Assessment of Ecological Effects – Marine Ecology

December 2017

Mt Messenger Alliance

Technical Report 7g

NZ TRANSPORT AGENCY WAKA KOTAHI

Mt Messenger Bypass

New Zealand Government

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Glossary

Term	Meaning
AEE	Assessment of Effects on the Environment Report
CMA	Coastal marine area
Construction Water Assessment Report	Construction Water Assessment Report (Technical Report 14, Volume 3 of the AEE)
DOC	Department of Conservation
Draft Coastal Plan	Draft Coastal Plan for Taranaki 2016
EcIA guidelines	Ecological Impact Assessment guidelines
EEZ	Exclusive Economic Zone
EIANZ	Environment Institute of Australia and New Zealand
MPI	Ministry for Primary Industries
NABIS	National Aquatic Biodiversity Information System
NZCPS	New Zealand Coastal Policy Statement 2010
NZTA Guideline	NZTA Erosion and Sediment Control Guidelines for State Highway Infrastructure, Construction Stormwater Management (dated September 2014
ONC area	Outstanding Natural Character area
ONFL	Outstanding Natural Features or Landscapes
Project	The Mt Messenger Bypass project
RCPT	Operative Regional Coastal Plan for Taranaki 1997
SH3	State Highway 3
Threat Management Plan	Hector's and Māui's Dolphin Threat Management Plan
Transport Agency	New Zealand Transport Agency
TRC	Taranaki Regional Council
TSS	Total Suspended Sediment
USLE	Universal Soil Loss Equation

Executive Summary

The NZ Transport Agency is to develop a new section of SH3, north of New Plymouth, to bypass the existing steep, narrow and winding section of highway at Mt Messenger. The Project comprises a new section of two lane highway, some 6km in length, located to the east of the existing SH3 alignment. This report assesses the potential effects of the construction of the Project on marine ecological values.

Marine ecology environment

The key marine ecological values identified for the coastal environment between Urenui and Tongaporutu estuary (the relevant study area for the Project) include:

- Estuarine habitat;
- Intertidal habitat;
- Subtidal reef habitat in Parininihi Marine Reserve;
- Subtidal soft sediment habitat;
- Marine mammals, including the Threatened Māui's and Hector's dolphins;
- Fishery resources, including commercial fisheries, and protected great white shark;
- Kaimoana; and
- Seabirds, including At Risk wading species and blue penguins.

The Mangapepeke Stream tributary is the largest of the streams affected by the Project footprint, which crosses several minor tributaries and the upper reaches of the main tributary. The Project footprint then crosses the upper reaches of Mimi River and several tributaries. The Waipingao Stream is not impacted by the Project.

Potential effects disregarding erosion and sediment control and other measures

In the absence of efforts to avoid, remedy or mitigate adverse ecological effects, the potential effects on marine ecological values would come from indirect, short-term effects during construction relating to sedimentation. Erosion and sedimentation after vegetation clearance and earthworks in the upper reaches of streams could potentially result in suspended sediment travelling down freshwater streams and rivers to the marine coastal environment. Any such sedimentation would only be a relatively very small addition to the sediment that already reaches the marine environment via the streams.

The degree to which the marine ecological values might be adversely affected is dependent upon how much, and how far, suspended sediment would travel from the Project. The Project is a significant distance from the coastal marine area (ie, 9.2km and 21.5km stream distance from the Tongaporutu and Mimi estuaries respectively).

Further, the Project footprint is very small within the context of the wider catchments and the overall marine environment, with the Project earthworks impacting on 0.05-0.06% of the catchment area. The catchment areas are subject to significant "natural" sediment yields in the absence of the Project. The increase in sediment yield from Project earthworks would, even disregarding the proposed erosion and sediment controls for the Project, be expected to be a small 0.3% increase against background sediment levels. The likelihood of meaningfully adverse amounts of suspended sediment reaching marine receiving environments as a result of Project activities would be very low, even in the absence of erosion and sediment control measures.

Given the high energy hydrodynamic conditions on the coast, it is expected that any Project-related terrigenous sediment that reaches the marine environment would be rapidly dispersed throughout the subtidal inner shelf. Furthermore, most of the marine species identified in the area are likely to have some level of tolerance to short-term sedimentation from terrigenous inputs or have the ability to avoid or move away from the adverse conditions.

Overall, the Project would be expected to have low to no effects on the values identified, even in the absence of construction water management (including sediment control) measures.

Effects once proposed erosion and sediment and other controls are proposed

Once the proposed best practice sediment and control measures are taken into account, the Project is expected to have no measurable effects on marine ecological values. Overall, the life-supporting capacity of marine ecosystems will be maintained through the construction and operation of the Project, including as a result of the best practice erosion and sediment control measures.

1 Introduction

1.1 Purpose and scope of this report

This report forms part of a suite of technical reports prepared for the NZ Transport Agency's Mt Messenger Bypass project (the Project). Its purpose is to inform the Assessment of Effects on the Environment Report (AEE) and to support the resource consent applications and Notice of Requirement to alter the existing State Highway designation, which are required to enable the Project to proceed.

This report assesses the ecological effects on marine ecology of the Project as shown on the Project Drawings (AEE Volume 2: Drawing Set).

The purpose of this report is to:

a Identify and describe the existing environment (Section 3);

b Describe the potential effects on marine ecology arising from construction and operation of the Project (Section 4);

c Recommend measures as appropriate to avoid, remedy or mitigate potential effects (including any proposed conditions/management plan required) (Section 5); and

d Present an overall conclusion of the level of potential effects of the Project after recommended measures are implemented (Section 5).

1.2 Project description

The Project involves the construction and ongoing operation of a new section of State Highway 3 (SH3), generally between Uruti and Ahititi to the north of New Plymouth. This new section of SH3 will bypass the existing steep, narrow and winding section of highway at Mt Messenger. The Project comprises a new section of two lane highway, approximately 6km in length, located to the east of the existing SH3 alignment.

The Project is intended to enhance the safety, resilience and journey time reliability of travel on SH3 and contribute to enhanced local and regional economic growth and productivity for people and freight.

A full description of the Project including its design, construction and operation is provided in the Assessment of Effects on the Environment Report, contained in Volume 1: AEE, and is shown on the Drawings in Volume 2: Drawing Set.

2 Assessment methods

2.1 Marine ecology characteristics and values assessment

2.1.1 Desktop review

A desktop assessment was undertaken to review available information and data relating to the ecology of the Project footprint and the surrounding area. This included:

- Identifying areas potentially affected by sediment or other contaminants arising from the Project, that are listed as having significant ecological values including:
    - Parininihi Marine Reserve and Pariokariwa reef
    - Subtidal soft sediment habitat
    - Estuarine and intertidal habitats
    - Nearshore and intertidal environments supporting:
        - Critically endangered Māui's dolphin and other marine mammals
        - Fish species including commercial stocks and the protected great white shark
        - Kaimoana species
        - Seabirds
- A review of key documents, reports and data including:
    - New Zealand Coastal Policy Statement 2010 (NZCPS)
    - Operative Regional Coastal Plan for Taranaki 1997 (RCPT)
    - Draft Coastal Plan for Taranaki 2016 (Draft Coastal Plan)
    - Taranaki Regional Council (TRC) 2004: Inventory of coastal areas of local or regional significance in the Taranaki Region
    - TRC 2009: Taranaki – Where We Stand. State of the Environment Report 2009
    - Department of Conservation (DOC) 1997: Conservation Management Strategy – Wanganui Conservancy 1997–2007
    - DOC 2017: Map of Māui dolphin sightings from 2002 to April 2017.
    - DuFresne 2010: Distribution of Māui's dolphin (Cephalorhynchus hectori maui): 2000–2009
    - New Zealand eBird 2017 database
    - Fechney et al. 1990: Coastal Resource Inventory, First Order Survey, Wanganui Conservancy
    - McKnight 1974: Benthic faunas from the continental shelf, west coast, North Island, Kawhia Harbour to Cape Terawhiti
    - Ministry for Primary Industries (MPI) 2017: NZ Fisheries InfoSite
    - National Aquatic Biodiversity Information System (NABIS) 2017
    - Sturgess 2015: Mapping the ecological and biophysical character of seabed habitats of the Parininihi Marine Reserve, Taranaki, New Zealand

- Cowie, Healy and McComb 2009: Sediment flux on the high energy Taranaki coast, New Zealand
    - Ewans and Kibblewhite 1992: Spectral features of the New Zealand deep-water ocean wave climate
    - Laurent 2000: The provenance and dispersal of beach sands on the west coast of the North Island, New Zealand.
    - Nodder 1991: Sedimentary Environments and Geological Hazards on Taranaki Continental Shelf
    - The Assessment of Ecological Effects – Freshwater Ecology (Technical Report 7b, Volume 3 of the AEE)
    - The Construction Water Assessment Report (Technical Report 14, Volume 3 of the AEE)
- Discussions with:
    - Kristina Hillock, DOC
    - Callum Lilley, DOC
    - Greg White, Ngati Tama (kaimoana values)
    - Graeme Ridley – Construction Water Management advisor
    - Keith Hamill – Aquatic ecologist

2.2 Assessment of effects methodology

The assessment of ecological effects follows Ecological Impact Assessment guidelines (EcIA) produced by the Environment Institute of Australia and New Zealand (EIANZ, 2015). The EcIA approach follows the steps outlined below:

Step 1: Assessment of Ecological Values

Ecological values are assigned a level on a scale of Low, Moderate, High or Very High based on assessing the values of species, communities, and habitats identified against criteria set out in the EcIA guidelines (see Table 2.1).

Table 2.1 – Assignment of values to species, vegetation and habitats within the potentially-affected marine area (adapted from EIANZ, 2015)

Value	Species Value requirements	Habitat value requirements
Very High	Important for Nationally Threatened species	Meets most of the ecological significance criterion as set out in relevant statutory policies and plans including indigenous biological diversity criteria in Policy 11 of the NZCPS
High	Important for Nationally At Risk – species and may provide less suitable habitat	Meets some of the ecological significance criterion as set out in relevant statutory policies and plans,

Value	Species Value requirements	Habitat value requirements
	for Nationally Threatened species	including indigenous biological diversity criteria in Policy 11 of the NZCPS
Moderate	No Nationally Threatened or At Risk species, but habitat for locally uncommon or rare species	Habitat type does not meet ecological significance criteria as set out in the relevant statutory policies and plans, or the NZCPS but does provide locally important ecosystem services (eg erosion and sediment control, and landscape connectivity)
Low	No Nationally Threatened, At Risk or locally uncommon or rare species	Nationally or locally common habitat and supporting no Threatened or At Risk species, and does not provide locally important ecosystem services

Step 2: Magnitude of effect assessments

Step 2 of the EcIA guidelines requires an evaluation of the magnitude of effects on ecological values based on the extent of any area which is likely to be affected, intensity and duration of effect. The magnitude of the effect that the Project is expected to have on ecological values is evaluated as being either No effect, Negligible, Low, Moderate, High or Very High, based on the proposed works (footprint size, intensity and duration; see Table 2.2).

Table 2.2 – Summary of the criteria for describing the magnitude of effect as outlined in EIANZ, 2015.

Magnitude of effect	Description
Very High	Total loss or major alteration of the existing baseline conditions; and/or Loss of high proportion of the known population or range
High	Major loss or alteration of existing baseline conditions; and/or Loss of high proportion of the known population or range
Moderate	Loss or alteration to existing baseline conditions; and/or Loss of a moderate proportion of the known population or range
Low	Minor shift away from existing baseline conditions; and/or Minor effect on the known population or range
Negligible	Very slight change from the existing baseline conditions; and/or Negligible effect on the known population or range

Step 3: Level of effects assessment in the absence of mitigation

Step 3 of the EcIA guidelines requires the overall level of effect to be determined using a matrix that is based on the ecological values and the magnitude of effects on these values **in the absence of any efforts to avoid, remedy or mitigate for potential effects**. Level of effect categories include No Ecological Effect, Very Low, Low, Moderate, Moderate/High, High and Very High. Table 2.3 shows the EcIA matrix outlining criteria to describe the overall level of ecological effects.

