Pakiri Mid-Shore Sand Extraction

Assessment of Effects on the Environment

IZ111900-NP-RPT-0003 | Issue 0

November 2020

McCallum Brothers Limited

Pakiri Offshore Sand Extraction

Project No:	IZ111900
Document Title:	Assessment of Effects on the Environment
Document No.:	IZ111900-NP-RPT-0003
Revision:	Issue 0
Document Status:	Final
Date:	November 2020
Client Name:	McCallum Brothers Limited
Project Manager:	Anthony Kubale
Author:	Tim Hegarty
File Name:	J:\IE\Projects\02_New Zealand\IZ111900\21 Deliverables\AEE - New Area\Pakiri Mid-Shore AEE November 2020 Lodgement Version.docx

Jacobs New Zealand Limited

Carlaw Park
12-16 Nicholls Lane, Parnell
Auckland 1010
PO Box 9806, Newmarket
Auckland 1149
New Zealand
T +64 9 928 5500
F +64 9 928 5501
www.jacobs.com

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
A	29/06/20	Draft for client review	Tim Hegarty	Anthony Kubale	Andrew Henderson	Bruce Clarke
B	26/08/2020	Updated following Client Review	Tim Hegarty	Anthony Kubale	Andrew Henderson	Bruce Clarke
Issue 0	18/11/2020	Updated following completion of supporting technical reports	Tim Hegarty	Derek Todd	Andrew Henderson	Bruce Clarke

Contents

Executive Summary

McCallum Brothers Limited (MBL) seek resource consent under sections 12 and 15 of the Resource Management Act 1991 (RMA) to undertake the extraction of sand from a mid-shore area between the 15 and 25 m chart datum depth contours at the Pakiri and Te Arai Beaches (Figure 1-1). This extraction area (known as the new extraction area) is planned to replace MBL's existing extraction area, which is located within the inshore area of both beaches. The area sought by this application is located further offshore and is outside any of the landscape or ecological overlays present in the Auckland Unitary Plan (Operative in Part) (AUP(OP)).

MBL seek the following extraction rate for a 35-year period:

- An annual average rate of 125,000 m^3/year over any consecutive 5 year period and a maximum rate of 150,000 m^3 over any 12-month period, with the temporal distribution of the extraction volume being limited to a maximum of 15,000 m^3 over any consecutive 30 day period and to be spatially balanced between a series of extraction cells located along the beach and between the 15 and 25 m depth contours.

In addition, resource consent is sought for the discharge of sediment, seawater and biota into the coastal marine area (CMA) from the extraction vessel, with this material resulting from disturbance of the local seabed and being separated from the required sand resource.

The sand resource at Pakiri is of regional importance to Auckland given its critical role for concrete production and ease of transport to urban Auckland via sea vessels to the Port of Auckland. Currently, operations at Pakiri supply at least 43% of the sand used to manufacture concrete in Auckland. With the projected population growth and quality compact form[1] planned by Auckland Council, concrete will be of increasing importance as a building material. Without continued access to this resource, Auckland will be reliant on sand resources which are of lower quality due to their chemical composition and/or are a greater distance away from Auckland.

These other sand resources located at the Kaipara Harbour, Tomorata and in the Waikato Region require long distance road transport to the market, causing road congestion, increased risk of traffic accidents and increased greenhouse gas emissions. Of these sands, the Waikato sourced aggregates are also not favoured in Auckland due to the increased risk of alkali silica reaction and the higher proportion of cement required to reach target strength. As such, these other sand sources generate additional greenhouse gas emissions in the order of 1,304 tonnes of CO_2 per annum and at least an additional 2.3 million km of incremental truck movements. These factors also increase the cost of sand sourced from these other locations and consequently the cost of concrete production, thereby affecting the affordability of building Auckland's new homes and infrastructure. These impacts are further detailed by Market Economics in the economic assessment provided with this application.

A range of technical assessments have been commissioned which demonstrate that the extraction activity will have no more than minor adverse effects on the environment, including effects on benthic ecology, marine mammals, avifauna, water quality, landscape values, cultural values and coastal processes.

The activity also has limited effects on local water quality. The discharge is limited to material extracted from the seabed and is currently returned to coastal waters via moon pools on the extraction vessel. As such, it only contains sediment and biota removed from the seabed, with sediment testing finding no contaminants of concern at levels above natural background. Furthermore, the sediment plume from the extraction vessel rapidly disperses, thereby avoiding any significant effects throughout the water column or on landscape values.

MBL have also engaged with mana whenua to ensure that cultural values and effects are addressed. The cultural values associated with the landscape, kaimoana, other taonga and the mauri of coastal waters have all been considered, with any significant effects avoided. In addition, Cultural Values Assessments (CVAs) have been sought from local iwi.

[1] The "quality compact" form refers to the urban growth model of the Auckland Plan 2050 and the AUP(OP). It is based on 70% of new housing being accommodated within existing urban areas, with the remaining 30% provided in greenfield areas and coastal/rural settlements.

