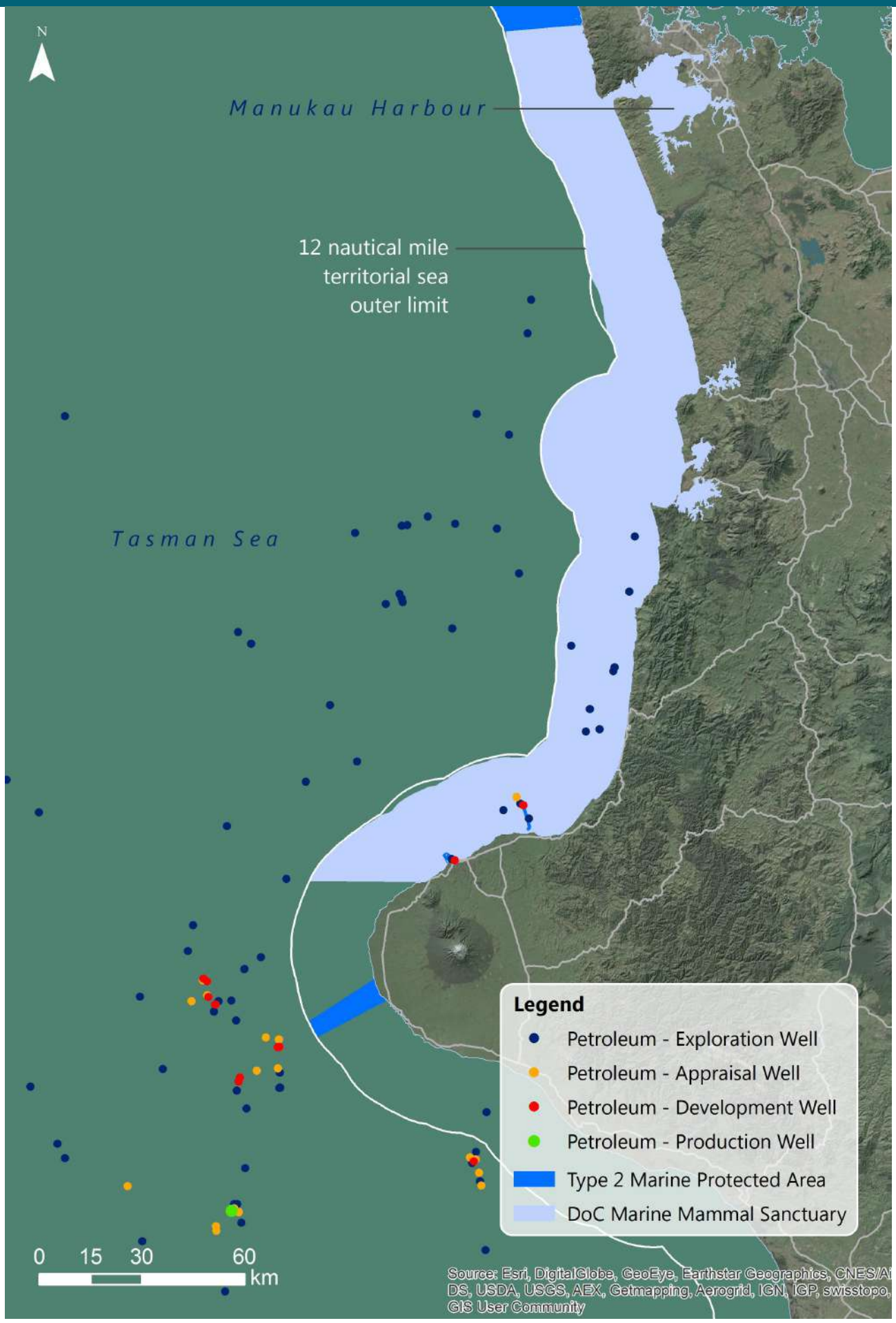


Figure 43: Marine Protected Areas (MPAs), marine mammal sanctuaries and petroleum wells for the west coast of the North Island.

Data from New Zealand Petroleum and Minerals, LINZ accessed on 20/12/2016 http://data.nzpam.govt.nz/permitwebmaps?commodity=minerals

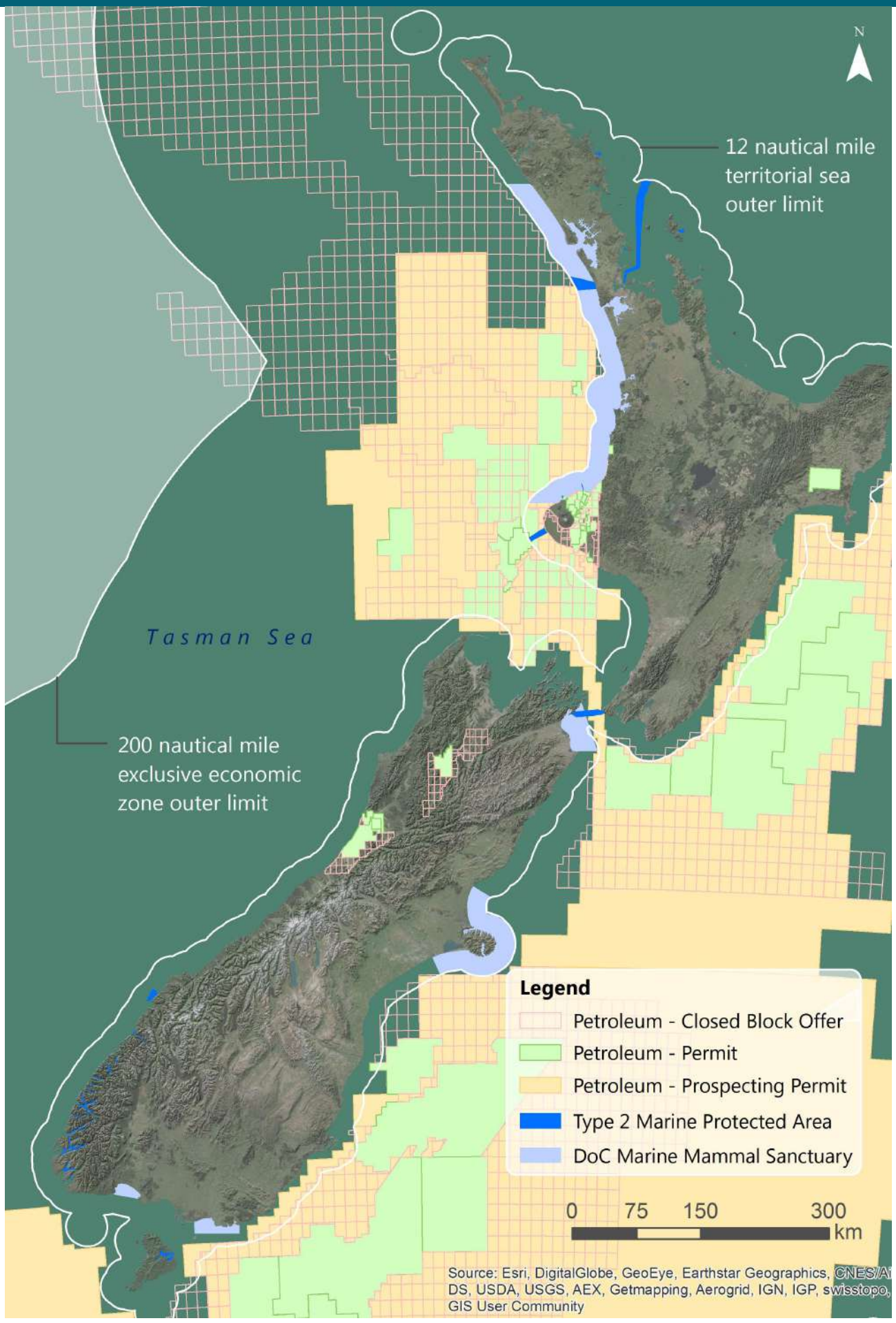


Figure 44: Marine Protected Areas (MPAs), marine mammal sanctuaries and petroleum block offers for the west coast of the North Island.

Data from New Zealand Petroleum and Minerals, LINZ accessed on 20/12/2016 http://data.nzpam.govt.nz/permitwebmaps?commodity=minerals

When there is a spill of oil (greater than 100 ppm of hydrocarbon) in the water) it is the responsibility of the permit holder to notify Maritime New Zealand or the Regional Council as soon as possible.

The annual number of oil spills and total volume that is discharged into the marine environment for the whole of NZ is summarised in Figure 42 (page 73). An average of 9,469 L of petroleum has been spilt into the marine environment per year from 116 spills events between 2008 to 2015 (Figure 42).

7.5 Sand Mining

Mineral sand mining involves the excavation sand from the seabed to extract minerals (Minerals Programme for Minerals (Excluding Petroleum) 2013). The sand is processed on board vessels to remove mineral particles and remaining sand is returned to the seabed (Minerals Programme for Minerals (Excluding Petroleum) 2013). The process for obtaining a mining permit is the same for petroleum mentioned above.

Table 7: Mining permits and types on the west coast of the North Island in 2016 (see Figure 45 for locations).

Permit type	General activities	Quantity issued*	Duration (years)
Prospecting	Low impact activities; geological mapping, hand sampling, offshore sampling or aerial surveys.	1	5
Exploration	Literature reviews, drilling, bulk sampling and mine feasibility studies.	3	5
Mining permits	Extract for specified minerals within a specified area.	0	5

* No. of permits issued for blocks within the west coast of the North Island (2016).

7.5.1 Impacts of Sand Mineral Mining

The actual and potential ecological impacts of sand mineral mining are summarised below from Environmental Protection Agency (EPA) (2016);

1. Discharge of sediment- indirect and direct effects of the sediment
   a. Reduction in water clarity,
   b. Smothering of benthic habitats and fauna,
   c. Disturbance to migratory movements of fish, birds and mammals,
   d. Resuspension of minerals and nutrients into the water column,
   e. Clogging of respiratory and feeding structures of marine animals,
   f. Reduction in primary productivity of algae through the reduction in light,
   g. Food web effects through interference with predator prey interactions e.g. it is harder to detect prey/predators in turbid water,
2. Physical seabed and soil disturbance from extraction and the infrastructure on the seabed e.g. anchor placement and removal
3. Acoustic disturbance
4. Fish in the direct area that get caught in the intake line and pump.
5. Injury or mortality to marine mammals from ship strike.

Seabed mineral mining is prohibited from the coast to two nautical miles within the marine mammal sanctuary, and out to four nautical miles from south of Raglan Harbour to north of Manukau Harbour.

7.7 Offshore Marine Management

The Waitākere Ranges Local Board has maintained a strong position advocating on behalf of its community in opposition to proposed petroleum exploration within the western coastline of Auckland on a number of grounds including protection of outstanding natural areas and features, protection of threatened marine mammals and birds, and in the unlikely, but potentially catastrophic event of a significant oil spill, the unique and exposed landscape presents numerous logistical and safety challenges to spill containment and response mechanisms.

Objectives

1. To maintain or enhance natural biological and physical processes in the offshore environment and recognise their dynamic, complex and interdependent nature.[11]
2. To preserve the natural character of the offshore environment and protect natural features and values.[12]

Actions

1. To advocate for and investigate potential to implement marine reserves within the western North Island.
2. To continue to advocate for the protection of the west coast of Auckland from potential impacts of mining and oil exploration.
3. Support the initiatives of Universities, Crown Research Organisations (e.g. NIWA, Cawthron Institute), DoC, volunteers and community groups for the monitoring of marine mammals, large migratory fish e.g. kingfish, and rays and sharks.
4. That the WRLB requests Auckland Council to address concerns regarding the adequacy of regional response capability in relation to the west coast and the northern Manukau Harbour in the event of a tier two or tier three marine pollution event in accordance with Auckland Council Pollution Response strategy and the NZ Marine Oil Spill Response Strategy 2015-2019.