Table 2.3 – Criteria for describing overall levels of ecological effects as outlined in EIANZ, 2015.

Magnitude of effect	**Ecological Value**			
	Very High	**High**	**Moderate**	**Low**
Very High	Very high	Very high	High	Moderate
High	Very high	Very high	Moderate	Low
Moderate	Very high	High	Low	Very low
Low	Moderate	Low	Low	Very low
Negligible	Low	Very low	Very low	Very low
No effect	No ecological effect	No ecological effect	No ecological effect	No ecological effect

Step 4: Establish if mitigation is required

The overall level of effect is used to determine if mitigation is required.

As discussed later in this report, the Project would have only negligible to low marine ecology effects (in terms of Step 3 of the EcIA guidelines), even without taking into account mitigation measures. However, as per the Transport Agency's standard practice for roading projects, extensive erosion and sediment (and other contamination) control measures will be put in place. Doing so will, in effect, completely avoid any measurable effects on marine ecology values arising.

3 Ecological characteristics and values

3.1 Environmental context

This section describes the physical marine environment for the North Taranaki coastline between Urenui and Tongaporutu (Figure 3.1) to provide context for the marine ecological values and the assessment of potential effects. This is the ultimate receiving environment for freshwater flowing from the two catchments affected by the Project. These catchments enter the marine coast at the Mimi and Tongaporutu estuaries.

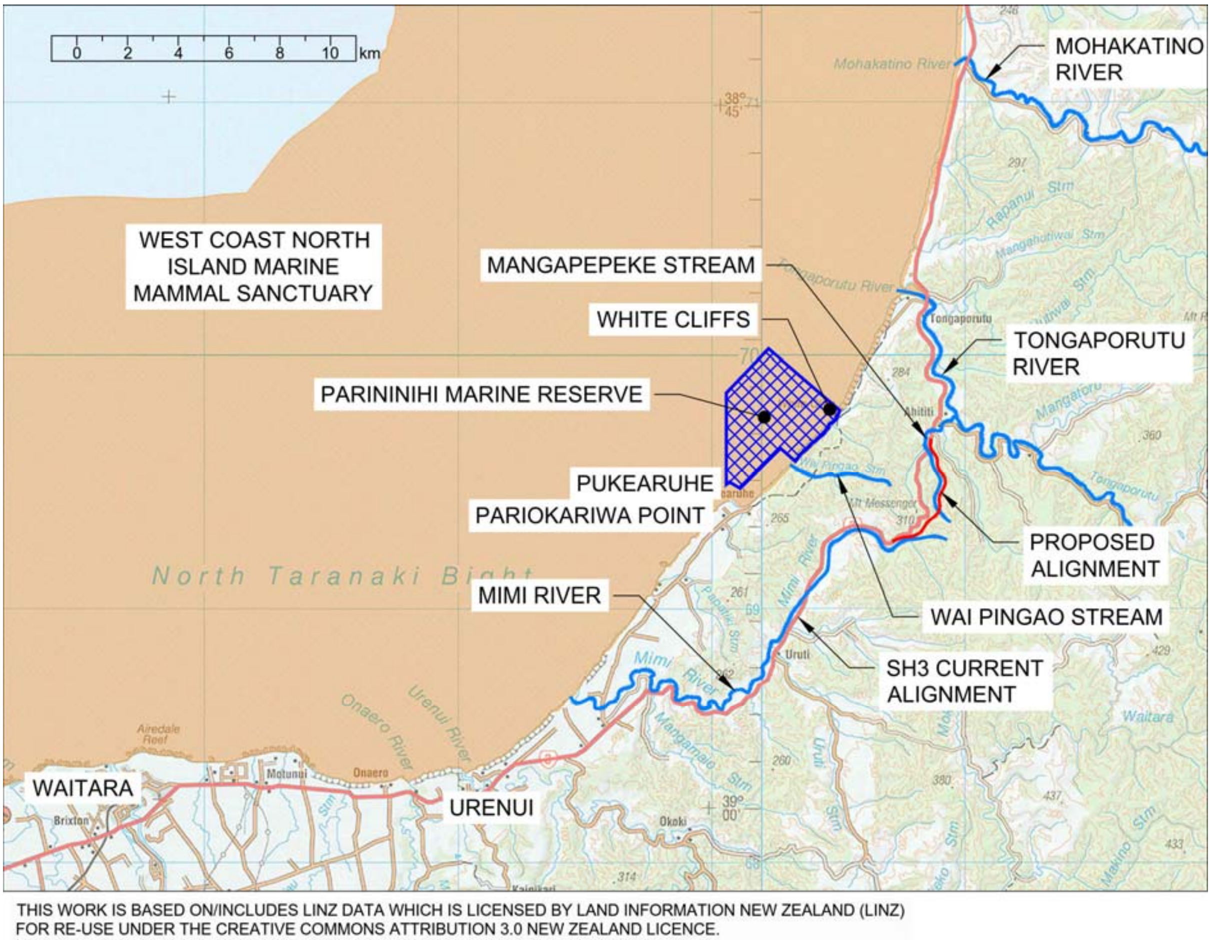

Figure 3.1: Map showing the location of key streams, rivers, estuaries and other coastal features in North Taranaki.

The North Taranaki coastline is characterised by almost continuous, rugged cliffs formed from uplifted marine sediments, and narrow, exposed black sand beaches (TRC 2009, DOC 1997, Fechney *et al.* 1990). The rugged nature of the Taranaki coastal environment means much of the coastal area has retained its distinct natural character (TRC 2009).

The most distinctive coastal cliffs are the Whitecliffs that extend to over 200m in height and are a well-known scenic feature. The narrow black sand beaches at the base of the cliffs are only accessible around low tide. There are more extensive sand deposits around the river mouths, with sand deposits extending up into their estuaries (DOC 1997, Fechney *et al.*

1990). Large areas of boulders and small rock pools are present in the intertidal area. Occasionally more resistant geological formation stand out as cut platforms or reefs off headlands such as Pariokariwa Point. There are two known large subtidal reef systems composed of sandstone. These are Epiha Reef south of the Mokau River (approximately 3km north of Mohakatino River), and Pariokariwa Reef at Pukearuhe which includes a rock platform known as Waikiekie Reef (DOC 1997).

This coastline is an exposed, high energy coastline that is subject to persistent, and occasionally extreme, wind and wave energy emanating from the Southern Ocean and the Tasman Sea (DOC 2011, Tonkin & Taylor 2007). There are few areas of sheltered water beyond the estuaries and almost the entire Taranaki coastline is subject to varying rates of erosion under these conditions (TRC 2009). Carter (1980) describes the currents in the area from Taranaki to Kaipara as 'ephemeral' since they may be reinforced, stopped or reversed under the highly variable meteorological conditions in the area. The current regime is dominated by three main processes; wind-driven flows, current flows and tidal movement, with the net flow often being a combination of all three. The coast is exposed to the west but sheltered from the predominant southwest winds (DOC 1997). The coast is influenced by the Westland current which flows north, and occasionally, by the West Auckland current extending south into the region (DOC 1997). Carter (1980) also suggests that an offshoot of the D'Urville Current flows around Cape Egmont, however this is not well defined and is thought to be weak with a generally net northward movement to Kawhia or Kaipara, where the flow is met, and reversed, by the West Auckland Current. A summary of these ocean currents along the North Taranaki coastline and other currents around New Zealand are depicted in Figure 3.2.

The coast has a very energetic wave climate with a dominant south-westerly directional component as shown in Figure 3.3 (Laing 1993, Ewans & Kibblewhite 1992, Kibblewhite *et al.* 1982, Pickrell & Micthell 1979). Wave energy and tidal energy drive sediment transport on the coast and through estuaries, respectively. Storm waves from the north and west disturb the bottom sediments. (TRC 2009). Tidal currents are typically weak (<10cm/s) and often masked by the wind-driven circulation. The maximum tidal range is 3.1m.

The subtidal marine environment is dominated by gravel sands and fine titanomagnetite (iron) sands on a narrow shelf that grades from sand to mud then back to sand over a gradually increasing depth range. The primary input of coastal sediments, including iron sand, occurs on the Mount Taranaki ring-plain, eroding coastal cliffs, and local catchments/estuaries (Laurent 2000). A summary of these sediment inputs for the North Taranaki coast is depicted in Figure 3.4. Sediments derived from offshore volcanic action, in combination with intermittent inputs from Mount Taranaki catchments feed the sediment pathways to the north and south of Cape Egmont. Minor inputs of sediment are derived from terrestrial sources (Laurent 2000).

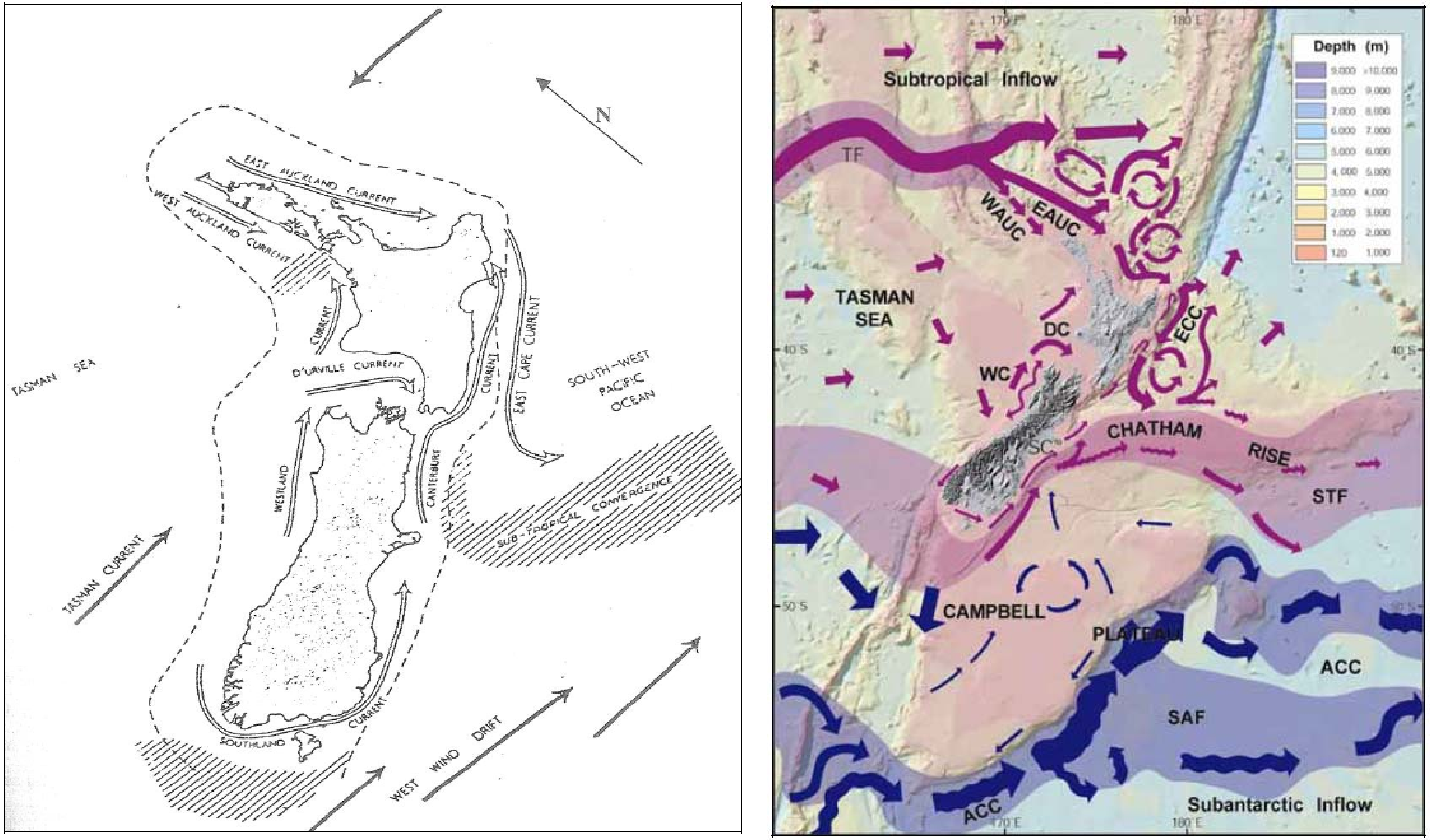

Figure 3.2: Schematic diagrams of ocean currents around New Zealand from (left) Laurent (2000) (not to scale), and (right) NIWA Chart – Miscellaneous Series 86. Relevant abbreviations include: DC – D'Urville Current, WAUC – West Auckland Current, WC – Westland Current.