The activity avoids effects on landscape values, in part due to its temporary nature and the change to more night-time and weekday timed operations. In addition, the rapid dissipation of the sediment plume assists in minimizing visual effects, while the lack of erosion effects avoids any impacts on the landward dune system or surf breaks. Lastly, it is noted that the activity does not require any onshore facilities at Pakiri and will be located further offshore than the existing extraction areas, further avoiding onshore effects.

The commissioning of the William Fraser in late 2019 has significantly improved the environmental performance of the extraction activity given the speed by which it can extract and process sand, its low emission engines, an electric pump, its increased storage capacity and discharge method below its keel. Operationally, the introduction of an altered extraction schedule, which focuses extraction activities during night-time hours, has also assisted in reducing any adverse effects from the activity.

The proposed extraction activity requires resource consent under sections 12 and 15 of the RMA, given both the disturbance to the seabed and discharges proposed. Overall, resource consent for a discretionary activity is required. The activity has been shown to be consistent with the relevant statutory tests and documents of the RMA. This includes the New Zealand Coastal Policy Statement (NZCPS), the AUP(OP) and Part 2 of the RMA.

Accordingly, it is considered that resource consent can be granted for this application.

PART A: RESOURCE CONSENT APPLICATION

To: Auckland Council

Address: Private Bag 92300

Auckland 1142

McCallum Brothers Limited requires a coastal permit under sections 12 and 15 of the Resource Management Act 1991 informed by (but not limited to) the following plan provisions:

Auckland Unitary Plan (Operative in Part)

Coastal Permit (s12)

The proposal involves the disturbance of coastal marine area within the General Coastal Marine Zone for mineral extraction. Pursuant to Rule F2.19.4 (A28), this is a discretionary activity.

Coastal Permit (s15)

The proposal involves disposal of waste and other materials arising directly from the offshore processing of a seabed mineral resource within the General Coastal Marine Zone. Pursuant to Rule F2.19.2 (A15), this is a discretionary activity.

Overall, consent is required for a discretionary activity.

The extraction activity is proposed between the following co-ordinates at Pakiri, Auckland:

NZTM2000 Projection	NZGD2000 Projection
1751204	5993734
1751413	5993934
1751900	5993479
1752079	5993742
1751719	5994097
1750052	5996935
1747801	6000891
1746958	6002961
1746424	6002537
1746240	6002344
1746633	6001846
1746710	6001541
1746871	6001324
1746942	6001092
1747184	6000673
1747394	6000384
1747545	5999988
1747622	5999921
1748103	5998951
1748165	5998713
1748335	5998587
1748731	5997974
1748900	5997943
1749415	5997346
1749443	5997246
1749881	5996850
1749599	5996347
1749810	5995843

NZTM2000 Projection	NZGD2000 Projection
1750064	5995501
1750339	5995018
1750825	5994285
1750946	5994154
1751077	5993917

Assessment of Effects on the Environment

In accordance with the Fourth Schedule of the RMA, an assessment of effects on the environment is provided in Section 6 of this report comprising detail that corresponds with the scale and significance of the actual and potential effects that the proposed activity may have on the environment.

Contact details

Shayne Elstob – Chief Operating Officer

PO Box 71031, Rosebank, AUCKLAND 1348

PART B: ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

LIST OF ABBREVIATIONS

Acronym	Meaning
AEE	Assessment of Effects on the Environment
ADCP	Acoustic Doppler Current Profiler
ANZG (2018)	Australian and New Zealand Guidelines for Freshwater and Marine Water Quality
AUP(OP)	Auckland Unitary Plan (Operative in Part)
CMA	Coastal Marine Area
CMT	Customary Marine Title
CO_2	Carbon Dioxide
CTD	Conductivity, temperature and depth
CVA	Cultural Values Assessment
DSAS	GIS Digital Shoreline Analysis System
HNC	High Natural Character
Inshore	Between 5 and 16 m deep contours
KL	Kaipara Excavators Limited
M	Million
MBL	McCallum Brothers Ltd
mgs	Mean Grain Size
MHWS	Mean High Water Spring
Mid-shore	Proposed Extraction Area between 16m and 25m contours
MPSS	Mangawhai-Pakiri Sand Study
MSL	Mean Sea Level
NZCPS	New Zealand Coastal Policy Statement
ONL	Outstanding Natural Landscape
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Total Polychlorinated Biphenyls
RMA	Resource Management Act 1991
RUB	Rural Urban Boundary
SEA	Significant Ecological Area
SQGs	Sediment Quality Guidelines
TSHD	Trailing Suction Hopper Dredger
TSS	Total Suspended Solids
WETlabs	WETlabs WQM

1. Introduction

This Assessment of Effects on the Environment (AEE) has been prepared to support the resource consent application by McCallum Brothers Ltd ® (MBL) to undertake sand extraction from the CMA at Pakiri, North Auckland.