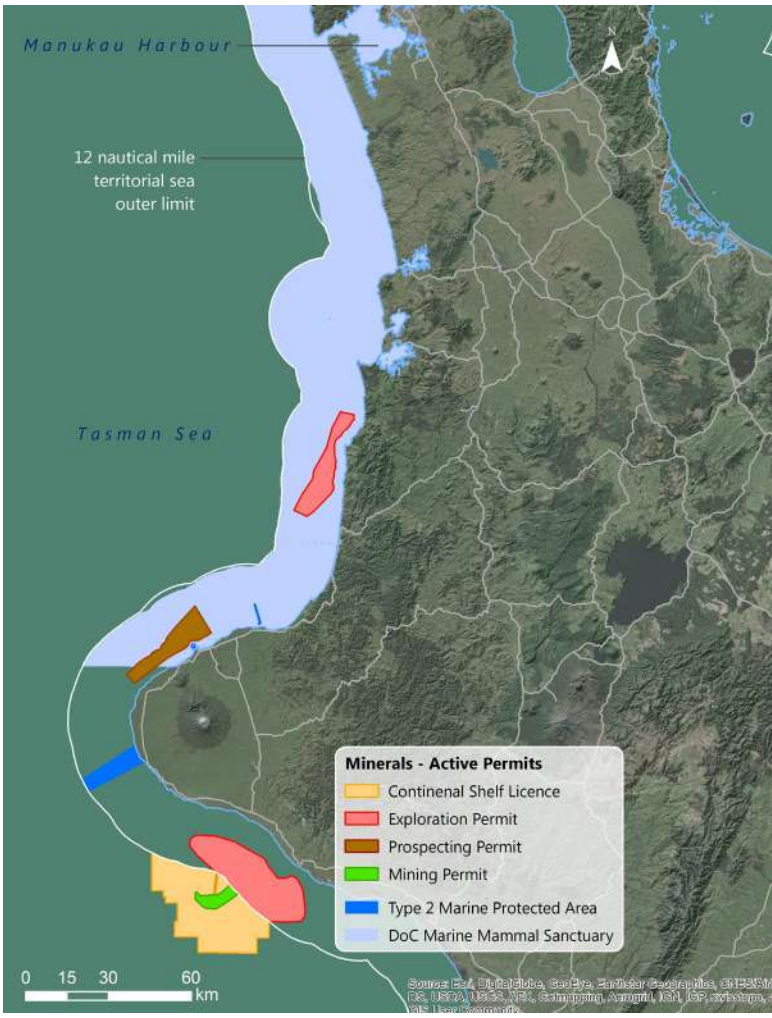


Figure 45: Marine Protected Areas (MPAs), marine mammal sanctuaries and active mining permits for the west coast of the North Island.

11. From the New Zealand Coastal Policy Statement 2010.
12. From the New Zealand Coastal Policy Statement 2010.

Part C

Finfish and Shellfish

8.0 Status of Fisheries

Key Words and Definitions

Fish	Bony and cartilaginous fishes with a backbone
Invertebrate	Animals without a backbone – for this purpose of this study e.g. scallops, mussels and octopus
Target species	Primary species of fishery
By-catch species	Species caught by accident while fishing for primary species
Associated or dependent species	Species impacted by the removal of key prey or predator target species.
Habitat destruction	Removal of living or non-living structures from the sea floor which provide a home for other marine species.
Biomass	Total weight (tonnes) of a specific species of fish or shellfish in a defined geographic area
Stock	Sub-population of a specific species of fish within a geographic area.
Quota Management System (QMS)	The NZ Quota Management System (QMS) allows the management of fisheries resources through control of harvest levels for each species dependent on geographical area.
Landings	Fish brought onto land
Actual catch	The quantity of fish caught annual. Calculated per fish stock.
Total Allowable Commercial catch (TACC)	The commercial quota for a particular species of fish in defined geographic area (stock).
Spawning stock biomass	Total mass of breeding age fish and this varies between species.
Fish stock assessment	A management tool used to maximise the catch without damaging the total fish population. A stock assessment integrates the history and the possible impact future quotas will have on the fishery.
Spawning stock biomass	The total mass of breeding age fish and this varies between species.
Fishing effort	Annual cumulative number of commercial fishing boats in a defined statistical area

8.1 Current Status of Habitats and Resources

The Ministry of Primary Industries (MPI) is responsible for the management, research and policing of commercial, recreational and customary fisheries. MPI hold records of commercial catch from 1988 and is responsible for determining the possible long term impacts of fishing on target and associated or dependent fish species (1988-current) (Anderson, 2004).

New Zealand's territorial sea and exclusive economic zone (EEZ) is split up into 638 separate stocks and 96 species. Of those species, 34 are in the west coast fisheries management area (FMA) of the North Island, called Northwest and Central (FMA 9 and FMA 8) (Figure 46).

FMA 9 is 329,373 km2 and extends from the north of Taranaki to North Cape out to the 200 NM EEZ boundary. All of the commercial fish catch from this west coast fishery is landed through the Port of Onehunga (NIWA, 2016). Localised descriptions on landing, limits and stock health are limited by the scale of reporting (total fishery region).

Each species or species group is divided into 1-10 stocks for management purposes. Stock status assessments are reported in plenary reports by MPI for each stock area. Stock areas overlap with and extend beyond the boundaries of FMA 9. Throughout this report, only the stocks that include the north west coast area are referred to.

8.1.1 Health of a Fishery

The stock status of a fishery is measured by soft and hard limits and an overfishing threshold.

The soft limit of a fishery is where the population biomass is below 20% of the original population and is classified as **overfished**.

The hard limit is where the population biomass is below 10% of the population and is deemed to be **collapsed**. This

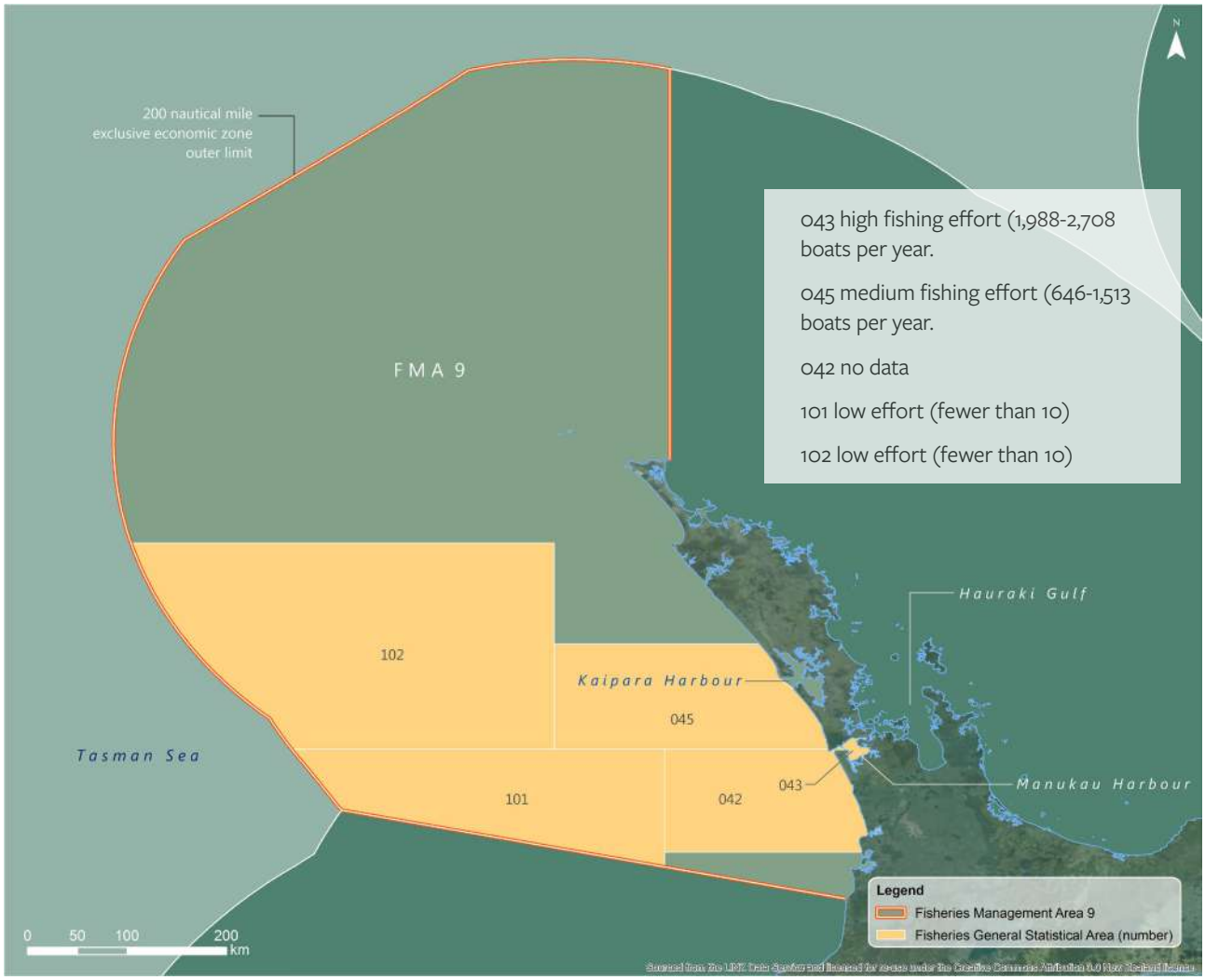


Figure 46: The Fisheries Management Area Nine (FMA9) – northwest region and commercial fishing effort per statistical area.

is where fishery closures should be considered in order to rebuild the stock at the fastest possible rate.

The overfishing threshold is that rate of extraction/percentage of stock removed each year that should not be exceeded as it will eventually lead to the overall biomass declining (MPI Status of NZ's Fisheries 2015).

These limits are dependent on the estimation of the original, unfished biomass which are calculated utilising existing stock size and recruitment information. However, this is poorly understood for many of our managed fisheries with sufficient information to report on the status of only 183 stocks out of a total of 377 managed stocks (MPI, 2016).

8.2 Finfish Fisheries

The North West fisheries management region encompasses 2,810 km of coastline from north Taranaki to North Cape (MPI, NZ fisheries infosite 2016). This region has expanses of exposed sandy coast punctuated by rocky shores and large harbours (MPI, NZ fisheries infosite 2016).

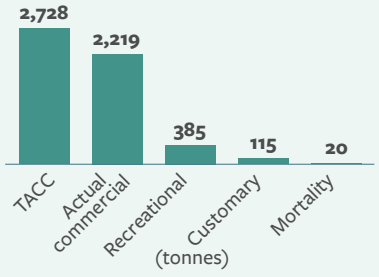
The Manukau Harbour is an important resource for commercial, recreational and customary fishers (Kelly, 2008). The main species caught in the Manukau Harbour include grey mullet, flatfish, rig, kahawai, trevally, yellow eyed mullet, parore, red gurnard and snapper (Kelly, 2008).

8.2.1 Commercial Fisheries

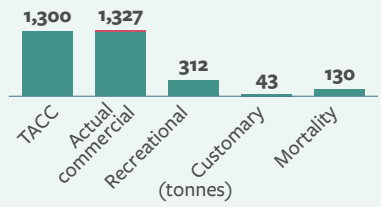
Commercial fishing is managed by quotas of total allowable commercial catch (TACC). Each fishery stock is managed by its own TACC amount, specified by MPI. The species caught in FMA9 in 2016 are summarised in Figure 47. The highest limit (TACC) for commercial catch was kahawai, Gurnard, Trevally, tarakihi, Snapper and Yellow belly flounder.

Of these species, the 2015 MPI plenary stock assessment summary indicates that trevally (TRE7) are or above target levels, no stock assessment has been conducted for

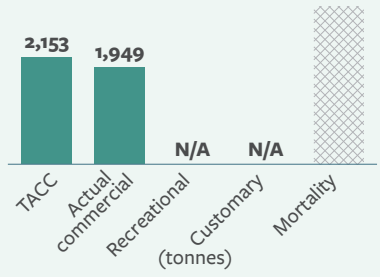
Kahawai
Arripis trutta and A.xylabion



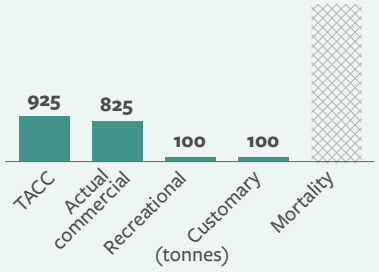
Snapper
Pagrus auratus



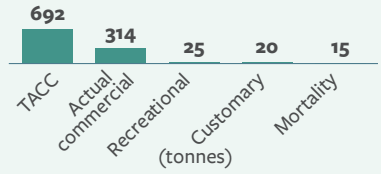
Trevally
Pseudocaranx georgianus



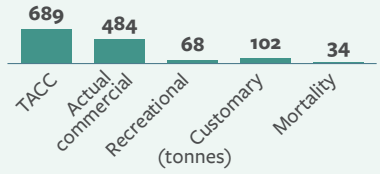
Grey mullet
Mugil cephalus



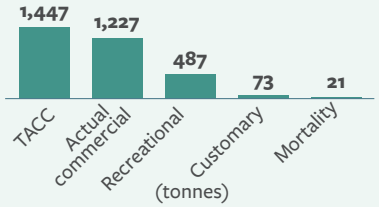
Rig
Mustelus lenticulatus



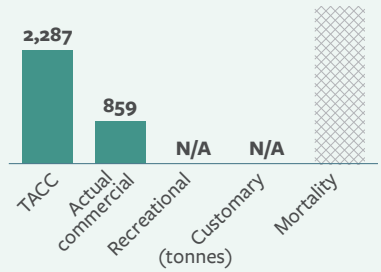
School shark
Galeorhinus galeus



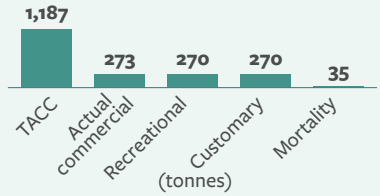
Tarakihi
Nemadactylus macropterus, Nemadactylus sp.