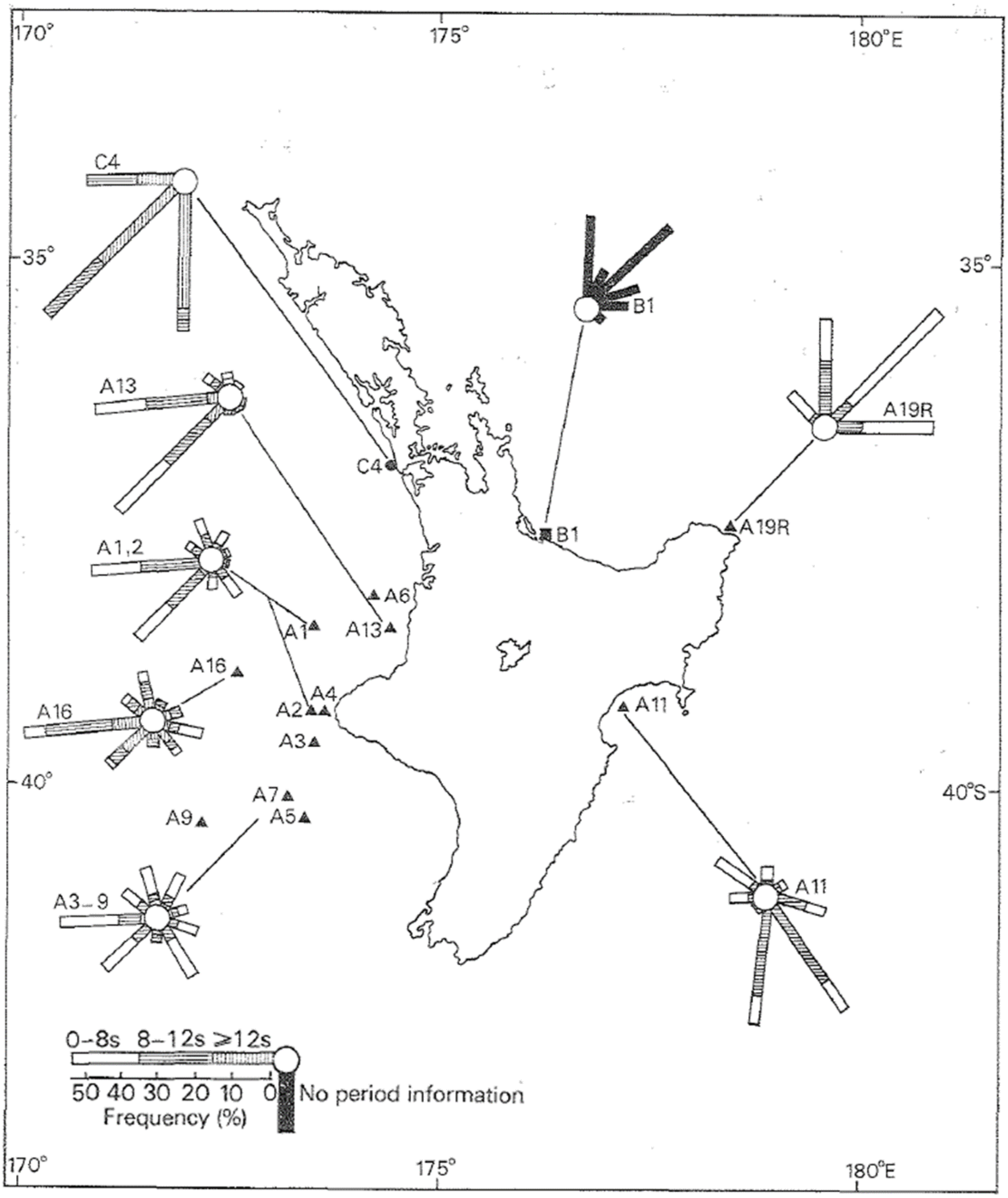

Figure 3.3: Percent frequency direction of wave approach in three groups of wave period; 0-8 s, 8-12 s, and >12 s. (Source: Pickrill & Mitchell 1979).

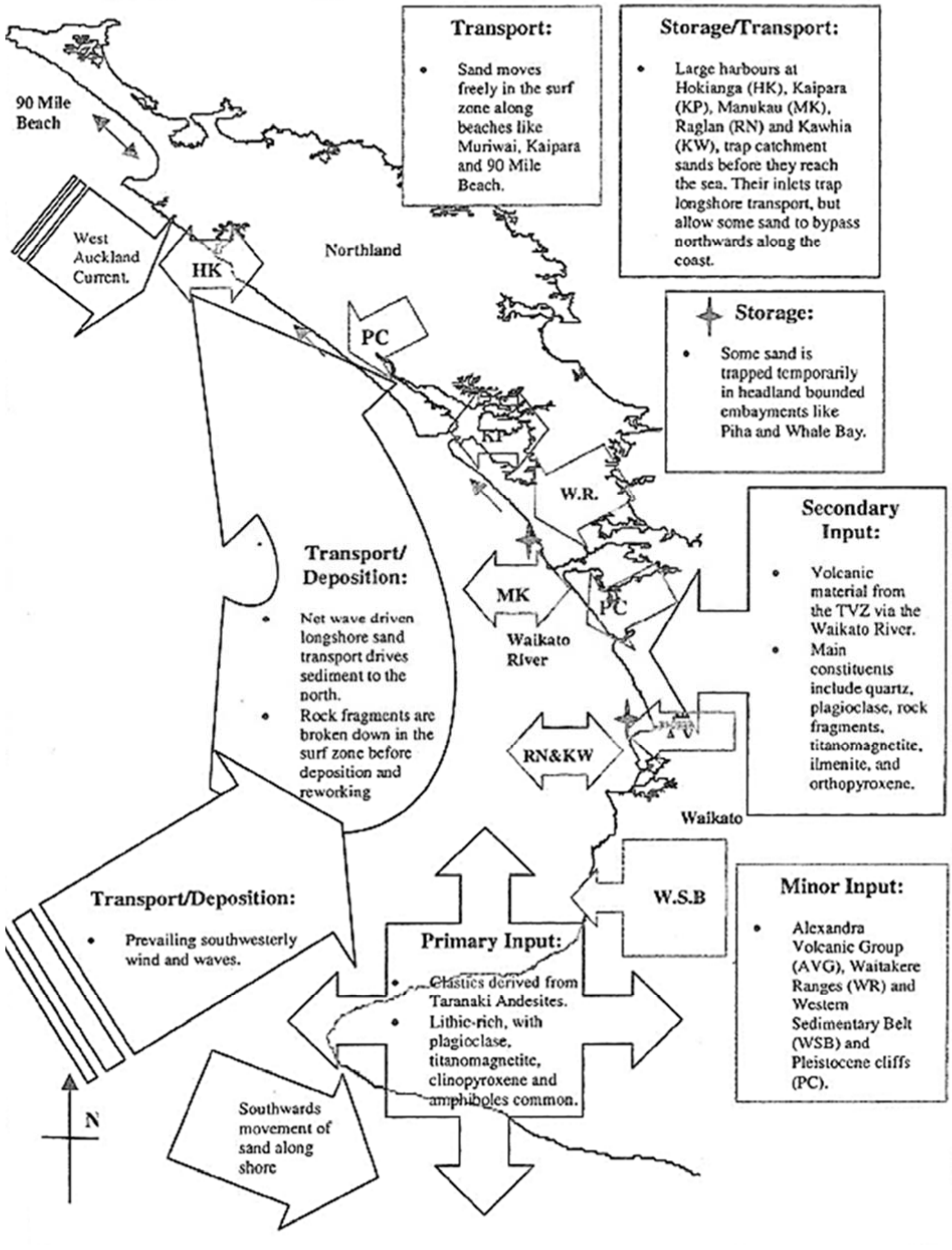

Figure 3.4: Schematic diagram of west coastal sediment inputs, dispersal and deposition (not to scale). AVG – Alexandra Volcanic Group, HK – Hokianga Harbour, KW – Kawhia Harbour, MK – Manukau Harbour, PC – Pleistocene cliffs, RN – Raglan Harbour, WR – Waitakere Ranges, TVZ – Taupo Volcanic Zone, WSB – Western Sedimentary Belt. (Source: Laurent 2000)

Sturgess (2015) described mineral analysis of sediment samples collected from Pariokariwa Reef and Whitecliffs. Pariokariwa Reef is dominated by fine grained sediments consisting of both terrigenous (clay and quartz) and biogenic material. There was a relatively high proportion of fine sediments indicating that the sediment on the reef is a cohesive mud/sand. This analysis indicated that Whitecliffs is a source for clay mineral loading in this marine environment. Turbidity values measured within Parininihi from 2002 to 2006 suggest that silt on the reef does not solely originate from local cliffs, but also from fluvial inputs from various river mouths, including Mokau, Tongaporutu, Mimi, Urenui and Waitata Rivers (McComb 2007, in Sturgess 2015). Sediment data collected offshore from Parininihi in 20-40m depths showed traces of riverborne terrigenous silts and muds which are likely to have been transported offshore via coastal currents (McComb 2007, in Sturgess 2015).

Longshore sediment transport is generally towards the north, while the presence of rivers and estuaries change the rate and magnitude of transport (Mead & Phillips 2007, Tonkin & Taylor 2007). The northward transport is thought to be in the order of three times the magnitude of the southward transport (Matthews 1977). Transport is dominated by waves and wave-driven currents, particularly by longshore currents generated by alongshore wave energy flux (ie waves approaching the shore at an oblique angle (Cowie *et al.* 2009). Tide-driven ocean circulation is generally weak (Nodder 1991).

Northward sediment transport is not uniform, rather it occurs in pulses in response to large wave and storm events (Tonkin & Taylor 2007). Several authors have commented on large sand deposits, or pulses, of sand that move up the west coast between Taranaki and Cape Reinga (eg Phillips 2004, McComb 2001). Sidescan sonar records reveal bedforms suggestive of periodic movement of material on the bottom at water depths of up to 50m, likely caused by storm waves (Nodder 1991). Nodder (1991) indicates that waves capable of suspending fine sand at 30m and 50m occur 67% and 20% of the time respectively. The wave climate is subsequently a dominant force in sediment transport along Taranaki shelf (Nodder 1991). While the physics indicates the suspension of sediments, little is known about its fate, ie, what are the sediment pathways (Tonkin & Taylor 2007). However, sediments derived from Mount Taranaki have been found on Ninety Mile Beach at the top of the North Island (Gibbs 1996 in TRC 2009).