Currently, MBL operate vessels within an inshore area at Pakiri to extract up to 76,000m^3/year of sand, taken from a depth of between 5 m and 10 m (Figure 1-1). This activity was approved by the Environment Court in 2006 (ARC28165, ARC228172, ARC28173 & ARC28174), with the consents having expired on 6th September 2020. MBL lodged an application to renew extraction with the existing inshore area in late February 2020 (Council References: BUN60352951, CST60352952 and DIS60347549).

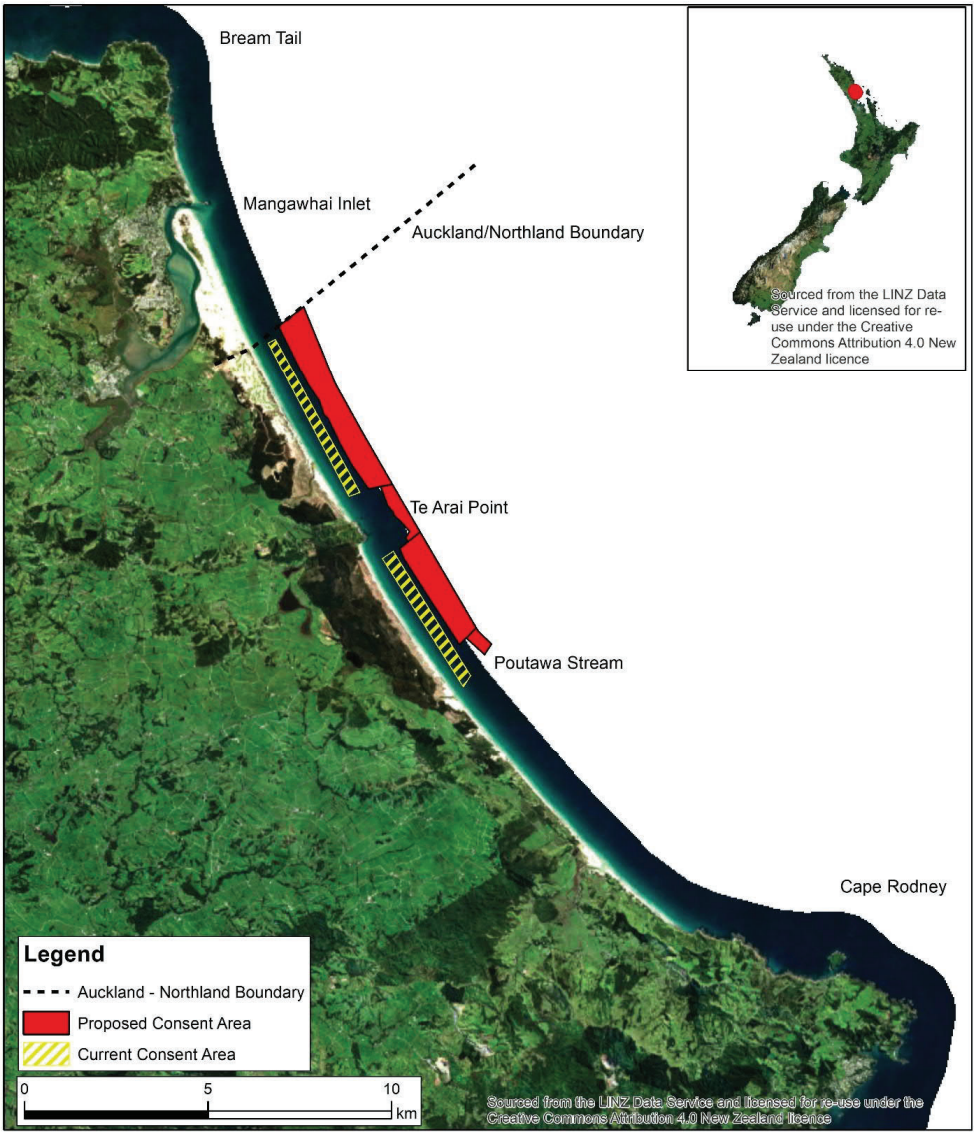

Figure 1-1: Location of existing and proposed extraction areas(Source: Jacobs)

However, based on feedback from interested parties and operational improvements, MBL have identified an area at Pakiri, between the 15 and 25 m contour that could replace the inshore extraction area. The proposed change in extraction depth pushes the extraction area out to between 860 m and 1680 m offshore (the current extraction area is between 350 m and 760 m offshore). This new area will replace the existing extraction area and following the approval of this current resource consent application, MBL will withdraw resource consent applications BUN60352951, CST60352952 and DIS60347549. The boundaries of the new extraction area are shown in Figure 1-1. MBL propose to extract sand at the following rates:

- An annual average rate of 125,000 m^3/year over any consecutive 5 year period and a maximum rate of 150,000 m^3 over any 12-month period, with the temporal distribution of the extraction volume being limited to a maximum of 15,000 m^3 over any consecutive 30 day period and to be spatially balanced between a series of extraction cells located along the beach and between the 15 and 25 m depth contours.