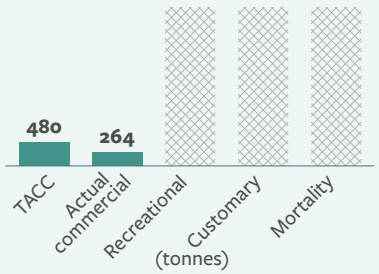
Gurnard
Chelidonichthys kumu



Yellowbelly flounder
Rhombosolea leporina

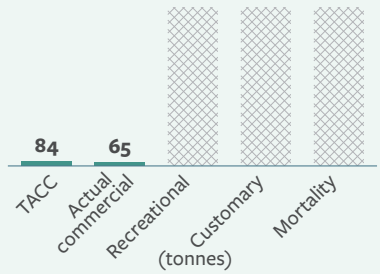


Hapuku and bass
Polyprion oxygeneios and P.americanus



Leatherjacket
Meuschenia scaber

Parore
Girella tricuspidata



Actual commercial catch in excess of TACC

No available data

Data: NZ Fisheries InfoSite, Ministry for Primary Industries http://fs.fish.govt.nz/Page.aspx?pk=91
Note – annual data for Fisheries Management Area 9 for the year 2016

Figure 47: Commercial (TACC), recreational and customary limits for FMA9 in 2016 in tonnes. Catch data is only available for commercially fished species.

NZ Fisheries InfoSite, MPI, 2016. Illustrations: Vivian Ward, University of Auckland – School of Biological Sciences.

kahawai (KAH 8) , or Tarakihi (TAR1), and it was considered about as likely as not that stock of gurnard (GUR 1W) are at or above target levels however it is considered unlikely that the stock is below the soft limit. Yellow belly flounder were not included in the stock assessment.

Plenary stock assessments for the snapper fishery within the west coast (SNA8) were last undertaken in 2005. At this time it was considered very likely (>90% probability) that the fishery was below the soft limit and the TACC was consequently reduced to improve the rate of rebuilding of the stock (MPI, 2015).

Commercial fishing effort is the estimated total number of boats fishing in an area summed over the year. This data is held by NABIS, available per statistical area but not available per stock. NABIS has commercial fishing effort from 1988 but for the purpose of this study, we have only analysed fisheries data over 6 years (2010-2016).

Commercial fishing effort reduces with depth. It is highest in the Manukau Harbour (043), less in the inshore fisheries of 045 and 042 and the least effort is out close to the 200 NM limit in 101 and 102 (Figure 46).

The most heavily fished year was 2011-2012 with 2720 estimated days of fishing in the Harbour. The inshore fishing area (045) had the second highest commercial fishing effort from 2010 till 2016 (Figure 46). The highest annual effort for this area was in 2012-2013 with 1697 days of fishing in the area (Figure 46).

Data availability for the offshore areas (101 and 102) was limited for some years and this was indicated as zero (National Aquatic Biodiversity System (NABIS) (http://www.nabis.govt.nz/ accessed on 25/01/2017). The highest fishing effort for the both offshore areas was in 2015-2016 with a total of 12 days of fishing in those areas. These higher results for these offshore areas could be reflective of recent advancements in technology, good weather and/or more efficient recording of boats.

8.2.2 Recreational Fisheries

Recreational fishers have a strong presence in the Manukau Harbour. The west coast has less recreational fishing pressure due to ease of access, difficulties crossing the Manukau bar and generally more intense storms and weather compared to the harbour and east coast. On both coasts, targeted species include snapper, kingfish, flatfish, gurnard, flounder, kahawai, grey mullet and rig. Recreational fisheries have daily bag and size limits which regulate how many fish an individual can take. This informs the recreational limits for the stock.

8.2.3 Customary Fisheries

Customary fisheries are regulated under the Kaimoana Customary Fishing regulations 1998. Coastal hapu are issued with a permit to catch fish and collect shellfish in their area for customary use. Gurnard and Trevally have no annual limit for catch and are only regulated by size and bag limits. Other species include grey mullet, snapper, yellow belly flounder, small sharks, eels, kina, mussels, scallops, pipi, cockles, tuatua, and toheroa. Toheroa are only able to be collected through customary fishing permits.

8.3 State of Shellfish Fisheries

8.3.1 Commercial Fisheries

The largest shellfish commercial catch for FMA9 in 2016 was Green Lipped Mussels with a limit of 180 tonnes and a total landing of 198 tonnes. There is no available stock assessment for Green Lipped Mussels (GLM 9).

129 tonnes of Spiny Red Rock Lobster (crayfish) was landed in the year. The TACC is 131 tonnes/year which is the largest target species for commercial shellfish fisheries in QMA9 for 2016 (Figure 49). The status of the CRA9 Westland-Taranaki Rock lobster stock is considered to be about as likely as not to be above target levels however it is considered very unlikely that this stock is below the soft limit.

Target shellfish species are shown in Figure 48. The majority of the remaining non-target commercial stocks are caught as bycatch through bottom trawling and dredging for scallops and are not shown in the graphic; sea cucumber, frilled venus shell, ringed dosinia, silky dosinia, knobbed whelk, trough shell, large trough shell and deepwater clam.

Actual commercial fisheries catch data for 2016 was not publicly available for 61% (14/23 species) of the invertebrate fish stocks in FMA9 (MPI website, accessed on 11 01 2017).

8.3.2 Target Recreational Species

Popular recreational shellfish species in FMA9 include paddle crabs, paua, kina, green lipped mussel, crayfish, cockles pipi, and scallops. However, no landing data t is publicly available for recreational and customary catch for 2016.

The collection of shellfish on the west coast is restricted to rocky shore and stable gravel beach habitats due to the lack of intertidal sandy beach species present (Hayward and Morley, 2004). Mussel beds that are easily accessible by foot at low tide along the Omanawanui coast inside the Manukau Harbour entrance, are heavily harvested (Hayward and Morley, 2004).

Historically, paua harvest was recorded along the Omanawanui and found at low tide around Mill Bay rocks in the 1950s but are no longer present (Hayward and Morley, 2004). This could be due to harvesting pressure or sediment build up. There is no stock assessment available for the PAU1 stock area.

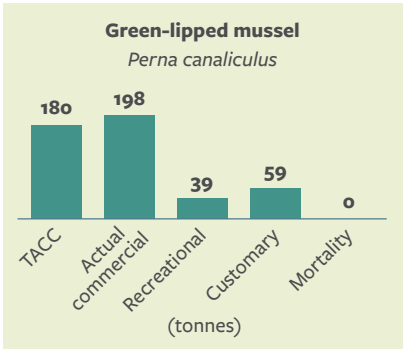
Kina, is found in large number at Mercer Bay however is present in low numbers right around the rest of the Waitākere coast (Hayward and Morley, 2004). This suggests that recreational pressure is likely impacting on kina numbers elsewhere (Hayward and Morley, 2004).

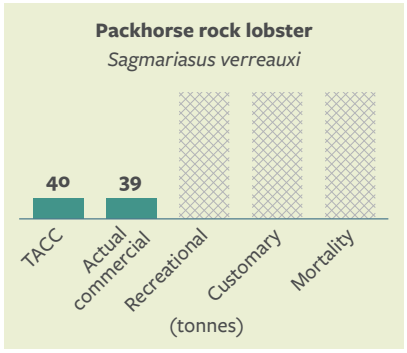
The collection of soft sediment species such as cockles and pipi occurs on the sandy and muddy beaches along the north Manukau coast, especially at Huia, Cornwallis, Mill and Armour Bays (Hayward and Morley, 2004).

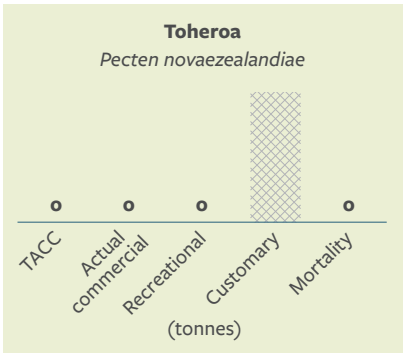
Anecdotal and other evidence seems to indicate that abundances of these species have been decreasing on most beaches throughout the Auckland region for many years.

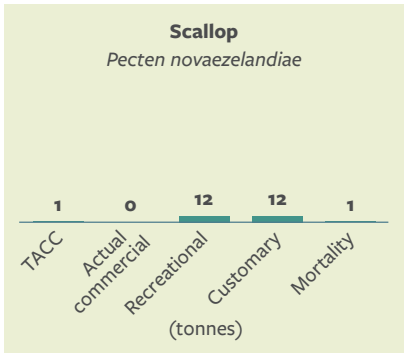
8.3.3 Target Customary Species

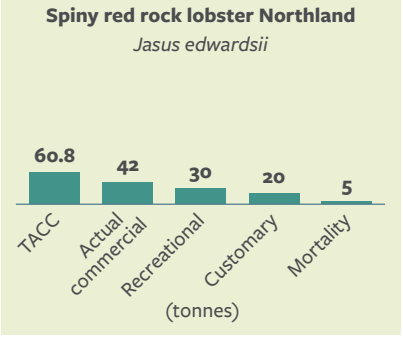
Target customary species are the same as the recreational species for this area which the exception of Toheroa which is still collected in small numbers by local hapu.

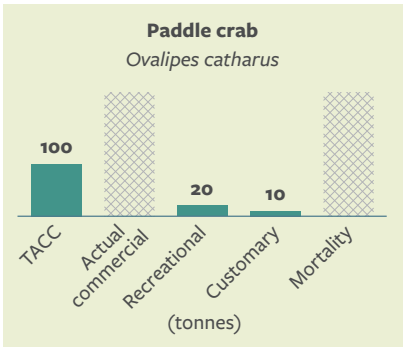


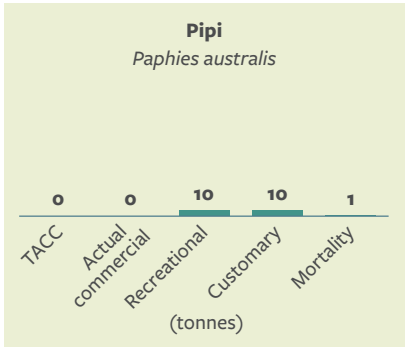


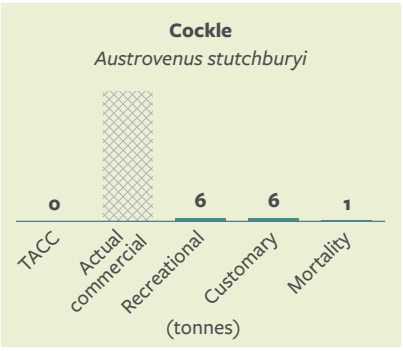


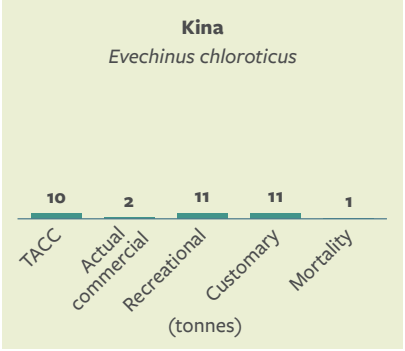


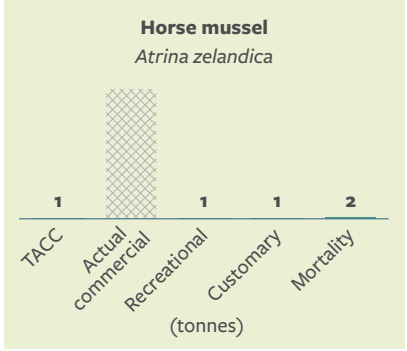


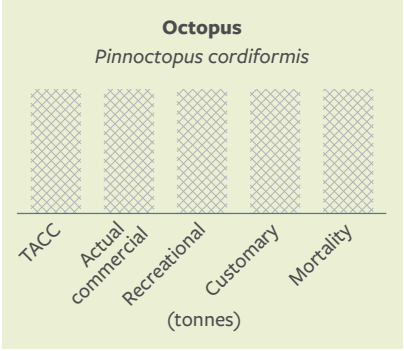












No available data

Data: NZ Fisheries InfoSite, Ministry for Primary Industries http://fs.fish.govt.nz/Page.aspx?pk=91
Note – annual data for Fisheries Management Area 9 for the year 2016

Figure 48: Annual Total Allowable Commercial Catch (limit) (TACC), actual commercial, recreational, customary and mortality catch for invertebrates in 2016 in tonnes. The bar graphs with a black box around them are commercial target fisheries and the ones that are blank are non-target species.

Illustration: Vivian Ward, University of Auckland – School of Biological Sciences.

8.5 Fisheries Impacts

8.5.1 Target and Non-target Commercial Fisheries

It is common for most commercial fisheries to catch some level of non-target or bycatch (Anderson, 2004). The fishing methods of the nine target fisheries in FM9 are summarised in Table 8. Target and non-target marketable species are kept for sale and species for where there is no or low market value for are discarded, often once dead (Anderson, 2004). Thus, even discarded non target species can have an impact on species abundance and have flow on population and ecosystem effects.