3.2 Coastal management areas

The coastline between Pariokariwa Point and Waihi Stream, including the Tongaporutu Estuary and Waipingao River mouth, is an Area of Outstanding Coastal Value under the RCPT. This same area of coastline is identified in the Draft Coastal Plan as a Coastal Management Area of Outstanding Value, and more specifically as an area of Outstanding Natural Features or Landscapes (ONFL). The proposed protection status of this part of the coast under the Draft Coastal Plan reflects the current status under the RCPT. Schedule 2 of the Draft Coastal Plan describes the ONFL as ‘an exceptional sequence of elevated marine terraces and striking coastal White Cliffs with erosion along the soft sedimentary rock creating an impressive array of formations. The Coastal Management Area extends out 1nm covering offshore spawning grounds, and areas frequented by marine mammals’ (Draft

Coastal Plan, p. 139). The marine ecological attributes identified in both the operative and draft regional coastal plans for this coastal management area include:

- Offshore fish breeding grounds within open coastal waters.
- Parininihi Marine Reserve contains significant scientific and ecological values including internationally important sponge gardens.
- Mohakatino and Tongaporutu estuaries contain important breeding areas for native fish.
- Tongaporutu Estuary contains abundant shellfish with high species diversity and excellent examples of saltmarsh communities.
- Threatened, At Risk and regionally distinctive flora and fauna species present.
- The only mainland nesting site for grey-faced petrel (Pterodroma macroptera gouldi, Not Threatened) in Taranaki at Rapanui.
- Offshore stacks and cliff edges have breeding colonies of seabirds including fluttering shearwater (Puffinus gavial, At Risk (Relict)).
- Northern blue penguin (Eudyptula minor iredalei, At Risk (Declining)) recorded as nesting in the area.
- Fur seal (Arctocephalus forsteri, Not Threatened) haul-out and seabird roosting area on Opourapa Island.
- Offshore reef connected to Opourapa Island contains abundant marine life.

Mimi Estuary is identified as an Area of Outstanding Coastal Value in the RCPT and an Area of Outstanding Natural Character (ONC) in the Draft Coastal Plan. The proposed protection status of Mimi Estuary under the Draft Coastal Plan reflects the current status under the RCPT. Schedule 2 of the Draft Coastal Plan describes the estuary as 'relatively unmodified providing exceptional biophysical values and high scenic associations' (p.124). Further detail of the marine ecological values of the Mimi Estuary is provided in Section 3.3.

The Parininihi Marine Reserve was not established when the RCPT was written. The Draft Coastal Plan includes the marine reserve within the Coastal Management Area of Outstanding Value and ONFL between Pariokariwa Point and Waihi Beach but also specifically identifies Parininihi, including the marine reserve, as an Outstanding Natural Character (ONC) area. Parininihi is noted for including 'intact coastal forest, spectacular coastal White Cliffs, and a marine reserve which provide exceptional and unique biotic and abiotic values along an unmodified and wild section of coastline' (Draft Coastal Plan, p. 122). Both abiotic and biotic natural character attributes were assessed to have very high value. The marine ecological attributes identified in the draft regional coastal plan for this coastal management area include:

- Unmodified and diverse habitats comprising coastal forest, Waipingao Stream and dune system, and offshore reefs.
- An extensive offshore reef system – unique for the generally sandy North Taranaki coastline.
- The marine reserve contains internationally important sponge gardens, a high diversity of fish species and important habitat for crayfish and pāua.

Further detail of the marine ecological values of the Parininihi Marine Reserve is provided in Section 3.4.1. Further details of the Tongaporutu, Mimi and Waipingao estuaries are provided in Section 3.3.

3.3 Estuarine and intertidal habitats and species

Estuaries are significant features along the northern west coast, creating quite different habitat from the open coast conditions (TRC 2009). Spawning areas for whitebait (Galaxiidae spp.) are believed to exist in the major estuaries (RCPT 1997, Fechney *et al*. 1990).

Tongaporutu estuary lies at the downstream extent of Tongaporutu River, of which the Mangapepeke Stream is a tributary. The estuary is approximately 40ha in area and is relatively unmodified and unpolluted and contains extensive mudflats (TRC 2004). Tongaporutu Estuary is noted in the RCPT for containing abundant shellfish with high species diversity and for this reason is an Area of Outstanding Coastal Value. The Draft Coastal Plan similarly includes Tongaporutu Estuary within an area of Outstanding Natural Features or Landscapes.

Tongaporutu estuary is considered a good example of natural mudflat and tidal wetland communities that are otherwise rare in North Taranaki and is noted for the presence of excellent saltmarsh communities (Draft Coastal Plan; Fechney *et al.* 1990). The biota of this estuary is dominated by pipi (*Paphies australis*), little black mussel (*Xenostrobus pulex*), rag worms (Nereididae polychaetes) and burrowing isopods. Green-lipped mussels (*Perna canaliculus*), rock oysters (*Saccostrea glomerata*), barnacles, crabs, and green alga (*Enteromorpha* sp.) are present in the intertidal zone (DOC 1997). Shrimp, yellow-eyed mullet (*Aldrichetta forsteri*), flounder (*Rhombosolea* sp.), trevally (*Pseudocaranx georgianus*), kahawai (*Arripis trutta*), jack mackerel (*Trachurus* sp.), estuarine stargazers (Uranoscopidae sp.), clingfish (Gobiesocidae sp.), bullies (*Gobiomorphus* sp.), and triplefins (*Grahamina* sp.) are common in both the middle and lower regions of the estuary (DOC 1997). The estuary also provides resting and feeding areas for national and international migratory wading birds moving between winter and summer habitats (DOC 1997).

The Mimi River estuary includes an extensive sandspit and has tidal mudflats, salt marsh and sand dunes, all of which are uncommon in North Taranaki (DOC 1997). A range of migratory and wading birds use this area. Mimi Estuary is identified in the RCPT and Draft Coastal Plan as an Area of Outstanding Coastal Value and an ONC area respectively. The abiotic natural character attributes of the estuary are described as very high in the Draft Coastal Plan, for providing a diverse and rare range of habitat types including riverine estuary, small tidal bays, estuary margins, and sandy foreshore and having unmodified natural processes including sand spit and dune processes and river mouth oscillation. The biotic natural character attributes of Mimi Estuary were also described in the Draft Coastal Plan as very high.

The marine ecological attributes identified in both the operative and draft regional coastal plans for this coastal management area include:

- Important habitats for a diverse range of resident and migratory birds including the 'Threatened (Nationally Vulnerable)' Northern New Zealand dotterel (Charadrius obscurus aquilonius, At Risk (Recovering)), Caspian tern (Hydroprogne caspia, Threatened (Nationally Vulnerable)) and red-billed gull (Larus novaehollandiae scopulinus, At Risk (Declining)).
- A well-established variety of mainly native plants on the south side of the estuary.
- Diverse and regionally distinctive native fish.
- Tidal mudflats, saltmarsh and sand dune habitat, uncommon in north Taranaki.
- Habitat of migratory and wading birds.
- Whitebait spawning area in upper estuary.
- Feeding ground for snapper (Pagarus auratus) and trevally.
- Nursery area for juvenile marine species and flounder.
- Blue penguin breeding site (periodic).

While the Waipingao River is not directly impacted by the Project, a description of the river mouth and estuary is included here for a complete description of the receiving coastline between the Mimi and Tongaporutu Rivers. There is very little information describing the marine ecological values of the estuarine reach of Waipingao River. The river is generally described as directly feeding into the intertidal area of the coast with little estuarine habitat (*pers. comm.* Greg White, Ngati Tama, August 2017). It is assumed that this area has habitat and marine species values similar to that described for the Tongaporutu and Mimi estuaries, albeit on a smaller scale given its smaller size. The estuarine reach of the river is included within the coastal management area between Pariokariwa Point and Waihi Beach identified in the RCPT and Draft Coastal Plan.

Overall, the estuaries are likely to provide spawning habitats and allow for the passage of diadromous species to the river catchments; therefore providing habitats in the coastal environment that are important during the vulnerable life stages of indigenous species, as identified in Policy 11 of NZCPS. They also support a range of wading and migratory birds, including At Risk species, and provide breeding sites for the blue penguin (see Section 3.8). Therefore, the estuarine habitats of the North Taranaki coast have high ecological value. However, the estuaries found in the vicinity of the Project receiving environment are typical of estuarine environments throughout the wider north western coastline.

Black and green lipped mussels, barnacles, chitons, limpets, periwinkles, snails, crabs, and sea lettuce live on the cliff faces, intertidal cliffs and inshore boulders of the neighbouring open coastline (DOC 1997). This type of intertidal community is characteristic of much of the shoreline within the wider North Island west coast area and is not considered to be of unique ecological or scientific value. Therefore, the ecological value of intertidal habitat is low.

3.4 Subtidal habitats and species

3.4.1 Subtidal reefs in Parininihi Marine Reserve

Gazetted in 2006, the Parininihi Marine Reserve is 1,800ha in size and extends along the Whitecliffs coastline (Sturgess 2015, DOC 1997). The seaward boundary is 3.7km out from Pukearuhe Beach, but excludes a coastal strip between Pariokariwa Point and a point 200m north of Waipingao Stream mouth, out to 750m offshore (Figure 3.5). This area gained reserve status based on its ecological values, whereby it encloses a typical slice of the North Taranaki marine environment, as well as the unique sponge gardens of a substantial inshore reef system, the Pariokariwa reef (Figure 3.6).

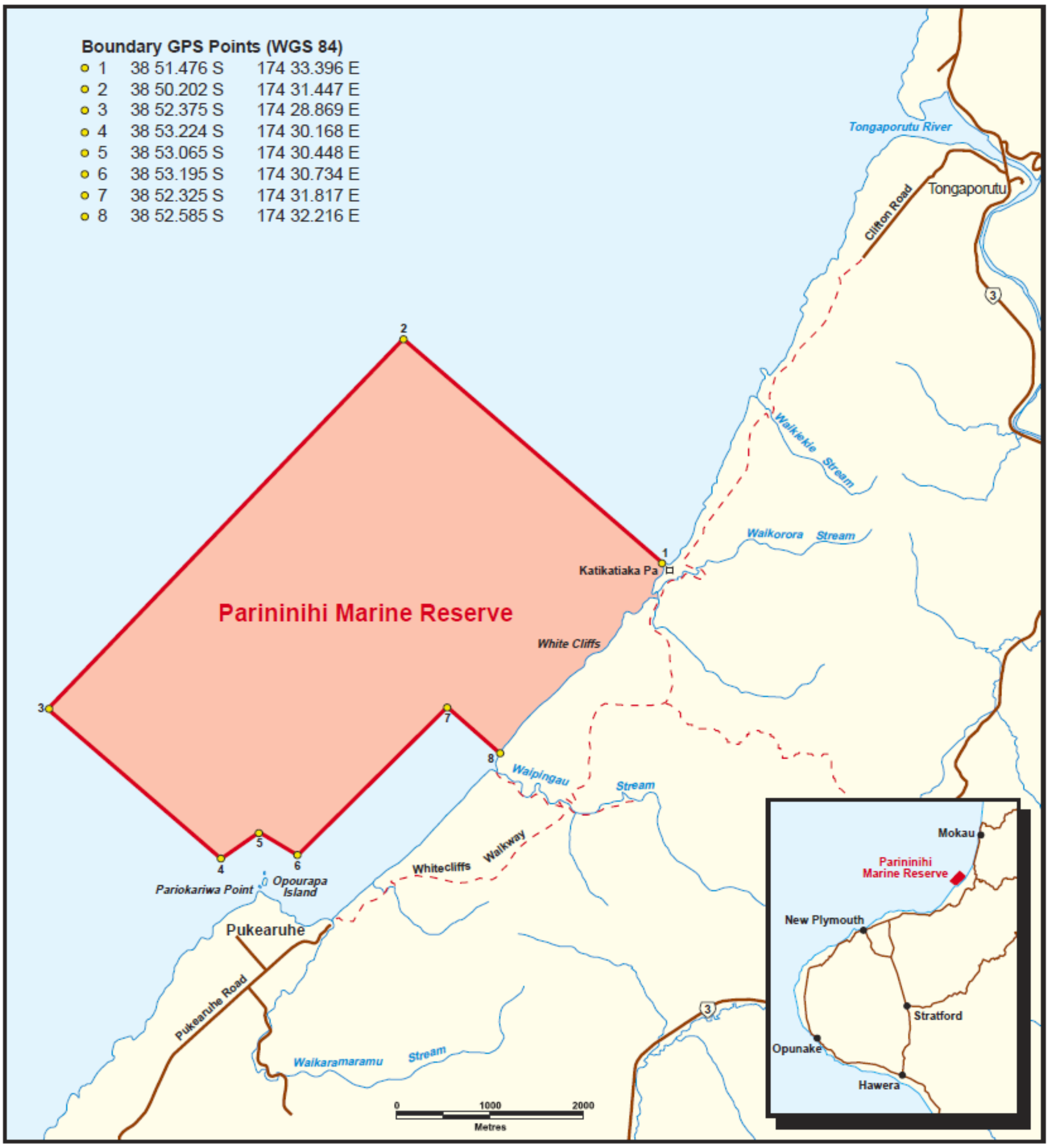

Figure 3.5: Map showing the location of Parininihi Marine Reserve on the North Taranaki coast (Source: DOC 2008).