In addition, resource consent is sought for the associated discharge of sediment, seawater and biota into the CMA from the extraction vessel, with this material resulting from disturbance of the local seabed and being separated from the required sand resource.

In addition to its own approved extraction activity, MBL also undertake additional offshore extraction activities at Pakiri under consents held by Kaipara Excavators Limited (KL), which allows for a total of 2 million m^3 of sand to be removed over a 20-year period from February 2003. Annual extraction within the CMA locations approved by KL's consents is currently limited to a maximum of 150,000 m^3/year of sand from between the 25 and 30 m contour, with sand permitted to be removed at seabed depths greater than 25 m off Pakiri (a 3 km exclusion area from the Leigh/Cape Rodney Marine Reserve is also imposed). KL have also lodged a resource consent application for additional extraction activities at Pakiri, although the extraction areas sought by KL do not overlap with MBL's proposed extraction area. At the time of writing the KL application had yet to proceed to a council hearing and determination.

Since 2004, MBL have extracted from both MBL and KL extraction areas an average of 137,000 m^3/year out of a total maximum consented extraction volume of 266,000 m^3/year from less than the 30m contour, with a maximum yearly extraction volume of 218,270 m^3 of sand extracted in 2019. Further details of MBL's operations, including its vessels, is provided in Section 2 of this AEE.

Figure 1-2: MBL vessels in operation during June 2018 (Source: Jacobs)

The sand resource at Pakiri is of regional significance to Auckland given its role as a construction material and its ease of transport to Central Auckland. Auckland is projected to experience significant growth over the coming 30 years, with an additional 720,000 residents requiring 313,000 homes over this time[2]. As discussed in Section 3, this population growth will be focused within the existing urban core, driving an increased demand for concrete as a building material for new homes, business premises, transport assets, social infrastructure and network utilities. Without a secure and reliable source of sand for concrete manufacturing, the ability of the construction sector to meet Auckland's needs will be compromised, with subsequent negative consequences for Aucklanders' quality of life and housing affordability. The importance of the sand resource and the benefits of the activity are elaborated on in Sections 3 and 6.2.

Regardless, MBL is cognisant of the high natural, social and cultural values at Pakiri (as identified in Section 4). Considering this, a range of technical reports have been commissioned to investigate the effects of the extraction activity and what, if any, mitigation is required. This has included consideration of potential effects on marine ecology, avifauna, coastal process, cultural effects, landscape values and water quality.

In addition, a new vessel has recently been commissioned, the William Fraser. This vessel has been designed to be quieter and with its extra loading capacity, it requires less time on station at Pakiri to undertake sand extraction than previous MBL vessels. The William Fraser has been designed to improve the overall environmental performance of MBL's operation at Pakiri and was commissioned specifically for MBL. In addition, MBL propose to switch to greater reliance on night-time extraction and will seek to limit any extraction on weekends and public holidays (although some extraction may be required during those times given demand and weather constraints). The benefits of both the new vessel (as opposed to the historically employed vessels) and the altered extraction schedule are discussed further in Section 6 and Appendix B.

Section 9, in conjunction with Appendix B of the AEE addresses statutory matters under sections 104, 104B, 105 and 107 of the Resource Management Act 1991 (the RMA). This assessment includes consideration of the Auckland Unitary Plan (Operative in Part) (AUP(OP)), the Hauraki Gulf Marine Park Act, the New Zealand Coastal Policy Statement (NZCPS), the Auckland Plan 2050 (the Auckland Plan) and the Hauraki Gulf Marine Spatial Plan.

Lastly, MBL is aware of the significant public interest in sand extraction at Pakiri. MBL has consulted widely with interested parties, all of whom preferred extraction further offshore. Based on this feedback and to make improvements to the operational capability of MBL, a decision was made to apply for a new consent more than 500 m further offshore than the existing consented extraction area, based on the shift of the inner boundary of both consent applications. It is envisaged that if this consent should be granted to MBL's satisfaction, the current consent would be surrendered. Given this interest, MBL request that this application undergoes public notification.

[2] Auckland Plan 2050, Auckland Council

2. Description of Activity

2.1 Background and Current Extraction Operation

MBL has been extracting sand in the Mangawhai-Pakiri embayment for more than 75 years. Throughout this time, this high-quality sand has been primarily used to supply concrete plants in the greater Auckland area and is an essential construction material for the continued growth of the region. With MBL's current consents and related operations further offshore under consents held by Coastal Resources Limited (owned by KL), MBL supplies approximately 43% of the construction sand requirements for the Auckland Region. Pakiri sand extracted by MBL is also used for sports fields, beach nourishment and equine activities, although the majority of extracted material is used for concrete production.

The current coastal permits were granted by the Environment Court in May 2006 for a 14-year period. The permits allow MBL to extract up to 76,000 m^3/year of sand from the inshore area between the Auckland/Northland regional boundary and the Poutawa Stream (as shown in Figure 1-1), subject to monitoring coastal erosion rates, bathymetric changes and regular reporting to Auckland Council. MBL have regularly submitted monitoring reports and sought to comply with these conditions throughout the implementation of these consents. A copy of the previous consent conditions is provided as Appendix A.