In New Zealand, incidental catch of iconic species such as the Māui dolphin, the common dolphin, endangered sharks, turtles and seabirds is a major impact of inshore and offshore fisheries. There is a commercial set net ban at the entrance to the Manukau Harbour and between 2 and 7 NM between Pariokariwa Point to Hawera to reduce the impacts of bycatch on these species.

Table 8: Commercial finfish species, fishing method, target status and the type of impact in FMA9.

Species	Method	Target	Common by-catch species/impact
Hapuku and bass	Longline or trawl	Yes	Seabirds, sharks, turtles
Flatfish	Bottom trawl or drag net	Yes	Demersal fish, shellfish and habitat destruction
School Shark	Longline, mixed trawl and set net	Yes	Seabirds, sharks, turtles, marine mammals
Trevally	Mixed trawl (with snapper)	Yes	Marine mammals
Gurnard	Longline	Yes	Seabirds, sharks, turtles
Grey Mullet	Set net	Yes	Marine mammals
Snapper	Bottom trawl and long line	Yes	Demersal fish, shellfish and habitat destruction. Seabirds, sharks, turtles
Kahawhai	Purse seine	Yes	Marine mammals and sharks
Rig	Set net and trawl	Yes	Marine mammals, demersal fish, shellfish and habitat destruction
Leatherjacket	Trawl	No	Marine mammals
Tarakihi	Trawl	Yes	Marine mammals

To watch videos on how these methods work in the ocean go to Monterey Bay Aquarium: Seafood Watch: http://www.seafoodwatch.org/ocean-issues/fishing-and-farming-methods

8.5.2 Food Web Effects

Fishing can impact several components on an ecosystem; through the removal of target and non-target species either directly or indirectly through food web effects (Reinaldo *et al*., 2015). In heavily fished ecosystems, major changes to the top predator biomass can have wider impacts on overall ecosystem structure (Reinaldo *et al*., 2015). In New Zealand, fisheries aim to operate within 30% to 40% of the total fish stock according to species and stock status. Collapsed fisheries may result in an ecosystem shift where other species may fill their space or "niche" in that food web.

Of concern on the west coast of Auckland are the current set net fishing operations. These pose a particular threat to the critically engaged Māui dolphin (to read more about the Māui dolphin, see section 7.1.2.

8.5.3 Habitat Destruction

Several methods of fishing can damage or destroy biogenic and benthic habitats including trawling, dredging, seine nets, and bottom long lines. Destructive fishing methods reduce the diversity of life on the seabed and removes important biogenic habitat for algae fish species such as snapper.

8.5.4 Shark Finning

In 2014, shark finning was banned in New Zealand. Shark species are split into three groups for fisheries management and these are listed below:

QMS Species

- Blue shark
- Elephant fish
- Ghost shark
- Mako shark
- Pale ghost shark

- Porbeagle shark[14]
- Rig
- School shark
- Spiny dogfish

Protected Species

- Basking shark
- Great white shark
- Oceanic whitetip shark
- Deepwater nurse shark
- Whale shark

CITES Listed Species[13]

- Porbeagle shark[14]
- Smooth shark
- Scalloped shark
- Great hammerhead shark

All other species that are not under the QMS where reporting is still necessary and best fishing practices apply. One exception to the "fins attached" rule is the blue shark where the regulations allow the fin to be removed on board during the processing of the fish.

8.6 Fisheries Management

The Ministry of Primary Industries (MPI) is the governing body that regulates and monitors fisheries in New Zealand. Currently MPI has programs in place to introduce regulations for electronic reporting, monitoring of commercial fishing activities, and review of Fisheries Management System (QMS). MPI has three main goals for the future;

1. Increasing the quality and quantity of fisheries data by use technology such as video to monitor commercial fishing.
2. Invest in technology to target certain species better and reduce by-catch.
3. Review the fisheries management system.

Specific management actions related to the Manukau Harbour includes the possible extension of set net and trawl boundaries further into the Manukau Harbour and extend further offshore on the west coast for the protection of the Māui dolphin (Currey *et al*., 2012).

Historically, MPI has captured recreational catch by boat ramp surveys and aerial surveys however the diffuse nature of the activity makes it difficult to accurately measure the impact in space and time. Digital surveys of recreational fisheries catches in the form of an online platform or application would be helpful to assess fishing pressure and hot spots of marine fauna in the harbour. App development should consider both the recreational value and ease of use as well as providing a sound data resource that may be integrated into management of fisheries stocks.

The following management objectives and actions have been identified for the WRLB to promote sustainable fishing in FMA9.

Objectives

1. Promote the sustainable management of fisheries in a way that enhances its food-producing and life-sustaining capacity, and also its contribution to people's well-being and recreational activities.
2. Support sustainable fisheries management and allocation.

Actions

1. Advocate for the extension of trawl and set net bans on the west coast to reduce impacts on areas of high marine mammal use.
2. Advocate for the extension of commercial and recreational set net bans to encompass the whole Manukau Harbour to protect the threatened Māui dolphin and other marine mammals.
3. Support and encourage public awareness around recreational fishing catch limits and methods including fish handling and release.
4. Support the development of socio-ecological system to manage recreational fisheries in a way that is scientific and statistically accurate and encourage use of online tools or apps to report recreational fish catch.
5. Support biogenic habitat restoration projects e.g. the enhancement of shellfish and seagrass beds which many target and non-target species rely on for habitat and refuge.
6. Develop, support and encourage community monitoring programmes to measure the status of shellfish beds.
7. Investigate potential to implement marine reserves or protected areas within the Manukau Harbour and/or within the western North Island.

13. Convention on International Trade in Endangered Species (CITES) is an agreement that manages the trade of animal and plant species.
14. Landings of the Porbeagle shark require a permit as it is now listed as a CITES protected species.

Part D

Recreation and Safety

9.0 Recreation and Safety

9.1 Recreational Water Quality (Safeswim)

Long term records of 12 beaches in the northern coast of the Manukau Harbour indicate that the region typically has poor recreational water quality. This means that bacterial contaminants are above indicator levels that are acceptable for high contact recreation e.g. swimming and water sports where there is a risk that the micro-organisms such as viruses, bacteria and protozoa can enter the body (MfE Microbiological Water Quality Guidelines-2003).

The Ministry for the Environment (MfE) have published guidelines for assessing and managing the public health risks of recreational waters: Microbial Water Quality Guidelines for Marine and Freshwater Recreational Areas (MfE, June 2003). These guidelines provide a grading for an individual beach using a framework that is a combination of:

- Qualitative catchment risk grading (generating a Sanitary Inspection Category or SIC, which measures the susceptibility of a water body to faecal contamination); and
- Historical microbiological results (generating a microbiological assessment category, or MAC, which provides a measurement of actual water quality at the beach over time using the 95th percentile of a minimum of 100 samples over 5 years).

An overall Suitability for Recreation Grade (SFRG) is then generated from these two components according to the matrix in Table 9 (marine site indicators, i.e. enterococci). This grade describes the general condition of a site at any given time, and provides the basis for communicating whether the water is suitable for recreational use, from a public health perspective. The risk of becoming sick from swimming at a beach increases as the beach grading shifts from Very Good to Very Poor.

For sites with the middle range of beach grades (Good, Fair and Poor) water quality varies according to conditions (e.g. high rainfall). Regular monitoring occurs throughout exposure periods (e.g. the summer bathing season) at sites that have sufficient use through the Auckland Council Safeswim monitoring programme. These monitoring results are processed and published online (www.safeswim.org.nz) based on comparison with the following guideline levels:

- Surveillance/Green Mode (<140 /100mL Enterococci) – continue regular weekly monitoring;
- Alert/Amber Mode (>140 /100mL Enterococci) – increase sampling frequency to daily, and investigate potential faecal sources;
- Action/Red Mode values, (>280 /100mL Enterococci) – for marine beaches erect signage warning the public that the site is unsuitable for recreation when exceeded by two consecutive samples.

The Auckland Council website should be referred to for the most current recreational water safety ratings.

The guidelines also allow for "modifying" a beach grade[15] if management or other interventions are proven effective in removing sources or discouraging recreational use, e.g., during predictable contamination events (such as high rainfall). The modified grade uses a revised SIC, and MAC that excludes predictable exceedances from the calculation. A grade of **Poor**, for example, could become modified to **Good** (but unsuitable for two days after heavy rainfall) after reassessment.

The Auckland Council Safeswim monitoring programme tests water quality at range of beaches in the region in order to notify the public whether they are acceptable for recreation. The issue is that water quality at beach (e.g. after high rainfall) can change by the time the results are processed and published online.

A water quality forecasting trial is being run by Auckland Council to predict the health of the beaches based on a model that incorporates the hydrodynamic factors of the Waitemata harbour with historical and current water quality information (www.aucklandcouncil.govt.nz/EN/environmentwaste/coastalmarine/Pages/waterqualityresults.aspx).

9.1.1 Manukau Harbour

There are standing long-term health warnings at Laingholm Beach and Wood Bay and contact recreation is not encouraged at these sites

Auckland Council is currently investigating water quality at Wood Bay, French Bay and Titirangi Beach along the Northern Manukau coastline with very poor long term bathing water quality (Table 9). All three beach catchments are serviced by a reticulated wastewater network and have known high faecal bacteria levels. Previous investigations have been carried out by the Land and Water Advisory

15. http://www.mfe.govt.nz/publications/international-environmental-agreements/microbiological-water-quality-guidelines-marine#notehxii

team in 2013 and 2015 with the aim to determine the levels of faecal indicator bacteria and the biological sources to this contamination.

9.1.2 West Coast

Karekare, Piha and Bethells (Te Henga) are iconic west coast beaches with excellent water quality (Noble, 2014). The adjacent lagoons at Piha. North Piha, and Bethells (Te Henga) are polluted by faecal contamination and are often unsafe to swim in with standing long-term health warnings (Noble, 2014).

In 2012, Auckland Council took over management of the private septic tank maintenance in an effort to improve freshwater quality, particularly in areas such as the coastal lagoons at Piha. Private septic tanks are held in a register, are cleaned and maintained in systematic way and managed on a cyclic basis.

9.2 Coastal Hazards

New Zealand's has an extensive coastline that is 15,000km long with 65% of the population within five kilometres of the coast (2006, Statistics NZ http://www.stats.govt.nz/browse_for_stats/population/Migration/internal-migration/are-nzs-living-closer-to-coast.aspx accessed on 20170230). Dynamic processes such as erosion, accretion from wind and waves are natural part of the coastal environment. Natural hazards arise from the interaction of these processes with coastal infrastructure and human use of the coast (Auckland Regional Plan: Coastal, 2013). Localised impacts are influenced by the following factors:

- Physical drivers such as wind, rain, swell and wave energy,
- Natural characteristics and geology of the coast,
- Human modification and coastal infrastructure,
- Climate change;
  - Sea level rise
  - Changes in rainfall patterns and intensity,
  - Increased frequency and intensity of storms.

There are three main impacts that coastal hazards have on low lying coastal communities: coastal erosion, coastal inundation and tsunami.

9.3 Introduced Species

Pacific oysters are an exotic species that are valued for aquaculture, but that have also spread through large parts

Table 9: Suitability for Recreation Grade Matrix for Marine Beaches[1] (MfE, 2003).

	Microbiological assessment category indicator counts (95th percentile)[2]			
Sanitary inspection category[3]	**A**	**B**	**C**	**D**
Very low	Very good	Very good	Follow up**	Follow up**
Low	Very good	Good	Fair	Follow up**
Moderate	Follow up*	Good	Fair	Poor
High	Follow up*	Follow up*	Poor	Very poor
Very high	Follow up*	Follow up*	Follow up*	Very poor

A: ≤ 40 enterococci per 100 mL
B: 41–200 enterococci per 100 mL
C: 201–500 enterococci per 100 mL
D: > 500 enterococci per 100 mL

1. Marine sites only, freshwater sites utilise E. coli and different values to establish MAC grades A-D.

2. Exceptional circumstances: that relate to known periods of higher risk for a graded beach, such as during a sewer rupture or blockage. Under such circumstances a grading would not apply until the episode has abated.