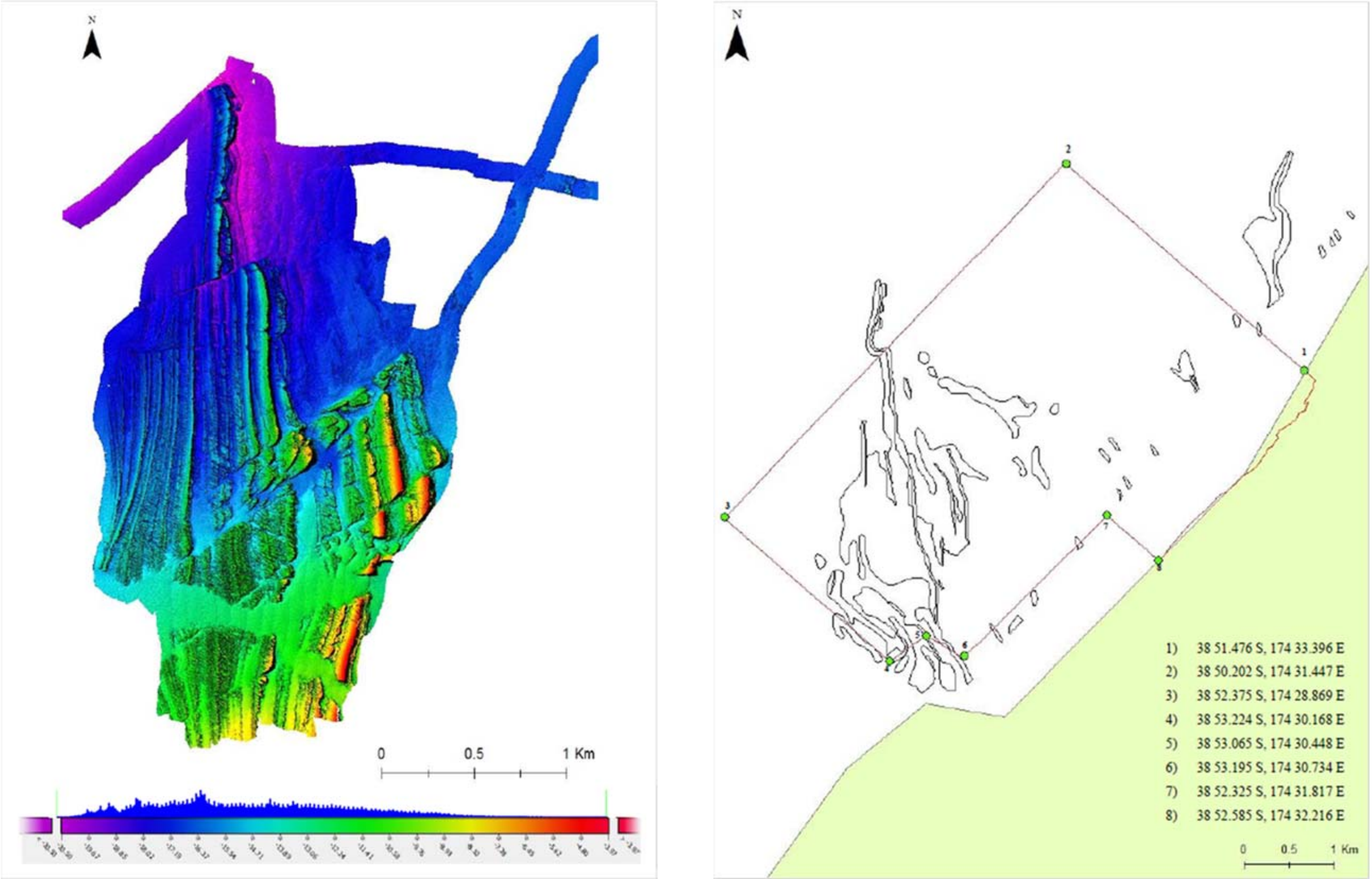

Figure 3.6: (left) Bathymetry of Pariokariwa reef from a multibeam echosounder survey in December 2014; and (right) charted map of Pariokariwa reef, within Parininihi Marine Reserve, produced through sidescan survey. The reef habitats are outlined in black and the reserve boundary coordinates are provided and outlined in red. (Source: Sturgess 2015).

The reef structure measures ~4.8km in length and 1.5km in width, and runs out from the coast in a north-east direction. It is relatively shallow ranging in depth from 4 to 20m, and its elevated structure allows biota to avoid the 'sand blasting' effects of moving seabed sediments. Three distinct benthic habitats were identified based on bathymetric data: sediment inundated reef; bedrock reef characterised by ridge tops, over hangs and under hangs; and mud and siltstone habitat (Sturgess 2015). The rocky morphology of Pariokariwa Reef provides important diverse habitats for reef fish and benthic species, while the sediment below the reef is inhabited by infaunal species.

This is one of the most diverse marine assemblages in the North Taranaki area, along with Epiha reef further to the north, including unusual and unidentified sponge species (Sturgess 2015, TRC 2004, DOC 1997). A preliminary survey conducted on Pariokariwa Reef by Battershill and Page (1996, in Sturgess 2015) indicated the reef system supports an unusually high biomass and diversity of sponges, some endemic to Pariokariwa Reef. Battershill and Page (1996, in Jones *et al.* 2016) described “remarkable densities” of Polymastia crassa that occupied up to 70% of the available surface, *Ecklonia* forests, and “Axinellid gardens” in 10-20m water depths where dense communities of finger sponges (*Raspailia* and *Axinella* spp.) and *Ancorina alata* were found. Three distinct habitats were identified on the reef: shallow boulder and rock outcrop reef; shallow boulder and rock outcrop sponge garden; and deep broken rock reef (Battershill & Page 1996 in Sturgess 2015).

An unpublished report by Smith (2007, in Sturgess 2015) described invertebrate diversity within the reserve and indicated that species richness was greater than 75% of sites found elsewhere in New Zealand. Seaweeds and encrusting marine animals, such as sponges, bryozoans, anemones, hydroids and ascidians are abundant along with crustaceans, shellfish and a large variety of fish (Sturgess 2015, DOC 1997). These dense assemblages cover about 75% of available reef surface and are among the densest and most diverse communities in New Zealand (TRC 2009).

Of the subtidal areas discussed, the Pariokariwa reef area of the North Taranaki shoreline was the most ecologically complex and varied. The ecological significance of this area is recognised in its legal status as a marine reserve and in the Draft Coastal Plan through its inclusion into an ONC area. The Draft Coastal Plan identifies this habitat as an extensive offshore reef system that is not found elsewhere along the North Taranaki coastline which contains internationally important sponge gardens, a high diversity of fish species and important habitat for crayfish and pāua. Therefore, this habitat has very high ecological value.

3.4.2 Soft sediment habitat

Outside of the reef structures, the dominant habitat type on the inner continental shelf is extensive sandflats (DOC 1997). The habitat here is more inhospitable and dynamic, where sand is continually transported offshore over a mudstone/sandstone base.

In depths less than 20m, a range of shellfish inhabit this habitat, including scallops (*Pecten novaezelandiae*), cockles (*Austrovenus stutchburyi*), tuatua (*Paphies subtriangulata*), pipi and green-lipped mussel and the bivalve *Dosinia anus* (DOC 1997, Fechney *et al.* 1990).

Hermit crabs, tube worms, hydroids, starfish, sand dollars, and heart urchins also characterise this inshore seafloor community. Isolated rocks and outcrops of mudstone, less than 1m above the level of sand flats, provide cover for mobile crustaceans and support growths of sponges, bryozoans and shellfish between storm events. Seaweed communities are limited in this area.

Subtidal benthic data is somewhat patchy in its availability. The New Zealand Oceanographic Institute collections from North Taranaki have been assessed several times, with specific communities determined using qualitative (McKnight 1974) and multivariate statistical (Grange 1991) community analyses. McKnight's (1974) qualitative study focussed on conspicuous species, mainly bivalves and echinoderms, and described several benthic communities that may still be present in this area, including the *Scalpomactra scalpellum – Maorimactra ordinaria* community, the *Nemocardium pulchellum – Pleuromeris zelandica* community, and the hermit crab community.

A further assessment of the samples was made to describe the biological communities in greater detail (Grange 1991). This later assessment was aimed at analysing the samples to determine species' associations that may be vulnerable to environmental disturbance by extractive activities. Grange (1991) described four communities were similar to those described previously by McKnight (1974). These communities included the *Paguristes – Pervicacia* community that occurred at all coastal stations in the southern part of the study area of the Taranaki Bight. This community was dominated by hermit crabs and snails that are adapted to inhabit unstable sediments as they are capable of rapid movement if disturbed. Some of the species found in this community are important food sources for demersal fishes. Grange (1991) regarded this community as having low to medium ecological value, and resilient to environmental disturbance as the sediments are continually and naturally moved by wave action.

TRC commissioned Cawthron Institute to provide a desktop investigation for the assessment of outstanding and sensitive substrates/benthic habitats and Threatened (and At Risk) marine taxa in the Taranaki coastal marine area (CMA) (Johnston 2016). There are no Threatened or At Risk species matches within the Taranaki CMA boundaries (Johnston 2016, Freeman *et al.* 2014, 2010).

Overall, the ecological value of subtidal habitat is low because no Threatened species are supported and the habitat is nationally and locally common habitat for benthic fauna.

3.5 Marine mammals

3.5.1 General

The compilation of full marine mammal species lists has relied heavily on stranding records maintained by the Museum of New Zealand since the latter part of the 19th century. The New Zealand Strandings Database records 17 species of large, medium and small whales having stranded singly or en masse between Wellington and Dargaville.

The species of marine mammals that may be found on the north-west coast, from Taranaki to Cape Reinga, are:

- New Zealand fur seal (Arctocephalus forsteri), resident, Not Threatened.
- New Zealand sea lion (Phocarctos hookeri), endemic, Threatened (Nationally Critical).
- Leopard seal (Hydrurga leptonyx), Non-resident Native (Vagrant).
- Blue whale (Balaenoptera musculus), Non-resident Native (Migrant), IUCN – Critically endangered.
- Right whale (Eubalaena australis), Threatened (Nationally Vulnerable).
- Humpback whale (Megaptera novaeangliae), Non-resident Native (Migrant).
- Orca (Orcinus orca), Threatened (Nationally Critical).
- Bottlenose dolphin (Tursiops truncatus), Threatened (Nationally Endangered).
- Common dolphin (Delphinus delphis), resident, Not Threatened.
- Dusky dolphin (Lagenorynchus obscurus), resident, Not threatened.
- Hector's dolphin (Cephalorynchus hectori hectori), endemic, Threatened (Nationally Endangered).
- Māui's dolphin (Cephalorynchus hectori maui), endemic, Threatened (Nationally Critical).

Information on the distribution of seals and cetaceans along the West Coast of the North Island is from DOC (2017a) and Baker et al. (2016).

Fur seals are distributed around all coasts of mainland New Zealand and offshore islands. The New Zealand sea lion is only likely to haulout on west coast North Island beaches in very low numbers as its primary haulout locations are in Otago and Southland. Leopard seals roam widely as juveniles and are seen on the New Zealand coast in the winter months of June to August.

Right whales will typically swim very close to shore, often inside the outer lines of breakers. Humpback whales pass through New Zealand waters as they travel between summer feeding grounds in high latitudes (Antarctica) and winter calving and breeding grounds in tropical or near tropical waters. They mainly travel along the east coast of the South Island and through Cook Strait during winter, and return along the west coast during spring. Blue whales, relatively rare but seen in increasing numbers around the New Zealand coast are generally found well offshore but occasionally will move inshore in pursuit of krill.