All existing extraction activities rely on dredging and pumping of a sand slurry from the seabed to one of the MBL dredge vessels. Once the dredge vessel is fully loaded, it returns directly by sea to a depot at the Port of Auckland for unloading. As such, there are no local onshore components to the extraction operation, avoiding any modifications to the Pakiri foreshore, while also saving on transportation costs and reducing the potential environmental effects associated with long-haul road transport (e.g. greenhouse gas emissions).

MBL has made a number of changes to the current sand extraction operation to reduce any potential effects on the environment. This includes no longer undertaking stationary extraction and moving solely to the use of Trailing Suction Hopper Dredgers (TSHD). In addition, a new purpose-built TSHD, the William Fraser, was commissioned in late 2019 and has since commenced sand extraction operations at Pakiri.

The current predominant form of historic sand extraction on the current inshore permit was stationary extraction, which is undertaken by anchoring a barge in one location and lowering a dredge head to a single point that extracted sand from that one location. This resulted in a deeper area of extraction within a circular area. By contrast, TSHDs (as proposed by this application) operate by sucking material from the seabed as a sand slurry using a trailing suction head fitted to pipes that trail over the bed as the vessel travels over the extraction area. Another key difference between the two techniques is that trailing suction dredging extracts the active sand layer to an average depth of 100 mm, which has a reduced effect impact on seabed geomorphology compared to stationary dredging (which creates larger depressions in the seafloor). The sand pumps lift the extracted sand slurry through the pipework to pass through sand screens which are to be deposited in the onboard hopper. A schematic diagram of a TSHD is shown in Figure 2-1 below.

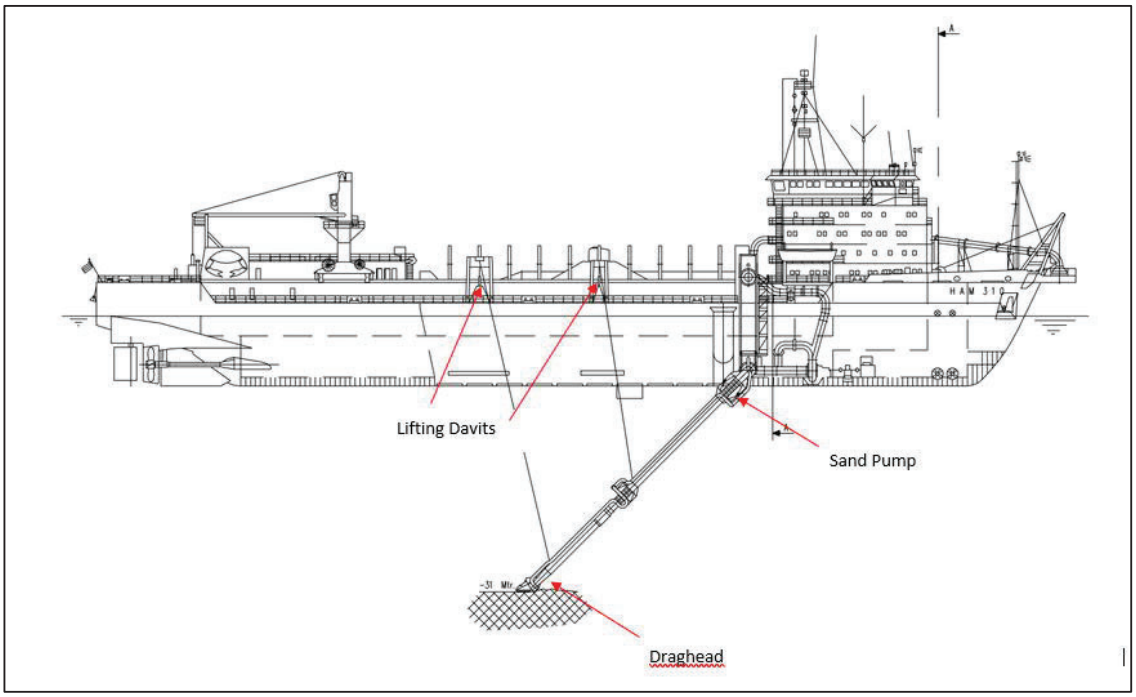

Figure 2-1: Schematic Diagram of Trailing Suction Hopper Dredge (note not an actual MBL vessel)

2.2 Proposed Consent Area and Volumes

This consent application proposes sand extraction from a new mid-shore area between 15 m and 25 m depth (as shown in Figure 1-1) and will replace the current inshore extraction areas. A duration of 35 years[3] is sought and will involve the following rate of extraction:

- An average rate of 125,000 m^3/year over any consecutive 5 year period and a maximum rate of 150,000 m^3 over any 12-month period, with the temporal distribution of the extraction volume being limited to a maximum of 15,000 m^3 over any consecutive 30 day period and to be spatially balanced between a series of extraction cells located along the beach and between the 15 and 25 m depth contours.