3. Indicates susceptibility to faecal influence.

** Indicates unexpected results requiring investigation (reassess SIC and MAC). If after reassessment the SFRG is still 'follow up', then assign a conservative grade (i.e. the first grade to the right of the 'follow up' in the same SIC row). This follows the precautionary principle applied in public health.*

*** Implies non-sewage sources of indicators, and this should be verified. If after verification the SFRG is still 'follow up', then assign a conservative grade (i.e. the first grade after 'follow up' in the same MAC column).*

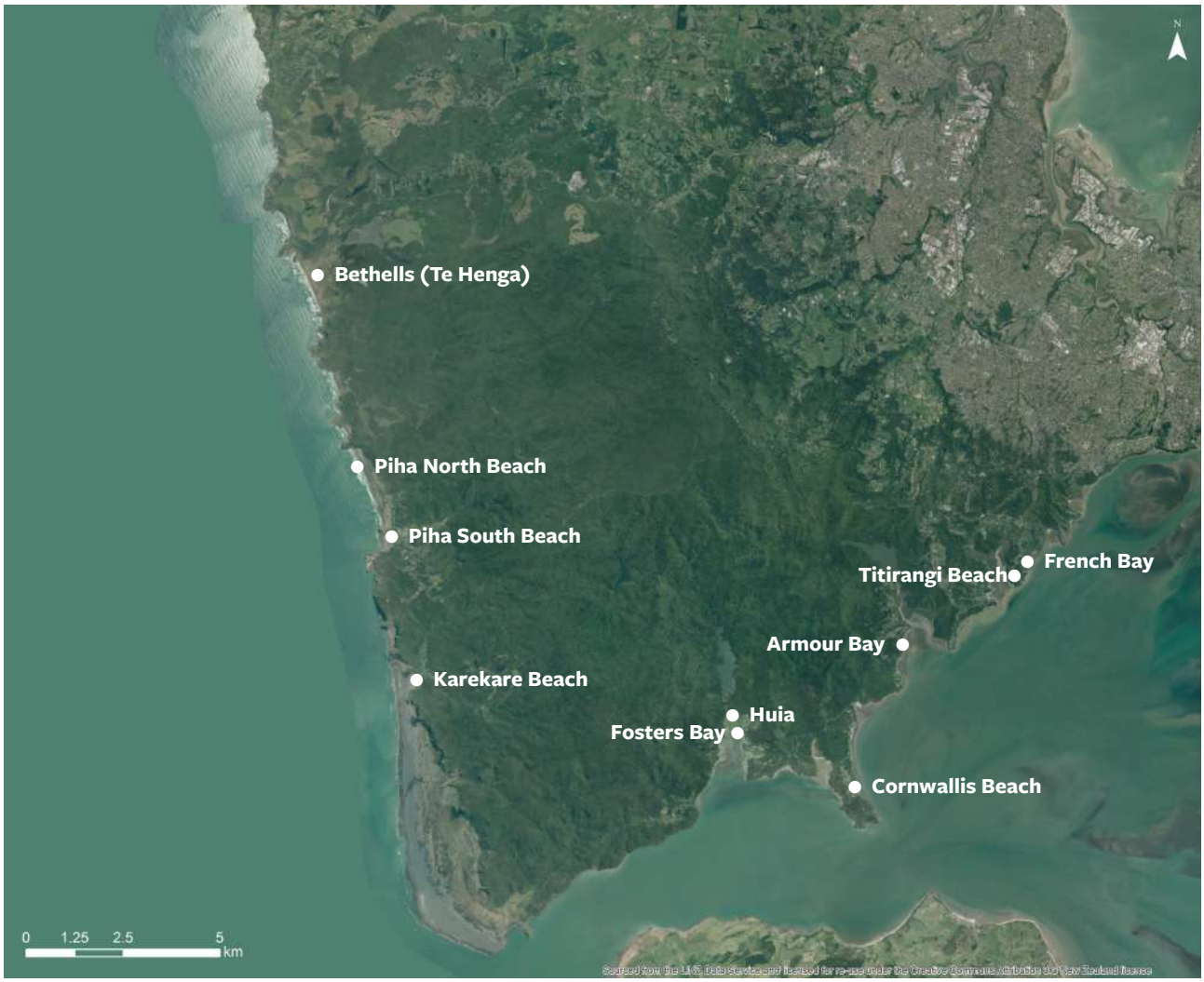


Figure 49: Safeswim monitored recreational beaches in the WRLB area.

of the coast resulting in the displacement of the native oyster and also causing significant adverse effects on recreational use and amenity values.

In some areas, including the Manukau Harbour, Pacific oysters have built up into reefs that limit the ability for people to safely use areas for boating, wind-surfing and other activities.

The accumulation of Pacific oysters and oyster shell along beaches also detracts from their recreational use and amenity value. Community groups around Auckland often undertake Pacific oyster shell removal projects to help restore beaches for recreational use.

There are a number of suspected marine pests including some algae, crabs, seastars, and sea squirts that have recently arrived or are global pests that MPI would like to keep out of New Zealand waters. Recreational equipment and facilities can host or transport these species or they may be observed during other activities such as diving and all are encouraged to be aware of any unusual species. To report suspected marine pests or diseases call MPI on 0800 80 99 66. For more information on identification of marine pests see the New Zealand Marine Pest ID Guide https://www.mpi.govt.nz/document-vault/10478.

9.4 Regional Park Activities

There are a number of recreational activities that can be enjoyed in the Waitākere Ranges Regional Park (Figure 50). These include; picnics, sightseeing, swimming, walking (see section 11.3), fishing, surfing, bird watching, camping, farm animals, boating and abseiling (pages 94–95 and 96–97).

9.4.1 Walking Tracks

The coastal area is serviced by several walking tracks that enable people to move between beaches including sections of the famed Hillary Trail (pages 94–95 and 96–97). The majority of other walking tracks in the area are concentrated at Huia in the Waitākere Regional Park. The Titirangi and French Bay Loop and Zig Zag track are in Titirangi area. Huia has 25 walking tracks with seven closed or partially closed until further notice (pages 96–97).

These tracks vary in condition and level of difficulty and walking times provided in track notes are approximate. Always check track routes and requirements before leaving and let someone know where you are going and expect to return. Large parts of the ranges have no cell phone coverage and tracks are not regularly patrolled.

Extreme care should be taken when accessing areas at low tide to ensure you have a safe window to travel, particularly on the west coast.

9.4.2 Boating

The Manukau Harbour is utilised extensively for recreational boating activities. There are 14 boat ramps scattered along the northern Manukau Harbour coastline providing access to this area. The locations of these are shown in the graphic on pages 96–97.

9.4.3 Dog walking

Dogs are allowed in some parks in the WRLB area but there are some restrictions for the protection of threatened native species, vulnerable ecosystems and farm animals. The type of dog activities are split up into (pages 94–95 and 96–97);

- Dog walking prohibited (dogs are not allowed in these areas)
- Dog walking restricted (to certain times of the day, area and season and generally restricted on lead areas).
- Dog friendly (under control off lead areas[16]).

Figure 50: Public recreational facilities at Piha Domain. Photo: Morphum Environmental.

9.4.4 Surf Beaches

The Bethells (Te Henga), Anawhata, Piha and Karekare beaches known in the Auckland region for their surf breaks (Figure 57). The west coast beaches are listed below with the appropriate surf lifesaving club that patrols the area (pages 94–95):

- **Bethells (Te Henga)**
  Patrolled by Bethells Beach Surf Life Saving Club
- **North Piha Beach**
  Patrolled by United North Piha Surf Life Saving Club
- **South of Lion Rock**
  Patrolled by Piha Surf Life Saving Club
- **Karekare Beach**
  Patrolled by Karekare Surf Life Saving Club

This information has been taken from http://www.surflifesaving.org.nz (accessed on 02/02/2017).

9.5 Emergency Services

There are seven fire stations within the Waitākere Local Board area. The west coast beaches are serviced by the Bethells Valley rural fire station, the Karekare volunteer fire station and the New Zealand Fire Service (NZFS) Piha (pages 94–95). The Manukau Harbour beaches are serviced by the NZFS Huia, Laingholm, Titirangi and Waiatarua stations (pages 96–97).

The closest ambulance station is in New Lynn and the closest hospital is Waitākere Hospital. The Westpac rescue helicopter also aids in emergency services for medical evacuation, casualty evacuation e.g. boating and aids the fire, police services for other types of rescue and aid (https://rescuehelicopter.org.nz/what-we-do accessed on 15/03/2017).

16. The Dog Control Act (1996) requires owners to keep their dogs under control and owners need to ensure that their dogs do not; cause a nuisance, cause damage to property and/or injure, endanger or cause distress to any person, stock, poultry or domestic animal or wildlife.

Waitākere recreational activities and safety services

Tasman Sea

Dog walking:

- Dog friendly
- Restricted
- Prohibited

Wedding or civil union:

- Booking required
- Permit required

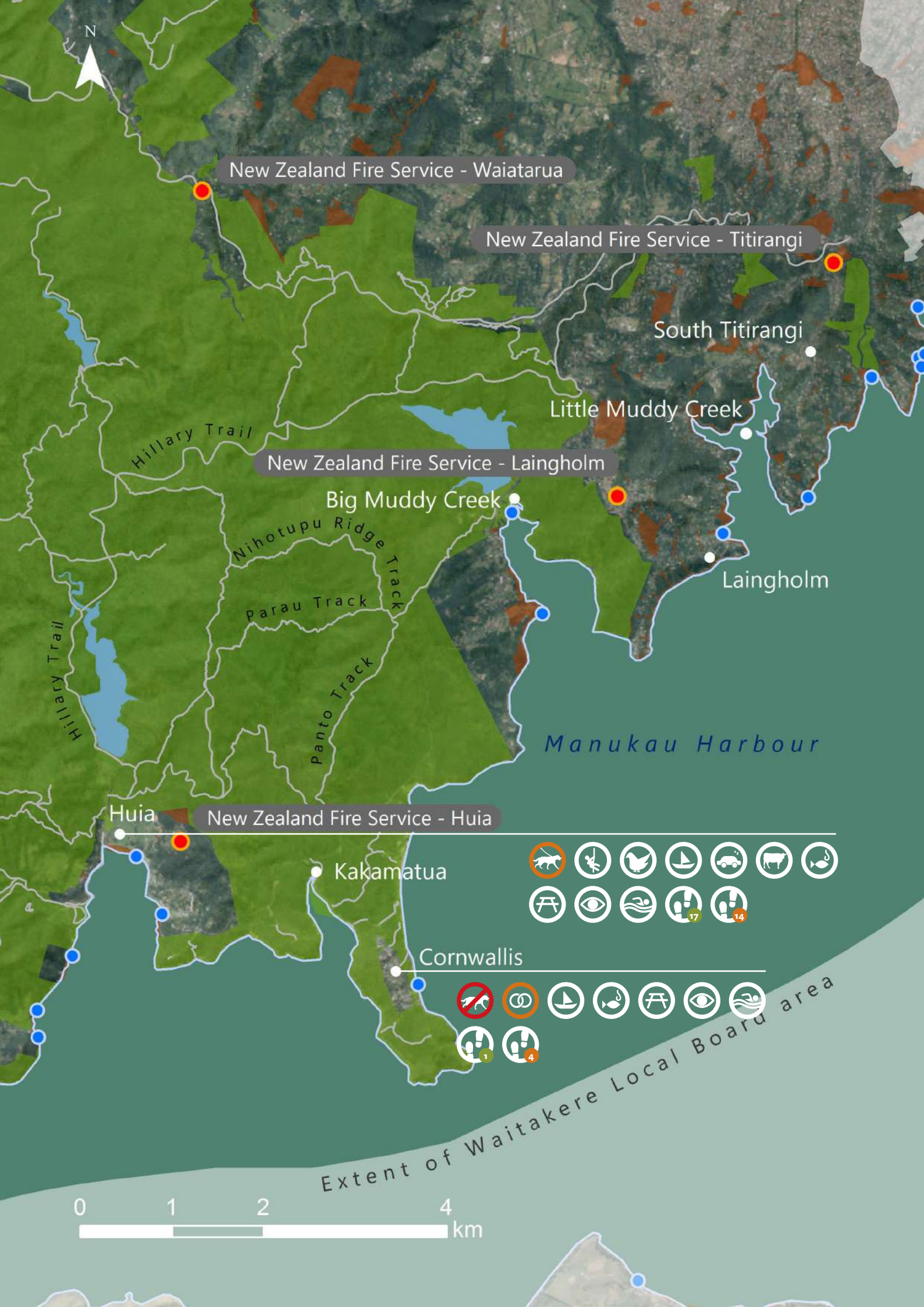
Other activities:

- Abseiling
- Bird-watching
- Boating
- Camping – back country
- Camping – vehicles
- Farm animals
- Fishing
- Picnics
- Sightseeing
- Surfing
- Swimming
- Volunteering
- Walks < 1 hour
- Walks > 1 hour