Orca are frequently seen along this coast, cruising close to shore in search of sting rays or fur seals upon which they feed. Bottlenose dolphins are seen periodically on the west coast of the North Island through the year, most often in late winter-early spring. Common dolphins are exceptionally abundant in the waters between Cape Egmont and Kaipara Harbour. Dusky dolphins are normally found in large groups over the shelf edge but will move inshore to feed.

3.5.2 Māui's and Hector's dolphin

Māui's dolphin is an endangered, endemic dolphin that is only found along the west coast of the North Island, generally distributed between Kawhia Harbour and as far south as New Plymouth (Figure 3.7; DuFresne 2010, TRC 2009). Maui's dolphin is classified as Threatened

(Nationally Critical) under the New Zealand Threat Classification System (Baker *et al.* 2016) and Critically Endangered on the IUCN Red List of Threatened Species (IUCN 2017).

Māui's dolphin has been classified as a subspecies that is distinct from the Hector's dolphin subspecies (*C. hectori hectori*) on the basis of morphological differentiation (skeletal characteristics) and genetic evidence (Baker at el. 2002, Pichler 2002). Hamner *et al.* (2012) used DNA profiles to estimate the abundance of Māui's dolphins to be approximately 55 individuals of ≥ 1 year old with 95% confidence limits of 48 and 69 individuals. Hamner *et al.* (2012) noted the movement of two female Hector's dolphins from the West Coast South Island population to the North Island. Therefore, there is the possibility of both Maui's and Hector's dolphins being present on the north western coast.

The extent of Māui's dolphin seaward distribution is not clearly defined. The best available information suggests that they are typically present within four nautical miles of shore but several sightings have been made of these animals further offshore on occasion (MPI & DOC 2012). Examination of location data in Hamner *et al.* (2012) showed that an individual dolphin travelled over a distance of approximately 80km in less than three weeks, with others moving up to 30km before being sampled again.

The southern extent of the Māui's dolphin population is uncertain however these dolphins have historically and recently been found in the Taranaki, Whanganui and Wellington regions (Figure 3.7; MPI & DOC 2012). A Māui's dolphin was videoed by a recreational fisherman off Waitara, Taranaki in 2010 (NZMSS 2010).

The North Taranaki coastline is included within the West Coast North Island Marine Mammal Sanctuary (DOC 2017). The sanctuary was established in 2008 as a part of the Hector's and Māui's Dolphin Threat Management Plan (Threat Management Plan) (MPI & DOC 2012), placing restrictions on seabed mining activities and acoustic seismic survey work. The sanctuary extends between Maunganui Bluff in the north and Oakura in the south, and offshore to twelve nautical miles. It is approximately 1,200,086 ha in area and covers 2,164km of coastline. In 2013, this was extended to prohibit commercial and recreational set net fishing between 2 and 7nm offshore between Pariokariwa Point and the Waiwhakaiho River based on recommendations after a review of the Threat Management Plan (MPI & DOC 2012). The extension area covers 350km^2.

The marine receiving environments for the Project are within the habitat range of Nationally Threatened species including Maui's and Hector's dolphins, therefore the marine mammal ecological value is very high. However, these species are known to range from Kaipara Harbour to Mount Taranaki and possibly further south, meaning that the majority of the north western coastline is of high ecological value for these species.

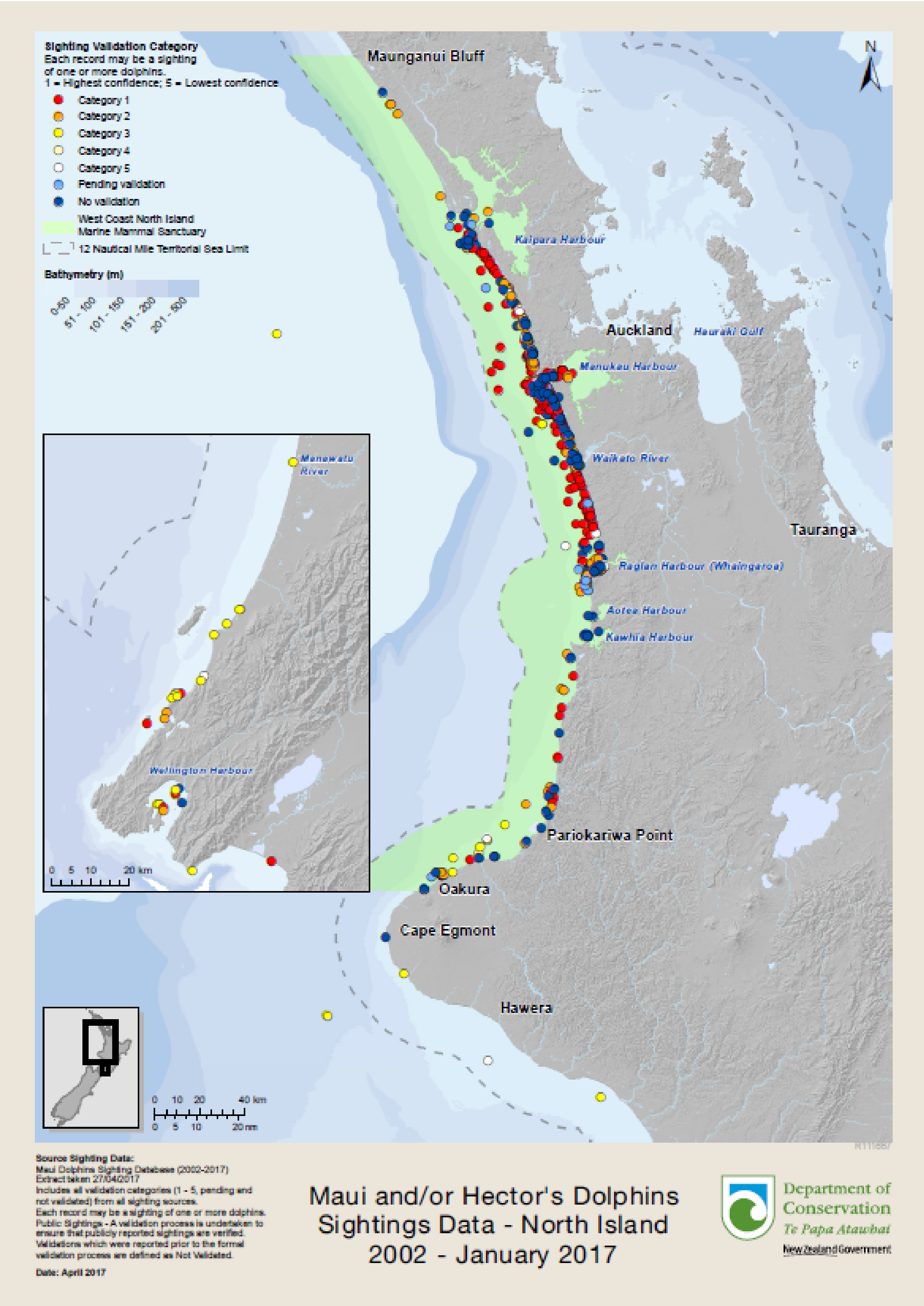

Figure 3.7: Māui's and/or Hector's dolphin sightings data for the North Island, 2002-2017 (Source: DOC 2017b).

3.6 Fish

The most abundant fish species on the west coast of the North Island include john dory (*Zeus faber*), snapper, jack mackerel, kahawai, leatherjacket (*Parika scaber*), rig (*Mustelus lenticulatus*), school shark (*Galeorhinus galeus*), skipjack tuna (*Katsuwonus pelamis*), spiny dogfish (*Squalus acanthias*), tarakihi (*Nemadactylus macropterus*) and trevally (NABIS 2017, Bagley *et al*. 2000, Anderson *et al*. 1998).

This part of the north Taranaki coastline falls within the Central West (FMA 8) fishery region (MPI 2017). The region can be divided into three main areas: the shallow-shelving, sandy beaches of the south; the mixed beaches/rock platforms of the Taranaki Bight; and the seacliffs and beaches of North Taranaki (which includes the marine environment adjacent to the Project). Despite its weather limitations, the region supports valued customary and recreational fisheries and valuable inshore commercial fisheries (MPI 2017). The iconic species for the region are trevally, gurnard and flatfish. The Central West Region supports a mixed trawl fishery for snapper, gurnard, tarakihi, trevally and white warehou. There is also commercial set netting for rig and school shark, longlining for snapper and potting for rock lobster. Figure 3.8 provides the most recent data on the fish species caught commercially in the Central West fisheries region (MPI 2017).

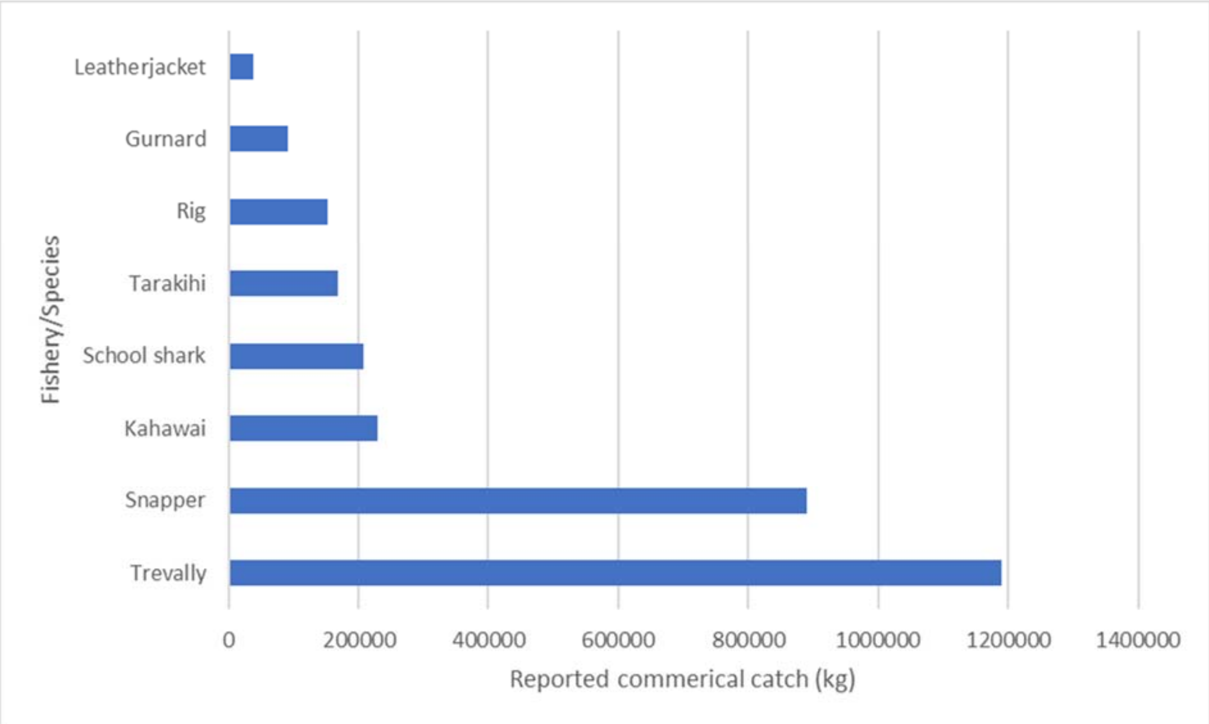

Figure 3.8: The reported commercial catch for marine fisheries that include the Central West (FMA8) fisheries region from 1 April 2016 to 31 march 2017. Note that trevally and leatherjacket catch data includes records for fisheries regions that extend further than FMA8. (Source: MPI 2017).