[3] A duration of 35 years is also sought for the associated discharges from the extraction vessel.

Table 2-1: Co-ordinates of new extraction area (NZTM projection)

NZTM2000 Projection	NZGD2000 Projection
1751204	5993734
1751413	5993934
1751900	5993479
1752079	5993742
1751719	5994097
1750052	5996935
1747801	6000891
1746958	6002961
1746424	6002537
1746240	6002344
1746633	6001846
1746710	6001541
1746871	6001324
1746942	6001092
1747184	6000673
1747394	6000384
1747545	5999988
1747622	5999921
1748103	5998951
1748165	5998713
1748335	5998587
1748731	5997974
1748900	5997943
1749415	5997346
1749443	5997246
1749881	5996850
1749599	5996347
1749810	5995843
1750064	5995501
1750339	5995018
1750825	5994285
1750946	5994154
1751077	5993917

The landward and seaward boundaries of the current consent are defined by water depths, being the 15 m and 25 m depths, with the area shown in Figure 1-1 being determined from the position by these inferred depth contours mapped on the LINZ Bathymetric Chart NZ522. It is noted that these depth contours are in terms of chart datum, being close to LAT[4], which is a different datum to the bathymetry presented in this report, which is in terms of mean sea level (MSL), being 1.9 m above chart datum for Auckland. Therefore, the water depths shown in the mapping presented and discussed in this AEE are in the order of 2 m deeper than on Bathymetric Chart NZ522, with the defined consent area (as shown in Figure 1-1) having water depths between 17 m and 27 m below MSL. To avoid confusion, it is proposed that the new mid shore consent area be demarcated solely by the above coordinates without reference to the water depths.

Overall, the southern limit of the consent area is located approximately 9.5 km from the northern limit of the Goat Island Marine Reserve. The proposed extraction area extends for a total of 10.4 km along the Pakiri Beach shoreline. The extraction area (including opposite Te Ārai Point) covers an area of 6.6 km^2[5]. The existing and new extraction areas are shown in Figure 1-1.

[4] LAT" Lowest Astronomical Tide

[5] The current consent covers an area 2.6km^2 area, 4 km^2 less than the area proposed by this application.

2.3 Dredging Vessels and Equipment

As indicated above, sand extraction will be undertaken by TSHDs. The current vessel, the William Fraser, has been in operation since late 2019 and features the following characteristics:

Table 2-2: William Fraser Characteristics

Photograph	
Commissioned	2019
Length	68 m
Beam	16 m
Deck Size	43 m x 10 m
Hopper Capacity	900 m^3
Loaded Draft	4.2 m
Vessel extraction speed	1.5 – 2.5 knots
Draghead Width	1.5 m
Sand pump capacity	400 mm
Sand screen size	2.5 mm

The William Fraser is designed to be able to operate in swells up to 2.5 m in height, although it is unlikely to operate in such conditions given the risk of damage to the dredgehead. It has wind operating limits of 25 knots from the NW to SE (clockwise) and 40 knots from west to south (anti-clockwise). Based on wave and wind hindcast data presented by MetOcean (2019), the William Fraser should be able to operate for 99% of days on an annual basis, with the lowest workability during July, when winter conditions prevail.

While it is proposed that all sand extraction under this proposed consent will be by TSHD and that initially this will be undertaken by the William Fraser, MBL do not wish to limit the operation of the consent to only this vessel. The use of similar types of vessels in the future may be possible, with the potential effects on the environment from the use of alternative dredge vessels anticipated to also be better than the existing dredge operation currently carried out by the William Fraser. In addition, unforeseen circumstances (such as maintenance) may also require the use of a different vessel.

2.4 Sand Extraction Operation

Once the dredge vessel arrives in the extraction location, speed is reduced to 1.5 to 2.5 knots and the generator is started to power the davits for lowering the pipes and the sand pump. The drag-head is unsecured from the vessel, the davits extend the pump and dredge pipework over the side and they are slowly lowered to the seabed. The pump is started as the drag head descends to the seabed and water will start coming on board the

vessel through the pipework and screen gear. Once the drag head reaches the seabed, pumping of the sand slurry begins and continues as the vessel moves forward along a pre-determined dredge track. With the William Fraser, the extraction process utilises recent advances in international industry best practice allowing a greater sand to water ratio to be drawn into the drag-head, more efficient screening systems and moon pools to reduce discharge turbidity. These practices increase the overall efficiency of the extraction operation when compared with earlier vessels.

The optimum operation involves the dredger staying on the same extraction track for as long as possible, starting at southern or northern boundary of the extraction area and then staying on the same track to the other end. Once a dredge run reaches the end of the extraction area, the drag-head is lifted off the seabed and the vessel turns back and then resumes extraction in the reverse direction on another dredge track. When the dredge hopper is full, the drag-head is lifted and the pump pushes water through the flumes to clear the system of any sand. The pumps and generator units are shut down, the pipes are lifted back into their storage place(s) and secured to the cradle on the vessel. The vessel then returns with a full hopper to the depot (at the Port of Auckland) for unloading. The round-trip time for the William Fraser from the Port of Auckland and a completed dredge operation is in the order of 16 hours. Most of this time (i.e. 12-14 hours) is in transit to and from the Pakiri extraction area.