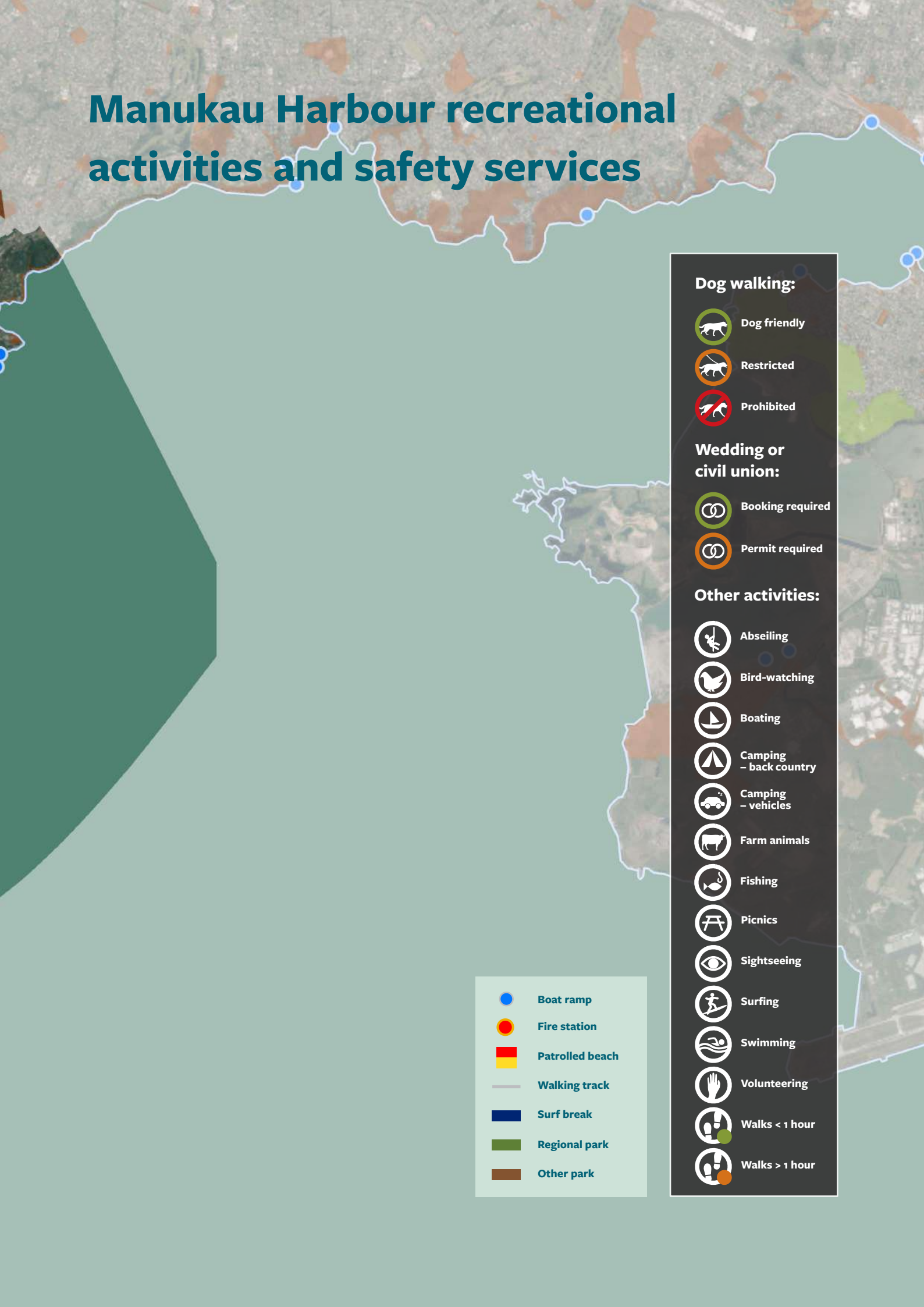
- Boat ramp
- Fire station
- Patrolled beach
- Walking track
- Surf break
- Regional park
- Other park

0 1 2 4 km


Bethells Valley Rural Fire Station
N
Whatitiri Track
Te Henga
(Bethells)
Patrolled by
Bethells Beach
SLSC
Wainamu Bush Track
Hillary Trail
Ridge Road Track
Cutty Grass Track
Anawhata
Patrolled by United
North Piha SLSC
Maungaroa Ridge Track
New Zealand Fire Service - Piha
Patrolled by Piha SLSC
Piha
Huia Dam Track
Huia Ridge Track
Karekare Voluntary Rural Fire Force
Karekare
Patrolled by Karekare SLSC
Odlin Timber Track
Fletcher Track
Walker Ridge Track
Gibbons Track
Kura Track
Whatipu


N
New Zealand Fire Service - Waiatarua
New Zealand Fire Service - Titirangi
South Titirangi
Little Muddy Creek
Hillary Trail
New Zealand Fire Service - Laingholm
Big Muddy Creek
Nihotupu Ridge Track
Parau Track
Laingholm
Hillary Trail
Panto Track
Manukau Harbour
Huia
New Zealand Fire Service - Huia
Kakamatua
Cornwallis
Extent of Waitakere Local Board area
0
1
2
4
km

Manukau Harbour recreational activities and safety services



9.6 Public Transport

The northern Manukau Harbour beaches of Blockhouse Bay, Green Bay, Oatoru Bay and Wood Bay can be accessed via train to New Lynn then by bus to the Titirangi shops. The northern Manukau Harbour beaches of Laingholm, Paturoa Bay and French Bay can be accessed via train and bus via Blockhouse Bay and Huia Road.

There are no Auckland Transport serviced public transport networks to the West coast beaches of Whatipu, Piha, Anawhata, Karekare and Bethells (Te Henga). Auckland Transport is currently reviewing transport options and demand for services associated with west coast communities associated with the revised West Auckland bus network.

Check your Auckland Transport Journey Planner for the best options for travel.

Figure 51: Safety signage, Karekare.
Photo: Morphum Environmental.

9.7 Drownings and Other Water Related Incidents

There were 12 preventable drownings (out of 81 in NZ) reported by www.drownbase.org.nz for the Auckland Region in 2016 (Table 14, Water Safety NZ, Drowning Toll Breakdown, 2016). Immersion incidents (where the person suffers because of unintentional submersion underwater) were the highest cause of drowning in 2016 (Drownbase, 2016 and ACC, 2017).

Table 10: Total preventable drownings for the Auckland region in 2016.

Activity	Total preventable drownings
Immersion Incident	5
Land Based Fishing	1
Underwater	2
Swimming	3
Water Sport/Recreation	1
Total	**12**

Information taken from http://www.drownbase.org.nz/assets/Regional-and-National-Fact-Sheets/2016/2016-Auckland-Statistics.pdf

Most surf life clubs recommend that swimmers follow the below rules at the west coast beaches (e.g., Figure 51):

- Always swim between the flags
- Read the safety signs
- Talk to the lifeguards for advice
- Beware and look out of rips
- Don't swim after consuming alcohol
- Known your own personal limits.

9.9 Recreational and Safety Management

Several management issues affecting recreational quality and safety are related to the quality of the water discharging from surrounding land use. There are existing management programmes that aim to address

The following recreational and safety objectives and actions are below:

Objectives

1. Improve recreational water quality in the west coast lagoons.
2. Improve recreational water quality at Manukau Harbour northern beaches.
3. Maintain the existing diversity and quality of recreational sites, opportunities and experiences.
4. Encourage the use of public transport to reduce carbon emissions.
5. Reduce boating and submersion accidents

Actions

1. Support projects aimed at improving water quality and reducing contaminant inputs to the west coast lagoons such as 'Love Your Lagoons' (Ecomatters and Auckland Council).
2. Investigate sources of wastewater contamination including; cross connections, illegal wastewater connections and non-compliant onsite treatment systems.
3. Investigate the reintroduction of advisory information for new residents on weed management, building design, septic tanks and sustainable environmental practice.
4. Local plan for managing invasive species such as pacific oyster which cause amenity and nuisance issues to the local community.
5. Advocate for improved public transport links to the popular west coast beaches.
6. Improve safety education targeted at surf beaches, boating on the Manukau and fishing on rocks.

Figure 52: Surfers at South Piha.

Part E

Gap Analysis, Management and Stakeholders

In this section

Table 10 summarises current gaps in understanding and information that were identified in parts A, B and C of this report. The Management Objectives and Actions section proposes directions and priorities for the WRLB coastal and marine environment which are summarised in Table 11. The stakeholder interests section provides a (not exhaustive) summary of what people are doing and what they are passionate about in relation to the coastal and marine environment (Table 12). The WRLB encourages feedback and stakeholder communication throughout the implementation.

Gap Analysis - what isn't currently known?

Current gaps in information and understanding of the coastal and marine environment in the WRLB area have been identified through the development of this report. The following information has been summarised from the research undertaken for Part A: Manukau Harbour, Part B: West Coast and Part C: Finfish and Shellfish Fisheries.

Management Actions – what would we like to see happen?

This section is intended to inform the WRLB in proposing directions, priorities and projects to protect and enhance the unique marine and coastal areas within the board's jurisdiction. To achieve this, 41 possible management actions consolidated from each of the eight chapters are summarised into overarching goals in Table 11. Ideally, these objectives will direct the focus of the board's coastal and marine programs in the future, and provide them with the information for informed decision making as well as advocating for big picture objectives that may be outside of a local board's jurisdiction.

The WRLB is not obligated to undertake any works identified as enhancement or management options in this report, and no preliminary prioritisation of projects has been undertaken as part of this methodology. Neither the feasibility, cost nor benefit of these actions has been assessed. The next step in this process will be for the WRLB to consider the recommendations from this report within the context of the WRLB obligations, budget and constraints.

Stakeholder Interests – what are people doing, and what are they interested in?

Potential stakeholder interest groups and projects are organised into groups based on the location of interest (Table 12, Table 13, Table 14, Table 15 and Table 16). These tables replace table 16 in the report v1.1 delivered in April 2017. However, stakeholder engagement was not in scope for this stage of the project, so it is possible that this is not a complete list. The WRLB encourages feedback and is committed to stakeholder communication through the implementation process of this project.

The stakeholders identified in this section are intended to support the WRLB in identifying what current projects are being undertaken in the coastal and marine WRLB area. From this stakeholder section, project gaps can be identified to inform future management projects in certain areas; e.g., there are dune restoration (Coast Care) groups in Piha and Te Henga- Bethells), but not in Karekare.

10.0 Gap Analysis

10.1 Gap Analysis

Many of the information gaps identified in this report are aimed at environmental monitoring and improving understanding of current baseline information. Long term monitoring programmes provide essential baseline information to track changes associated with human impacts, such as the effects of invasive species, climate change and sea level rise. These programmes are important given population growth predictions for Auckland, increasing threats and demands on ecosystems and resources and the effects of climate change on these ecosystems.

Monitoring of migratory and wide ranging species such as seabirds, marine mammals and sharks is challenging and expensive to undertake. However, it is critical to understand where these species feed and breed to realise the magnitude and scale of human impacts on these populations. Advocacy for these types of projects can be undertaken by the WRLB to encourage data sharing and a collaborative approach to the management of the marine and coastal environment.

Establishing the locations of habitats (e.g., seagrass beds or seabird breeding sites) aids the identification of potential risks to the population and the development of management interventions for their recovery and/or enhancement. Organisations such as DoC, MPI, councils and crown research institutions (NIWA and Cawthron) have biodiversity monitoring programmes; however, the observations of citizen scientists can play an important role. As a start, species that have terrestrial breeding sites; e.g., seals and seabirds, are more accessible to researchers and the public, but gathering other types of information about things such as feeding patterns at sea is more challenging due to the sporadic and transient nature of certain behaviours. Citizen science data and community programmes are commonly undertaken where people are likely to be, so it is important that restoration projects do not neglect the more secluded areas. Tangata whenua, residents and community groups will be important potential partners in pursing this.

Prioritisation of these actions has not been carried out and that details for the specifics of these environmental benefits are discussed in the earlier sections of this report. Recreational, safety or amenity benefits are measured against the objective to maintain and improve the quality and safety of recreational locations, opportunities and experiences. All management recommendations associated with improving water quality, particularly recreational water quality standards also improve recreational health and safety.

Table 10: Current gaps in coastal and marine research and understanding for the WRLB area.

Section of Report	Description of Information Gap
Part A: Manukau Harbour	
1.0 Coastal	
1.1. Streams and Catchments Detailed assessment of bank and asset erosion contributing to sedimentation in the Huia and Kakamatua estuaries.	The effect that Nihotupu and Huia reservoirs have on sediment grain size, and the effect that cleaning procedures (e.g., flushing of sediment basins) have on the receiving environment.
1.2 Seabirds Research and collation of existing information on specific locations of nests, breeding sites and foraging areas for threatened seabirds, particularly within the Manukau Harbour.	Consolidation of seabird data. Currently seabird data is recorded in a variety of ways and stored in multiple locations; e.g., multiple citizen science platforms, local resident groups, universities and several crown research organisations.