There is a subtidal area on the North Taranaki Bight that has been closed to commercial trawling under the Fisheries (Central Area Commercial Fishing) Regulations 1986 (clause 6A) as it was identified as a nursery area for juvenile snapper (DOC 1997, CRI 1990). The closed area is the waters of Urenui Bay lying inside a straight line from Airedale Reef (at 174°14.5′E and 38°59′S) to the Tongaporutu River mouth (at 38°48.98′S and 174°35.23′E). The greatest densities of snapper were found within the 0-25m depth stratum (Horn 1986). Commercial trawling and set netting is also prohibited under the same legislation along the northern Taranaki coastline from Tirau Point (approximately 38km north of Mokotino) to Pariokariwa Point and out to two and seven nautical miles (respectively) from the mean high water mark. Danish seining is prohibited from Tirau Point south out to three nautical miles.

The expansive Pariokariwa reef and surrounding sand and mud areas are home to a variety of fish species, such as blue cod (*Parapercis colias*), blue moki (*Latridopsis ciliaris*), red moki (*Cheilodactylus spectabilis*), gurnard (*Chelidonichthys kumu*), john dory, leatherjacket, kahawai, red cod (*Pseudophycis bachus*), tarakihi, trevally and snapper, as well as rock lobster/crayfish (*Jasus edwardsii*) populations (TRC 2009).

Great white sharks (*Carcharodon carcharias*) occur throughout Taranaki and are fully protected in New Zealand waters under the Wildlife Act 1953. It is illegal to hunt, kill or harm them within the 200nm limit of the Economic Exclusion Zone (EEZ). The ecological values associated with fisheries is moderate owing to the occasional presence of great white sharks and the protected spawning area which provides locally important ecosystem services.

3.7 Kaimoana

Mr Greg White of Ngati Tama (pers. comm. August 2017) provided an historic overview of the kaimoana resources along the coastline to the north and south of the Waipingao River mouth and parts of the Pariokawira reef system which is now within Parininihi Marine Reserve. This part of the coast was the focus for kaimoana harvesting due to the ease of access.

Mr White preceded his description of kaimoana resources by commenting that the conditions of the coast had changed notably over the past 50-60 years; specifically notable was the absence of seaweed (and attached fauna) which was once prevalent when washed up on the beach. Green-lipped mussels remain the predominant kaimoana species and appear to follow a periodic (c.10 year) cycle of high abundance and very low abundance, appearing as 'mats' covering the available rocky surfaces. Pāua (*Haliotis* sp.) and kina (*Evechinus chloroticus*) are now scarce. Rori or sea cucumber (*Australosticopus mollis*) was once reasonably plentiful but have not been seen for some time. Pūpū or cat's eye (*Turbo smaragdus*) and the pink anemone (likely to be kotore moana or wandering anemone, *Phlyctenactis tuberculosa*) are harvested occasionally. The red and purple rock crabs (*Guinusia chabrus* and *Leptograpsus variegatus* respectively) are collected from rocky habitat and area also a food resource for coastal sharks. Pipi were collected long ago from further south towards the Mimi River mouth. It is not known whether pipi still remain in harvestable amounts in this area as it is not a common or regular resource collected for kaimoana, with greater preference for pāua, kina, pūpū and crabs.

This description of kaimoana is similar to the findings of the only public, published survey on the kaimoana of North Taranaki which was carried out in 2000-2001 as a collaboration between Fletcher Challenge Energy, Otaraua Hapu, Ngati Rahiri, Ngati Matunga and TRC (FCE 2001). That report covered the coastline approximately between Waiongana River (between Bell Block and Waitara) and the Mimi River. The ecological value of kaimoana resources is moderate as they provide locally important ecosystem services.

3.8 Seabirds

Recent seabird sightings at Tongaporutu estuary included (eBird 2017, Robertson *et al.* 2016):

- Variable oystercatcher (*Haematopus unicolor*) - At Risk (Recovering);
- Spur-winged plover (*Vanellus miles novaehollandiae*) - Not Threatened;
- Red-billed gull (*Larus novaehollandiae scopulinus*) - At Risk (Declining);
- Southern black backed gull (*Larus dominicanus dominicanus*) - Not Threatened; and
- White-fronted tern (*Sterna striata striata*) - At Risk (Declining)

Other seabird likely to be encountered on the North Taranaki coast include fluttering shearwaters which breed on the cliffs and blue penguins which burrow near stream mouths and estuaries (TRC 2004, DOC 1997). The Draft Coastal Plan describes the coastline between Pariokariwa Point and Mokau River as containing important habitats for Northern New Zealand dotterel, Caspian tern and red-billed gull. The Coastal Resource Inventory describes the estuaries of the North Taranaki coast as supporting diverse wildlife populations such as spotless crake (*Porzana tabuensis tabuensis*, At Risk (Declining)), North Island fernbird (*Bowdleria punctata vealeae*, At Risk (Declining)) and Australasian bittern (*Botaurus poiciloptilus*, Threatened (Nationally Critical)) (Fechney *et al.* 1990). Dune adjacent to the Mimi estuary provide nesting areas for Caspian tern and fluttering shearwater (Fechney *et al.* 1990). The ecological value of seabird populations in the marine receiving environment of the Project is moderate given the recent sightings in Tongaporutu Estuary and known inhabitants of the open coast which include At Risk seabird species; however, these species are not restricted to these habitats and likely utilise other estuaries and coastal area along the west coast of the North Island.

4 Assessment of effects on marine ecology values

In the absence of efforts to avoid, remedy or mitigate adverse ecological effects, the potential effects on marine ecological values come primarily from indirect, short term effects during construction relating to sedimentation. Erosion and sedimentation after vegetation clearance and earthworks in the upper reaches of streams could result in suspended sediment travelling down freshwater streams and rivers to the marine coastal environment.

It would also be possible, in the absence of mitigation, for construction materials and contaminants to impact on the marine environment because of spillage into freshwater catchments.

Finally, the potential operational effect of the proposed route on marine ecological values, without any mitigation, is the potential increase in stormwater and road-generated contaminants entering freshwater systems that flow to the marine receiving environment.

The likelihood (or risk) and magnitude of these effects occurring and the potential level of effects on marine receiving environments relevant to the Project are discussed as follows. Again, it is important to note that the effects discussed in this section will in fact be addressed through mitigation measures, as discussed later in the report.

4.1 Marine ecology values assessment

Step 1 of the EcIA guidelines requires ecological values to be assessed and ranked. As defined by Table 4.1below, marine ecology values within the Project's marine receiving environment range from 'low' for intertidal habitat to very high for the Parininihi Marine Reserve and Māui's dolphin.

Table 4.1 – Assignment of values within the marine receiving environment to species, vegetation and habitats (adapted from EIANZ, 2015)

Habitat/Species	Value	Comments
Estuarine habitat	High	Provides habitat for Nationally At Risk blue penguin, Caspian tern and red-billed gull and possibly the Nationally Threatened Northern New Zealand dotterel; however these species are not restricted to these habitats and likely utilise other estuaries along the west coast of the North Island. The criteria met under Policy 11 of the NZCPS include the potential presence of At Risk indigenous fauna and habitats in the coastal environment that are important during the vulnerable life stages of indigenous species (ie, snapper spawning and diadromous fish migration).

Habitat/Species	Value	Comments
Intertidal habitat	Low	This is a nationally and locally common habitat characteristic of much of the shoreline within the wider North Island west coast area and is not ecologically unique. Habitat does not support nationally Threatened, At Risk or locally uncommon or rare species.
Subtidal reef habitat (Parininihi Marine Reserve)	Very high	Meets most of the ecological significance criteria as set out in operative RCPT and Draft Coastal Plan for outstanding value. The criteria met under Policy 11 of the NZCPS includes an area set aside for full or partial protection of indigenous biological diversity and containing nationally significant examples of indigenous community types. This habitat potentially includes nationally rare or uncommon, or unidentified sponge species.
Soft sediment habitat	Low	Habitat type does not support Threatened species and is nationally and locally common habitat found throughout a large proportion of the west coast of the North Island. .
Marine mammals	Very high	Marine receiving environments for the Project are within the habitat range of Nationally Threatened species including Maui's and Hector's dolphins; however, these species are known to range from Kaipara Harbour to Mount Taranaki and possibly further south. Therefore, the majority of the north-western coast is of very high marine habitat value. Other Threatened and At Risk marine mammals may visit the area but no notable haulout, feeding or breeding sites have been recorded.
Fish	Moderate	The inshore coastal receiving environment for the Project includes areas protected from commercial fishing and is known to be important during the vulnerable life stages of snapper. These species are not threatened, locally uncommon or rare and their habitat is nationally and locally common throughout the EEZ but the protected spawning area provides locally important ecosystem services. Coastal fisheries also include the protected great white shark.

Habitat/Species	Value	Comments
Kaimoana	Moderate	Recreational kaimoana gathering is known to occur within the receiving environment of the Project. Therefore, these resources provide locally important ecosystem services.
Seabirds	Moderate	Recent sightings in Tongaporutu Estuary and known inhabitants of the open coast include At Risk seabird species; however, these species are not restricted to these habitats and likely utilise other estuaries and coastal area along the west coast of the North Island.

4.2 Magnitude of effects assessment

4.2.1 Overview

Step 2 of the EcIA guidelines requires an evaluation of the magnitude of effects on ecological values based on footprint size, intensity and duration.

The Mangapepeke Stream tributary is the largest of the streams potentially affected by the Project, as the proposed route runs along the south-eastern side of the stream following the valley path. This route crosses several minor tributaries and the upper reaches of the main Mangapepeke Stream tributary. The proposed route then crosses the upper reaches of Mimi River and several tributaries, running along the north-eastern side of the river. The Waipingao Stream will not be impacted by the proposed route option.

Suspended sediment travelling down the Mimi River and Mangapepeke Stream systems would enter the marine coastal environment at the Mimi River mouth between Urenui and Pariokariwa Point and at the Tongaporutu River estuary to the north of the Whitecliffs, of which Mangapepeke Stream is a tributary.

Without any mitigation measures in place, the degree to which the marine ecological values may be adversely affected is dependent upon how much, and how far, suspended sediment would travel from the Project. The Project is a significant distance from the coastal marine area: 9.2km stream distance from the Tongaporutu River mouth and 21.5km stream distance from the Mimi Stream mouth. In addition, the large size of the wider catchments demonstrate the very small footprint of the Project within the context of the overall marine environment. This is shown in Table 4.2. The Waipingao catchment is not included in this assessment because the Project footprint does not impact on that catchment.

The potential sediment yield from uncontrolled erosion and sedimentation from the Project has not been modelled because there was considered to be minimal value in completing Universal Soil Loss Equation (USLE) calculations for the Construction Water Assessment Report (Technical Report 14, Volume 3 of the AEE) (Construction Water Assessment Report).

Table 4.2 – Project earthwork catchment areas and potential sediment yield (adapted from MMA 2017a).

Catchment	Project earthworks (ha)	Catchment area (ha)	Project % of catchment area	Potential “natural” sediment yield for catchment (tonnes)	Potential sediment yield from earthworks (tonnes)
Tongaporutu Catchment	24.6	21,237	0.12%	167,770	1207
Mimi Catchment	11.4	13,235	0.09%	104,550	560

However, baseline monitoring and visual assessments undertaken for the Project, as reported in the Construction Water Assessment Report, have confirmed that the catchment areas are subject to significant “natural” sediment yields in the absence of the Project. Sediment yields that may result from the Project have been estimated in the Construction Water Assessment Report based on data from a similar project and is shown in Table 4.2. There is expected to be only a small increase of up to approximately 0.7% for each catchment overall.

A comprehensive approach to sediment control is proposed, as set out in the Construction Water Assessment Report. This is based on well-established and tested methods that have been used successfully on numerous other State Highway and other infrastructure projects in New Zealand. The following is a discussion of potential effects from sedimentation on the marine environment, in the extremely unlikely event that the proposed controls fail for any reason. This is the worst-case scenario and is a conservative approach for this assessment.

During construction, it is also possible for construction materials and contaminants to impact on the marine environment because of spillage into river systems. This impact could include leakage of material such as grout, oil or other fluids into the rivers. However, the potential for this to occur even without measures in place to prevent such spills, and for contaminants to reach the marine environment in significant concentrations, is very low given that works will be carried out to manage discharges to receiving streams (refer Technical Report 13).