The dredge trench parameters and time required to complete a dredge run with the William Fraser are presented in Table 2-3.

Table 2-3: Extraction Characteristics for the William Fraser

Vessel	William Fraser (anticipated)
Width of extraction trench	Average 1.6 m
Depth of extraction trench	Average 100 mm
Extraction trench shape	Trapezoidal
Hopper volume capacity	900 m^3
Volume required to be extracted from seabed to fill hopper	1800 m^3
Length of extraction track needed to fill hopper	12 km
Time to fill hopper	3-4 hrs
Number of trips in 30 consecutive days for 15,000 m^3 limit	17 trips

Figure 2-2: William Fraser draghead in operation in 10 m water depth and resulting extraction trench 5 minutes post-dredging.

Current dredging operations are reporting that the 900 m³ hopper is filled with sand in 3-4 hours of dredging, with an average sand extraction track length of approximately 12 km, based on a sand extraction profile 1.6 m wide and an average depth of 100 mm (which equates to a sand extraction efficiency by volume of 47%). Based on this, the annual volume limits will restrict the number of the sand extraction trips per year to an average of less than 139 trips per annum, covering approximately 2.67 km² of the 6.6 km² proposed extraction area. Under the controls of the proposed Environmental Monitoring Management Plan (EMMP), MBL have stated they plan to distribute the sand extraction spatially evenly within and between management cells. Therefore, theoretically up to 40% of the seabed included in the application will be extracted in any one year and any area of seabed is unlikely to be extracted more than once in any 30-month period. The position fixing and dredge tracking technology of the William Fraser also allows for extraction trench locations to be monitored, ensuring that the trenches have the maximum time to infill by natural sediment transport processes.

The other operational change to the sand extraction that has been occurring and will continue with this consent is to continue with a greater use of night-time sand extraction. Prior to the use of the William Fraser (September 2018 to August 2019), 67% of dredging was carried out in the hours of darkness (measured as the hours from 7 pm to 6 am). From December 2019 the William Fraser took over all extraction from the existing dredge vessels. Due to the improved technologies on board and an increased focus on night-time extraction, MBL has since increased night-time extraction to 91%, as measured on all inshore sand trips from December 2019 to October 2020.

These recent changes to the extraction schedule are considered to be beneficial in reducing potential visual impacts of the extraction operation, while also avoiding recreational users within the CMA. As such, MBL plans to focus on night-time extraction operations (weather and sand demand permitting).

2.5 Discharge of Water and Extraction Material to the Ocean

Discharge to the ocean from a dredge vessel typically occurs in the following two ways:

- Discharge of by-wash containing oversized material that is too large to pass through the sand screens to the hopper; and
- Discharge of water over the weir boards as the hopper fills with sand.

These discharge methods are discussed below.

2.5.1 By-Wash and Over-sized Material Discharge

On the William Fraser, new sand screening technology is being used, with the sand slurry passing over an 8 m^2 “screen deck’ (Figure 2-3: Diagram of sand “Screening Deck” on the ‘William Fraser’). The remaining material is

then transported to the hopper via two pipes with nine discharge points located along the front and side of the vessel so that the load in the hopper can be balanced. The use of the "screen deck" gives an effective screen area 3.6 times greater than was available on previous vessels, with a greater volume of sand able to be discharged into the hopper, resulting in dredging efficiency being considerably improved.