Section of Report		Description of Information Gap
2.0 Shore and Beach		
2.1	**Habitat Types**	
2.1.1	**Intertidal Habitats**	Conversion of baseline habitat surveys (1998–2002) into a digital format, so they are accessible to decision makers for management.
2.1.2	**Wetlands and Estuaries**	On the ground confirmation of the habitat data from Singers et al., (2016). Confirmation that the habitats mapped in this report are accurate at a local scale.
		Consolidation of wading and shore birds data. Currently seabird data is recorded in a variety of ways and stored in multiple locations; e.g., multiple citizen science platforms, local resident groups, universities and several crown research organisations.
2.2	**Wading and Shore Birds**	Monitoring for presence, absence and abundance of wading and shore birds in the intertidal area.
2.3	**Environmental Monitoring**	See 3.2 below.
3.0 Nearshore		
3.1	**Habitat Types**	Monitoring of biogenic habitats (living habitats with high diversity) in the subtidal (below low tide) region. Biogenic habitats are the foundation of ecosystems. They have a high diversity, so are more resilient to change and collapse; e.g., seagrass beds provide a nursery habitat for snapper fisheries. The current DoC habitat mapping is at MHWS and above.
3.2	**Water Quality**	How water quality is affected by wastewater networks, stormwater networks and point source pollution. The current collaborative hydrodynamic model should help to answer some of these questions.
3.3	**Marine Mammals**	Development of monitoring programmes that takes into account the transient and sporadic movements of marine mammals in the Manukau Harbour. Public sightings of marine mammals from DoC are commonly skewed to where people are likely to be. Maintained database on where seals are found and the quantity and/or seasonal nature of these occurrences. This exists in Naturewatch, and possibly other citizen science platforms, but it is not a complete description of the habitat range of this species.
3.4	**Sharks, Skates and Rays**	Monitoring of abundance, presence and absence of sharks, skates and rays in the Manukau Harbour. Advocate for the review of the accuracy of the data from NABIS; e.g., data on rough skates in the Manukau Harbour may be inaccurate. Updates to classify the NZ threat status for the species in this group (DoC is currently updating the threat status of the sharks, skates and ray group).
3.5	**Bony Fishes**	Classification of threat status for bony fishes. The data shown in this section is from NABIS; its accuracy is unknown. Confirmation that these species are resident or transitory (moving in and out) in the Manukau Harbour. Are these large data sets accurate at a local scale? Most are in a fishery so the abundance and presence is important for the resilience of these populations.

Section of Report		Description of Information Gap
Part B: West Coast		
4.0 Coastal		
4.1	**Streams and Catchments**	No known baseline water quality and habitat surveys (such as stream assessments) have been undertaken for the Waitākere catchment; e.g., streams in Whatipu, Anawhata, Karekare and Te Henga- Bethells. How does sediment from the Waitākere Reservoir effect the receiving coastal environment? I.e., what is the impact on sediment grain size, and what is the effect that cleaning procedures (e.g., flushing of sediment basins) have on the receiving environment?
4.1	**Habitats**	
4.2.2	**Lakes and Lagoons**	See Recreational Water Quality section.
4.2.3	**Wetlands**	West coast wetland monitoring report to capture and record the effectiveness of current enhancement projects, so that the methods can be documented and the learnings applied in other locations in NZ.
4.2.4	**Dunes**	Local management plans for the dune and beach systems at Karekare and Whatipu. Currently such plans only exist for Piha and Te Henga- Bethells.
4.3	**Seabirds**	Monitoring programmes for threatened seabirds such as sooty shearwater (declining), flesh-footed shearwater (nationally vulnerable) and white fronted tern (nationally critical). Currently there are monitoring programmes for two threatened species on the west coast: the grey-faced petrel (not threatened) and the little penguin (declining), but not for other species.
		Information on specific locations of nests, breeding sites, number of fledglings, breeding pairs and foraging areas for threatened seabirds.
		Diversification of bird management programmes. While predator control (trapping and poisoning of feral cats, dogs and rats) is highly important, the enhancement of breeding; e.g., sound attraction and breeding boxes, is equally important to the success of species recovery (Sawyer and Fogle, 2010). Advocacy for marine plastics and reduction in by-catch in fisheries are equally important for seabird management and the population recovery of threatened species (Friesen, Beggs and Gaskett, 2016).
5.0 Shore and Beach		
5.1	**Coastal Processes**	Understand and report on the drivers of sediment transport, and improve understanding of these processes on Auckland's west coast. A draft Coastal Management Strategy for the Auckland Region is underway to inform future management of coastal areas including the effects of sea level rise and extreme events (e.g., tsunami) on coastal erosion (Auckland Council). As part of a consortium led by the University of Waikato, eCoast is undertaking research that will provide baseline data on how surf breaks work. One of the selected sites in this study is Piha.
5.2	**Habitat Types**	
5.2.1	**Exposed Beach**	Higher resolution aerial photography for the WRLB area and conversion of baseline habitat surveys (Hayward and Morley (2004), monitoring from 1998–2002) into a digital format.
	Environmental Monitoring	Improvements to the environmental monitoring data for the west coast beaches. Conversion of known data from the 2016 summary sheet into a marine report card.
6.0 Nearshore		
6.1	**Marine Mammals**	Monitoring of seal presence on the west coast of Auckland.
6.2	**Sharks, Skates and Rays**	Updates to classify the NZ threat status for the species in this group (DoC is currently updating the threat status of the sharks, skates and ray group).
6.3	**Habitat Types**	Protection of unique species; e.g., bull kelp, in the form of a marine reserve or marine protected area.

Section of Report		Description of Information Gap
7.0 Offshore		
7.1	**Physical and Ecological Characteristics**	
7.2	**Benthic Species**	Advocate for mapping of the location of benthic species in the offshore environment.
7.3	**Pelagic and Migratory Species**	Advocate for a review of the accuracy of the data from NABIS. Monitoring and mapping of migration pathways of birds, schools of fish, marine mammals and large sharks to help inform management and protection of threatened or data deficient species.
7.4	**Petroleum**	Information and analysis of adequacy of a regional response capability to a marine pollution event.
7.5	**Sand Mining**	Information on the impact of sand mining carried out in the lower west north island on coastal and chemical processes in the wider west coast region. Neutral public information and reporting regarding the impacts of seabed mining.
Part C Finfish and Shellfish		
8.1 Current Status of Habitats and Resources		
8.2	**Finfish Fisheries**	Current summary information on fisheries on a stock basis is out of date (the majority of plenary reports are almost 10 years old).
	Commercial Fisheries	Improvements to commercial catch reporting and accuracy of stock assessment reporting. MPI is looking to introduce electronic reporting in 2017. Currently there is a lack of data on sources of mortality, illegal take, recreational take and customary take. Data is limited in the offshore areas. Commercial fishing effort is the estimated total number of boats fishing in an area summed over the year. This data is publicly available in NABIS per statistical area, but not per stock. Robust information for mortality assessment per stock. There is no current management tool for assessing this.
		Publicly available information on the location and extent of shellfish beds within the WRLB area at a finer spatial resolution that the entire FMA 9 area.
	Recreational Fisheries	No current system for capturing recreational fishers' catch rates. Recreational harvest ranges from the plenary assessments are old (1991). There was a more recent survey carried out in 2001, but this data is not publicly available, and it is difficult to use these reports in the plenary assessment style to infer stock status. Some species lack recreational catch bag limits for certain species; e.g., Hapuku, Bass, Parore and Gurnard. Monitoring of the closed shellfish beds (rahui) from Whatipu to Muriwai. Has this closure been successful to reinstate shellfish populations in this area?
	Customary	Little information on how customary fish catches are allocated and what traditional methods are used per species. Could be a useful topic for hui with iwi in the area. Mātauranga (traditional knowledge) would provide insight to conservation and restoration efforts in this area.
Part D Recreational and Safety		

11.0 Management Objectives, Actions and Benefits

11.1 Summary of Management Objectives, Actions and Benefits

Some of the greatest threats to the diversity and resilience of marine and coastal habitats are global issues including greenhouse gas emissions and associated climate change, ocean acidification and sea level rise. Several of the identified management actions relate to how the local board can advocate for addressing local scale carbon emissions that contribute to these global issues.

	ENVIRONMENTAL BENEFITS	
Management Objectives and Actions	**Reduce chemical contaminants**	**Improve water quality and clarity**
1. Water quality – catchments to harbour: To maintain and improve water quality and clarity in the streams, lagoons, estuaries, harbour, and coastal environment. a. Encourage and implement projects aimed at improving water quality and reducing contaminant inputs to waterways, lagoons, and into the stormwater network.. b. Support water sensitive projects that educate the public to promote sustainable water use, natural water infiltration, and natural flow regimes in catchments. c. Enhance degraded watercourses in the catchments including riparian vegetation enhancement, and remediation of existing erosion issues. d. Support campaigns and community efforts to reduce plastic pollution and marine debris. e. Investigate sources of wastewater contamination including; cross connections, illegal wastewater connections and non-compliant onsite treatment systems.	●	●
2. To enhance habitats to improve native species abundance and diversity and preserve the natural character of the coastal environment and protect natural features and landscape values. a. Support current and future pest plant management strategy for coastal areas. b. Support an integrated pest plant and animal control programme to maintain viable habitats for native flora and fauna. c. Support wetland management plans and promote restoration, monitoring and assessment of coastal wetlands in the Waitākere Ranges Local Board area. d. Support MPI surveillance and public reporting programmes for introduced pests and diseases. e. Support habitat naturalisation programmes in the terrestrial, coastal and marine environment. f. Encourage projects which improve habitat quality and quantity. g. Support projects that improve species diversity and abundance such as fish passage remediation and biogenic habitat enhancement.	●	●
3. Natural coastal processes: To maintain or enhance natural biological and physical coastal processes in the shore and beach environment, recognising their dynamic, complex and interdependent nature. a. Encourage education around dune planting and support signage to educate the public on current projects. b. Support objectives of the Auckland Council Regional Plan for Coastal to inform beach management which incorporates the dynamic fluctuations in sediment supply and beach profiles. c. Implement weed control initiatives including facilitation of local weed-free property initiatives for high priority sites including Whatipu Scientific Reserve, Lake Wainamu and Te Henga wetland, and medium priority sites such as Big Muddy Creek.		

Key pressures affecting the marine and coastal habitats within the WRLB area include:

- urban development and discharge of contaminants;
- fishing pressure and methods;
- habitat destruction;
- wastewater pollution; rubbish, plastics and marine debris; and
- invasive species

In addition, there are potential risks to these habitats that are associated with petroleum and sand exploration and mining.

While improvements have been made to local and regional management approaches, 90% of our native seabirds and more than a quarter of our native marine mammals are threatened with or at risk of extinction. The rapid expansion of urban Auckland has resulted in coastal marine habitats and ecosystems becoming degraded. Chemical contaminants, high levels of nutrients and discharged sediments from waterways will continue to result in negative impacts. Even with the implementation of best practice management, it is unknown how reversible these ecosystem level changes may be.

The purpose of this section is to outline management objectives and actions that will direct the focus of the board's coastal and marine programmes in the future, provide them with the information for informed decision making and advocate for "big picture" objectives that may be outside of a local board's jurisdiction. Prioritisation of the Objectives and Actions in table below have not been carried out, and the specifics of these environmental benefits are discussed in earlier sections of this report.

ENVIRONMENTAL BENEFITS					
Decrease the frequency of algal blooms	**Reduce rubbish, plastics and oil based pollution**	**Reduce invasive species**	**Improve habitat diversity and abundance**	**Improve species diversity and abundance**	**Recreational and safety benefits**
●	●		●	●	●
●		●	●	●	●
		●	●	●	●

Management Objectives and Actions	ENVIRONMENTAL BENEFITS	
	Reduce chemical contaminants	Improve water quality and clarity
4. Sustainable fisheries: To promote the sustainable management of fisheries in a way that enhances their food-producing capacity and ecology while also their contribution to people's wellbeing and recreational activities. a. Support and encourage public awareness around recreational fishing catch limits and methods including fish handling and release. b. Support biogenic habitat restoration projects e.g. the enhancement of shellfish and seagrass beds. c. Develop, support and encourage community monitoring programmes to measure the status of shellfish beds within FMA9. d. Advocate for the introduction of regulations for electronic reporting, monitoring of commercial fishing activities and review of Fisheries Management System Review (QMS). e. Support the development of socio-ecological system to manage recreational fisheries in a way that is scientific and statistically accurate and encourage use of online tools or apps to report recreational fish catch. f. Support and encourage mangrove, seagrass, and shellfish monitoring programmes with particular focus on those below MHWS. g. Investigate potential to implement marine reserves or protected areas within Manukau Harbour and/or within the western North Island.		●
5. Marine mammals: To advocate for the protection of the Māui dolphin and other marine mammals from human induced pressures. a. Advocate for the extension of trawl and set net bans on the west coast to reduce impacts on areas of high marine mammal use. b. Advocate for the extension of commercial and recreational set net bans to encompass the whole Manukau Harbour to protect the threatened Māui dolphin and other marine mammals. c. Support the initiatives of Universities, Crown Research Organisations (e.g. NIWA, Cawthron Institute), DoC, volunteers and community groups for the monitoring of marine mammals, large migratory fish e.g. kingfish, and rays and sharks. d. Support community efforts to reduce plastic pollution and marine debris.		
6. Offshore: To preserve the natural character of the offshore environment and protect natural features and values. a. To continue to advocate for the protection of the west coast of Auckland from potential impacts of mining and oil exploration. b. That the WRLB requests Auckland Council to ensure adequacy of regional response capability in relation to the west coast and the northern Manukau Harbour in the event of a tier two or tier three marine pollution event in accordance with Auckland Council Pollution Response strategy and the NZ Marine Oil Spill Response Strategy 2015-2019. c. To advocate for and investigate potential to implement marine reserves within the western North Island.	●	●
7. Recreational value and safety: To maintain and improve the quality and safety of recreational locations, opportunities and experiences. a. Develop localised management strategies that allow for the management of flooding, increased frequency of storms and other predicted climate change effects. b. Local plan for managing invasive species such as pacific oyster which cause amenity and nuisance issues to the local community. c. Advocate to Auckland Transport to improve public transport links to the popular west coast beaches. d. Improve safety education targeted at surf beaches, boating on the Manukau and fishing on rocks.		
8. Knowledge and research: To be well informed and to incorporate new research into adaptive management actions for the marine environment. a. To review the outcomes of current research programmes including Watercare's hydrodynamic modelling, NIWA budget and sources of sediment to west coast beaches, Auckland Council seabird monitoring. b. Support the initiatives of Universities, Crown Research Organisations (e.g. NIWA, Cawthron Institute), DoC, volunteers and community groups for the monitoring of marine mammals, large migratory fish e.g. kingfish, and rays and sharks. c. Develop a research strategy to address identified knowledge gaps including habitat mapping and potential implementation of marine protected areas.		