In the absence of mitigation measures, the ongoing use of new roading infrastructure has the potential to generate an increased amount of stormwater and road-generated contaminant load if there is an increase in the impervious area. The Project will increase the amount of impervious surface area in both the Mangapepeke Stream and Mimi River catchments, but in absolute terms the amount of impervious area will remain very low (refer to the Assessment of Ecological Effects – Freshwater Ecology(Technical Report 7b, Volume 3 of the AEE)). Therefore, the potential for increases in runoff contaminant concentrations reaching the marine environment is very low.

4.2.2 Effects on estuarine and intertidal habitats

The estuarine areas of the Tongaporutu and Mimi Rivers would be the immediate marine receiving environments for any suspended sediments travelling from upstream as a result of uncontrolled construction activity. There is no available data on the hydrodynamic conditions within these estuaries to determine the fate of suspended sediment but, given the low-energy, depositional nature of these environments, it is assumed that some degree of sediment deposition could occur. Therefore, there is the potential for estuarine habitats and benthic fauna to be buried by sediment deposition. High suspended sediment levels may also impact on filter feeding organisms by reducing their feeding efficiency. Given that the increase in sediment yield from Project-related activities is predicted to be very small (0.3 % increase as described above), the probability of high levels of suspended sediment reaching the receiving marine environment is low. However, should significant sediment loads reach the estuaries, the ability of estuarine fauna to recover from sedimentation impacts is discussed below.

Maurer *et al.* (1986, 1982, 1981, 1980) examined the ability of invertebrates to migrate to survive burial, showing that the process of recovery can commence immediately after or even during the disturbance. Estuarine and coastal benthos can typically burrow up through deposited sediment many centimetres thick (Palermo *et al.* 1990). Roberts (1990) indicated that some mobile New Zealand benthic species can migrate through at least 8cm of sediment. Hinchey *et al.* (2006) found that more motile, rapid burrowing infauna had greater survival after an acute burial event than did sedentary infauna species. Specifically, amphipods and bivalve molluscs are generally highly adapted for a burrowing lifestyle and exoskeletons or shells serve to protect the soft internal tissues from damage (Hinchey *et al.* 2006). Estuarine filter feeders are also known to tolerate short-duration, high turbidity events such as those occurring naturally during storms and high river flows, when high suspended solids in run-off and wave resuspension of marine sediments may both contribute. More recent research undertaken in New Zealand on the tolerance of marine invertebrate to total suspended sediment (TSS) is laboratory-based but indicates that sensitive organisms such as horse mussel (*Atrina zelandica*), pipi and a tubeworm (*Boccardia syrtis*) suffer sublethal effects after three or more days exposure to TSS concentrations around 75-80 mg/kg while cockles may be able to tolerate concentrations of up to 400 mg/kg for up to 14 days (Nicholls *et al.* 2003, Ellis *et al.* 2002, Hewitt *et al.* 2001). Hinchey *et al.* (2006) concluded that some benthic species exhibit mechanical and possibly physiological adaptations that allow them to survive deposition events of the magnitude commonly encountered in estuarine environments, and that some juveniles were highly tolerant of burial by sediment.

Therefore, the estuarine soft-sediment communities are expected to be generally tolerant of short-term turbidity and sediment deposition. It is expected that the magnitude of the effect of uncontrolled erosion and sedimentation on estuarine habitat would be very low. In the absence of the proposed erosion and sediment controls, the level of effect of the Project on estuarine habitat would be low (applying Step 3 of the EIANZ guidelines).

Even without erosion and sediment control, the likelihood for the deposition of suspended sediments in intertidal coastal habitats is low given the high-energy conditions of the coastline. The magnitude of effects on intertidal habitats is expected to be negligible resulting in very slight change from the existing baseline conditions. Applying Step 3 of the EIANZ guidelines, the level of effect on intertidal habitat would be very low and limited to the duration of Project construction.

4.2.3 Effects on subtidal reefs in Parininihi Marine Reserve

The proposed route will not affect the Waipingao Stream, which leads directly to the coastline of the Parininihi Marine Reserve. Therefore, if any suspended sediment were to reach the subtidal reef, given the typical sediment transport processes that are known to exist in the area, it would likely be via northerly alongshore transport of sediment exiting the Mimi River, travelling over a distance of 10km. Given this distance and the high energy oceanic conditions, as described in Section 3.1, the potential for high volumes of terrestrial sediment from Project-related uncontrolled erosion and sedimentation reaching the reef is low.

Moreover, the shallow water levels on the reef during low tide and storms, mean surface currents reach the reef bed and uplift sediment, transporting it away from the reef (ie, the reef is not a depositional area during low tide or storm conditions) (Sturgess 2015). This process would further disperse any Project-related sediment in the unlikely event that it should reach the reef in significantly adverse quantities. Therefore, even in the absence of any erosion and sediment controls, the likelihood of significant, adverse suspended sediment loads resulting from Project activities reaching and settling on the Pariokariwa reef is very low.

In addition, Sturgess (2015) described the ecologically significant sponge fauna of the reef as being tolerant of some degree of smothering by fine grain sediment. Photographs of the sponges on Pariokariwa reef showed them being heavily covered in fine grain sediments, and Sturgess (2015) suggested that the local sponge communities may have adapted to surviving turbid conditions, and are therefore likely to continue to survive in this environment. Most sponge species can tolerate fine to medium grained sediments if the sediment layer is less than 1cm in depth (Sturgess 2015).

Even in the unlikely event of sediment release during construction, the magnitude of effects on the subtidal reef habitat in Parininihi Marine Reserve would be expected to be negligible given the known sediment transport processes. Therefore, the overall level of effects would be low under the EcIA effects assessment scheme, and of a short duration during construction. This is without taking into account the proposed erosion and sediment controls.

4.2.4 Effects on soft sediment subtidal habitats

Declining water clarity and increased turbidity, associated with suspended sediments, is closely linked to the declining health of benthic marine ecosystems because fine-grained sediments are prone to smothering and killing small marine infauna and settling propagules. However, as for estuarine species, subtidal benthic fauna have the ability to respond to, and survive, burial and smothering from deposited sediments (see Section 4.2.2). Furthermore, the coastal habitats in the North Taranaki area are ‘exposed’ in terms of prevailing weather and, as a consequence, the regions' coastal ecosystems represent a robust community of organisms. The high energy hydrodynamic conditions on the coast would also act to rapidly disperse terrigenous sediment throughout the subtidal inner shelf (see Section 3.1). The magnitude of effect on subtidal soft sediment habitats would be expected to be negligible, therefore the overall level of effects under the EIANZ scheme would be very low and for a short duration during construction.

4.2.5 Effects on marine mammals

The potential effects on marine mammals, particularly Māui's dolphin which venture relatively close to shore, is from interference with their respiratory and feeding functions from suspended sediment. As described in the preceding sections, the high energy hydrodynamic conditions on the coast would act to rapidly disperse terrigenous sediment throughout the subtidal inner shelf. Furthermore, given the low population abundance and extensive west coast range of Maui's dolphin, the likelihood of an animal encountering significant, adverse sediment loads from Project activities is low. Therefore, if there were not erosion and sediment controls proposed for the Project, the magnitude of effect on marine mammals would be expected to be negligible, and the overall level of effects would be low.

4.2.6 Effects on fish

The potential effects on fish is from interference with their physiological functions from suspended sediment and potential impacts on benthic food resources. As described in the preceding sections, the high energy hydrodynamic conditions on the coast would act to rapidly disperse terrigenous sediment throughout the subtidal inner shelf. Further, the level of effect on subtidal habitats and benthos is expected to be very low. The extensive populations and range of fisheries on the west coast of the North Island also means that the potential risk to fish populations from Project-related sedimentation is negligible. Based on this level of risk, there would be no overall effect on fish.

4.2.7 Effects on kaimoana

Even without erosion and sediment control, the likelihood for the deposition of suspended sediments in intertidal and shallow subtidal environments inhabited by kaimoana is low given the high-energy conditions of the coastline. The magnitude of effects on kaimoana is expected to be negligible resulting in a very slight change from the existing baseline conditions. Therefore, the level of effect on kaimoana would be very low and limited to the duration of Project construction.

4.2.8 Effects on seabirds

In the absence of controls, effects on seabirds would potentially arise due to degradation of feeding habitat values or diminished food resources. As per Section 4.2.2, the expected level of effect on estuarine habitats which support significant seabird species would be low. Further, these are expected to be short-term effects, which mobile bird species could avoid by utilising available feeding habitat throughout the region. Therefore, the magnitude of effect on seabirds would be negligible and there will be no effect on seabirds from sedimentation.

Should a contaminant spill occur in such significant amounts as to reach the marine environment, a spill of any oil-based material would have the potential to affect birds more than other taxa due to the surface nature of an oil spill. However, the potential for such large amounts of oil (or other construction contaminants) to be used on site and to reach the marine environment is low, with any risk limited to the duration of construction.

4.2.9 Summary

Table 4.3 provides a summary of the ecological value (Step 1), magnitude of effects (Step 1), and level of effects (Step 3) for each of the marine ecological values identified for the marine receiving environment of the Project.

Table 4.3 – Ecological values, magnitude of effects and level of effects for the marine receiving environment of the Project.

Habitat/Species	Ecological Value	Magnitude of Effect	Level of Effect
Estuarine habitat	High	Very low	Low
Intertidal habitat	Low	Negligible	Very low
Subtidal reef habitat (Parininihi Marine Reserve)	Very high	Negligible	Low
Soft sediment habitat	Low	Negligible	Very low
Marine mammals	Very high	Negligible	Low
Fish	Moderate	Negligible	No ecological effect
Kaimoana	Moderate	Negligible	Very low
Seabirds	Moderate	Negligible	No ecological effect

5 Recommendations for addressing potential adverse effects

5.1 Recommendations for avoiding or minimising potential adverse effects

The level of effects described in Section 4 for marine ecological values was assessed in the absence of efforts to avoid, remedy or mitigate adverse ecological effects. However, erosion and sediment control measures are proposed as a key component of the Project to avoid adverse ecological effects as described in the Construction Water Assessment Report (Technical Report 14, Volume 3 of the AEE).

Erosion control is based on the practical prevention of sediment generation in the first instance. If erosion control measures and practices are effective, then sediment generation will be minimised and the primary reliance on the sediment control measures is reduced. Sediment control refers to management of the sediment after it has been generated. It is inevitable that some sediment will be generated through land disturbance activities even with best practice erosion control measures in place. Sediment control measures are designed to capture this sediment and to minimise any resultant sediment-laden discharges to waterways. A primary sediment control measure that will be utilised on the Project is sediment retention ponds.

Prior to any land-disturbing activities occurring, erosion and sediment control measures will be installed to minimise potential adverse effects by achieving industry best practice. The NZTA Erosion and Sediment Control Guidelines for State Highway Infrastructure, Construction Stormwater Management (dated September 2014) (NZTA Guideline) have been considered in the design of the erosion and sediment control measures and is considered the default guideline. “Best Practice” will however apply throughout to reflect site conditions.

The erosion and sediment control measures are sufficient to keep suspended sediment levels reaching the marine environment, within the known tolerances of marine fauna to total suspended solid concentrations and to burial by deposited sediments (as described in Section 4). For instance, it is considered highly unlikely that more than 1cm of suspended sediment (refer paragraph 2 in Section 4.2.3) would be deposited or accumulate on the sponge garden at Parininihi Marine Reserve as a result of Project activities.

Given that the level of overall effects on most marine ecological values is expected to be low to no ecological effect in the absence of construction water management measures, the implementation of best practice sediment and control measures is expected to reduce the expected level of effects to negligible. Overall, the life-supporting capacity of marine ecosystems will be maintained through the efforts of best practice erosion and sediment control measures.

5.2 Recommendations for addressing adverse residual effects that cannot be avoided or minimised

Monitoring of the marine environment is not proposed given that the Project is expected to have no measurable effects on marine ecological values.

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