ENVIRONMENTAL BENEFITS					
Decrease the frequency of algal blooms	Reduce rubbish, plastics and oil based pollution	Reduce invasive species	Improve habitat diversity and abundance	Improve species diversity and abundance	Recreational and safety benefits
	●		●	●	●
	●		●	●	●
	●				●
					●
			●	●	●

12.0 Stakeholder Involvement

The purpose of the stakeholder interest table is to start the conversation and acknowledge the groups who are currently undertaking projects in the coastal and marine environment in the WRLB area (Table 12). Stakeholder interest in environmental projects in the WRLB area has been organised into groups in Table 12 based on known location(s) of interest and known coastal and marine projects listed.

An initial assessment of stakeholder interest gaps was undertaken in Table 12; however, no stakeholder engagement was undertaken under the scope of this report, so it may not be an exhaustive list. The WRLB encourages feedback and is committed to stakeholder communication through the implementation process of this project.

Local interest groups for water safety, environmentally interested schools, fishing groups and other residents and rate payers societies have been listed in Table 13, Table 14, Table 15 and Table 16 respectively.

Please note that this list was compiled in collaboration with Auckland Council and may not be an exhaustive list of all the stakeholder projects in the WRLB area.

Table 12: Stakeholder groups, known projects and interests in the WRLB area.

Location of Interest	Group Name	Interest Area/Project Name if relevant	Known Projects in the WRLB area
MANUKAU			
Cornwallis	Cornwallis Petrel-Heads	Grey petrel conservation.	Bait and trapping for predators to protect nesting burrows.
Manukau Harbour	Friends of Manukau Harbour	Educational Facebook group.	Information about projects and events for the Manukau Harbour; e.g., Seaweek, water quality and Māui dolphin.
Manukau Harbour	Manukau Harbour Forum	Advocacy for the restoration of Manukau Harbour.	Manukau Harbour Forum runs the Manukau Harbour Symposium to facilitate conversations about the restoration of the harbour and its environs.
Manukau Harbour Beaches	Sustainable Coastlines	Beach clean ups and anti-plastic pollution advocacy Love your Coast Programme.	Cornwallis annual beach clean-up during Seaweek
Manukau Harbour Beaches	MarineMeters[2]	Citizen science and education.	Davis Bay Intertidal Survey (2014).
	Friends of Whatipū	Swamp and coastal sand dunes.	Bird roosting protection and signage – NZ dotterel, variable oystercatchers and grey faced petrel. Beach clean ups.
WEST COAST			
Piha	Piha CoastCare	Dunes	Ecological Restoration Plan. Dune planting plan. Weed removal. Spinifex and pingao seed collection. Walks and workshops for wetland education. Community and council engagement. Signage to protect sand dunes.

Location of Interest	Group Name	Interest Area/Project Name if relevant	Known Projects in the WRLB area
WEST COAST (CONT.)			
Te Henga (Bethells Beach)	Bethells Beach Care	Coastcare: dune restoration.	Re-established foredune. Dune stabilisation with sand fences, pingao and spinifex planting. Public signage and dog control.
Te Henga (Bethells Beach)	Bethells Beach Dotterel Protection programme	Pest control in sand dunes.	Community volunteers and Auckland Council targets mustelids and rats in the dunes behind the beach and protects breeding birds around Te Henga- Bethells Beach and O'Neills beach.
Te Henga Wetland	Habitat Te Henga	Habitat Te Henga is a Forest & Bird project to improve biodiversity in the Te Henga-Bethells area.	A project of Forest & Bird Waitākere Branch working together with private landowners of Te Henga wetland and within a wider perimeter to protect and restore biodiversity. Initiated as a project to enable pateke to be returned to the area by controlling predators to safeguard the duck, the project is expected to benefit many other species from the coast to the upper valley as it merges into the Ark in the Park project. For more information, go to www.forestandbird.org.nz.
ALL			
West Auckland	Septic tank clean out programme.	Wastewater pollution.	A programme run by Auckland Council to regularly clean out rural septic tanks, helping to ensure that these systems
West Coast	Auckland Council	Love our Lagoons programme.	function properly, and do not pollute nearby waterways and the environment.
	EcoMatters	Love your Lagoons programme.	Education on residential septic tank management to reduce wastewater pollution in coastal lagoons.
NATIONAL			
National	Kiwis against Seabed Mining (KASM)		KASM challenges deep sea mining applications and other regulations.
	Seaweek		Seaweek's annual events:
	Nature watch		Event at Cornwallis for Love your Coast Manukau Harbour Clean Up (2017) funded by the WRLB
	Nature watch		Waitākere Ranges Coast Intertidal Life Project.
	Biobiltz		Waitākere Coastal Region Project.
	Gecko Trust		Conservation and advocacy - support to community groups in South Titirangi - Northwest Wild Link

Please note that this list was compiled in collaboration with Auckland Council and may not be an exhaustive list of all the stakeholder projects in the WRLB area.

Table 13: Local Interest Groups in the WRLB area

Location of Interest	Group Name
MANUKAU	
Cornwallis	Cornwallis Peninsula Group
Green Bay	Green Bay Ratepayers and Residents
Huia/Cornwallis	Huia/Cornwallis Ratepayers and Residents
Laingholm	Laingholm District Citizen Association
Parau	Parau Residents and Ratepayers
Paturoa Bay	Paturoa Bay Residents & Ratepayers (Titirangi Beach)
South Titirangi	South Titirangi Residents & Ratepayers
Titirangi	Titirangi Residents & Ratepayers
WEST COAST	
Anawhata	Anawhata Ratepayers and Residents
Karekare	Karekare Resident and Ratepayers
Piha	Piha Ratepayers and Residents
Te Henga- Bethells Beach	Bethells/Te Henga Community Group

Table 14: Water Safety Organisations in the WRLB area

Location of Interest	Group Name
French Bay	French Bay Yacht Club
	French Bay Coastguard
Karekare	Karekare Surf Lifesaving Club
Piha	United North Piha Lifeguard Service
	Piha Surf Lifesaving Club Inc.
Te Henga- Bethells Beach	Bethells Surf Lifesaving Club
Anawhata	Anawhata Ratepayers and Residents
Karekare	Karekare Resident and Ratepayers
Piha	Piha Ratepayers and Residents
Te Henga- Bethells Beach	Bethells/Te Henga Community Group

Table 15: Environmental Interest Schools

Location of Interest	Group Name
Laingholm	Laingholm School
	Laingholm Primary School
	Woodlands Park School
Manukau Harbour	Steiner School SN

Table 16: Recreational Fishing Groups

Location of Interest	Group Name
Laingholm	Laingholm Fishing Club
Location of Interest	**Group Name**
Huia	Huia Fishing Club
Whatipu	Whatipu Fishing Club
Te Henga- Bethells Beach	Te Henga Fishing Club
Piha	Piha Deep Sea Fishing Club

Figure 53: Armour Bay

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Scientific Species Names

Seabirds

Bar-tailed godwit *Limosa lapponica*

Black billed gull *Chroicocephalus bulleri*

Diving Petrel *Pelecanoides urinatrix*

Grey-faced petrel *Pterodroma macroptera*

Little penguin *Eudyptula minor*

New Zealand dotterel *Charadrius obscurus*

Sooty shearwater *Puffinus griseus*

South Island pied oystercatcher *Haematopus finschi*

Spotted shag *Stictocarbo punctatus*

White fronted tern *Sterna striata*

Wrybill *Anarhynchus frontalis*

Marine Mammals

Bottlenose dolphin *Tursiops truncates*

Common dolphin *Delphinus delphis Linnaeus*

Hector's dolphin *Cephalorhynchus hectori*

Māui dolphin *Cephalorhynchus hectori maui*

New Zealand fur seal *Arctocephalus forsteri*

Orca *Orcinus sp.*

Southern right whale *Eubalaena australis*

Finfish

Barracouta *Thyrsites atun*

Bass *Polyprion americanus*

Grey mullet *Mugil cephalus*

Gurnard *Chelidonichthys cuculus*

Hapuku *Polyprion oxygeneios*

Kahawhai *Arripis trutta*

Leatherjacket *Parika scaber*

Parore *Girella tricuspidata*

Snapper *Pagurus auratus*

Tarahiki *Nemadactylus macropterus*

Trevally *Pseudocaranx Dentex*

Yellowbelly flounder *Rhombosolea leporina*

Sharks, Skates and Rays

Blue shark *Prionace glauca*

Broadnose sevengill shark *Notorynchus cepedianus*

Bronze whaler shark *Carcharhinus brachyurus*

Dark ghost shark *Hydrolagus novaezealandiae*

Great white shark (white pointer shark) *Carcharodon carcharias*

Long tail stingray *Dasyatis thetidis*

New Zealand eagle ray *Myliobatis tenuicaudatus*

Pale ghost shark *Hydrolagus bemisi*

Porbeagle shark *Lamna nasus*

Rig (lemonfish) *Mustelus lenticulatus*

Rough skate *Dipturus nasutus*

School shark *Galeorhinus galeus*

Seal shark *Dalatias licha*

Short tail stingray *Dasyatis brevicaudata*

Shortfin mako shark *Isurus oxyrinchus*

Shovelnose dogfish *Deania calcea*

Smooth hammerhead *Sphyrna zygaena*

Smooth skate *Dipturus innominatus*

Spine-tailed devil ray *Mobula sp.*

Spiny dogfish *Squalus acanthias*

Thresher shark *Alopias vulpinus*

Invertebrates

Anemones *Isocradactis magna*

Blackfoot paua *Haliotis iris*

Calliostoma snail *Calliostoma ligatum*

Chiton *Plaxiphora obtecta*

Cockle *Austrovenus stutchburyi*

Common pulmonate limpet *Siphonaria australis*

Corals *Madrepora oculata, Solenosmilia variabilis, Goniocorella dumosa, Enallopsammia rostrate, Oculina virgosa*

Crabs *Macrophthalmus hirtipes, Leptograpsus variegatus, Hemigrapsus edwardsi, Plagusia chabrus*

Deep water tuatua *Paphies donacina*

Dosinia *Dosinia sp.*

Dredge oyster (Bluff oyster) *Ostra chilena*

Estuarine mussel *Xenostrobus secures*

Fragile limpet *Atalacmea fragilis*

Frilled venus shell *Bassina yatei*

Green lipped mussel *Perna canalicula*

Kina *Evechinus chloroticus*

Limpet *Patelloida corticata*

Marine snails *Melanopsis trifasciata, Amphibola crenata, Potamopyrgus estuarinus*

Nudibranchs *Ceratosoma amoenum* (duck's bill limpet), *Doris wellingtonensis, Dendrodoris citrina, Scutus breviculus* (sea slug)

Orange reef star *Stichaster australis*

Ornate limpet *Cellana ornate*

Oyster borer *Lepsiella albomarginata*

Pacific oyster *Crassostrea gigas*

Packhorse rock lobster *Jasus verreauxi*

Paddle crab *Ovalipes catharus*

Periwinkle *Littorina littorea*

Pipi *Haliotis iris*

Radiate limpet *Cellana radians*

Sand beach isopod *Tylos neozelanicus*

Sand tube worm *Neosabellaria kaiparaensis*

Scallop *Pecten novaezealandiae*

Shelly tube worm *Spirobranchus cariniferus*

Spengler's trumpet *Cabestana spengleri*

Spiny red rock lobster *Jasus edwardsii*

Sponge gardens *Polymastia fusca, Aaptos globosum, Homaxinella erecta, Polymastia aurantium, Tethya aurantium*

Toheroa *Paphies ventricosa*

Tuatua *Paphies subtriangulata*

White rock shell *Dicathais orbita*

Plants and Algae

Bull kelp *Durvillaea antarctica*

Flax *Phormium tenax*

Glasswort *Sarcocornia quinqueflora*

Kowhai *Sophora sp.*

Mangroves *Avicennia marina australasica*

Mānuka *Leptospermum scoparium*

Oioi (jointed rush) *Apodasmia similis*

Pohutakawa *Metrosideros excelsa*

Red seaweeds *Gigartina laingii, Gigartina alveata*

Seagrass *Zoster sp.*

Seaweeds *Chymenia lusoria, Gigartina marginifera, Gigartina atropurpurea, Carpophyllum maschalocarpum, Nothogenia fastigata, Melanthalia abscissa, Arthrocardia corymbos*

Tauhinu *Cassinia retortai*