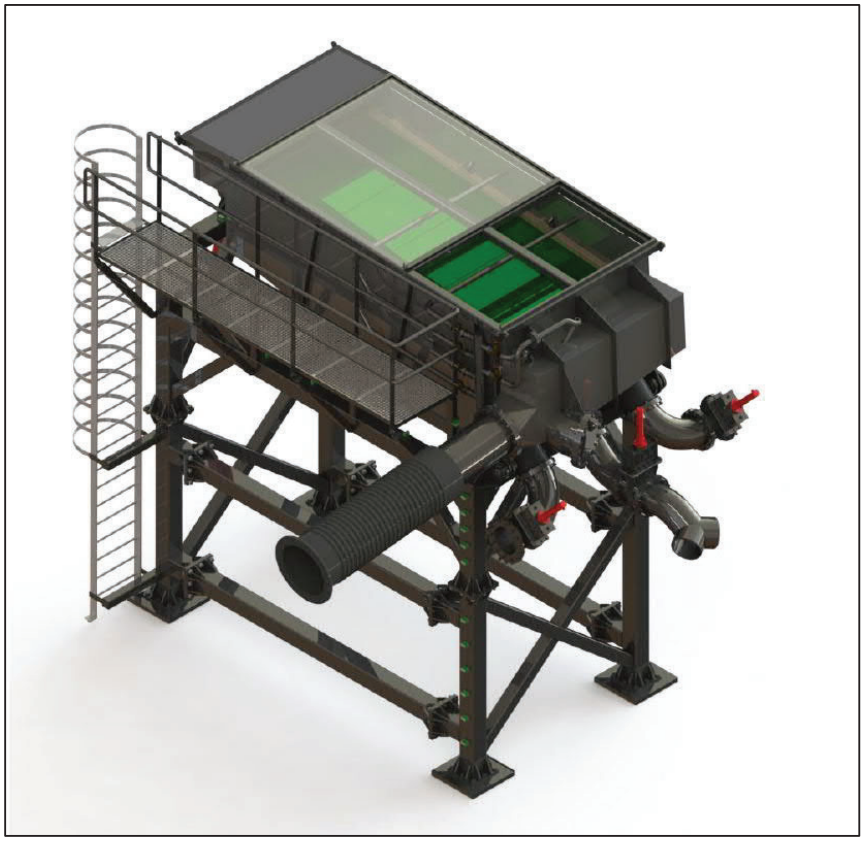

Figure 2-3: Diagram of sand "Screening Deck" on the 'William Fraser'

The discharge method for this by-wash and over-sized material involves the use of a series of "moon pools" along the sides of the hopper. These are discharged at least 1.5 m below the water's surface along the keel of the vessel. Sub-surface discharges are considered to be industry best practice, reducing the environmental effects by providing improved visual clarity at the sea surface, smaller sediment footprint settling back into the area that has been dredged, and less spread of the sediment plume (due to less interaction with wave activity and aeration of the discharge water). The effect of this discharge on water quality (turbidity) was monitored by Jacobs and is summarised in Section 6.3 and presented in Appendix H.

2.6 Noise Discharge

Styles Consulting Group (Styles Group) undertook underwater acoustic monitoring of the William Fraser in November 2019 (Appendix I). The monitoring was undertaken during fine weather (variable 10 knot breeze, sea state zero and no swell), using six SoundTrap 202STD recorders (Figure 2-4).

Figure 2-4: Location of hydrophones and the GPS track of the William Fraser (Source: Styles Group)

Using the monitoring data and modelling to remove potential noise from other sources (e.g. passing vessels), the maximum recorded noise level was 135 dB re 1 µPa (Figure 2-5). It was noted by Styles Group that these levels were less than MBL's previous vessel (the Coastal Carrier). Further assessment of the vessel's noise is provided in Sections 6.5 and 6.8.

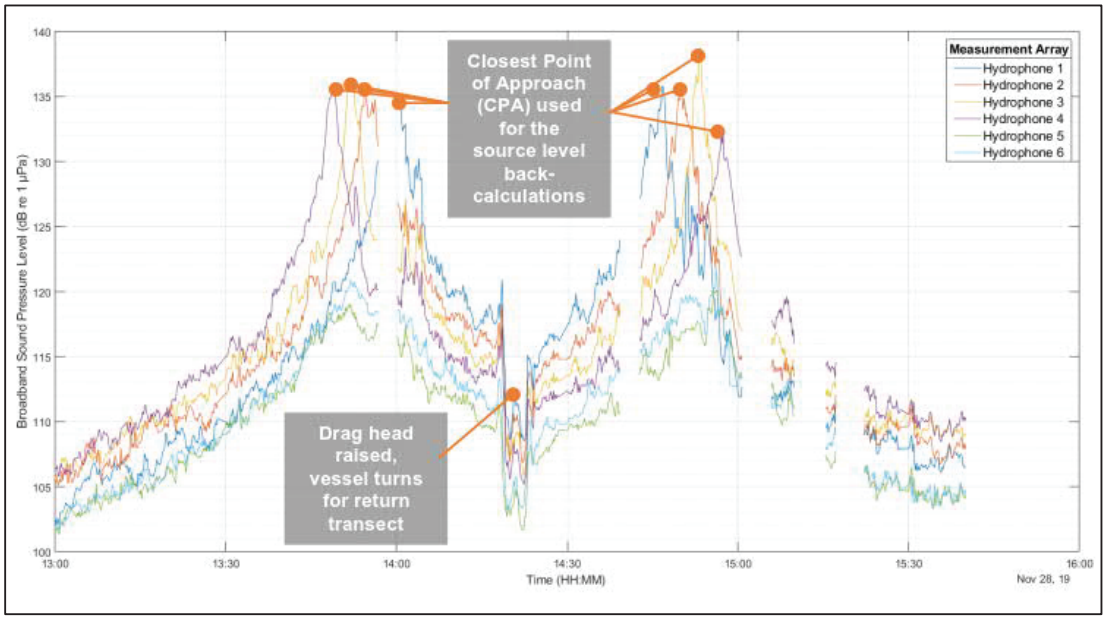

Figure 2-5: Measured Sound Pressure Levels generated by the William Fraser (Source: Styles Group)

3. The Pakiri Sand Resource and its Strategic Importance to Auckland

The underlying purpose of this application is to allow MBL to continue the extraction of sand in the Mangawhai-Pakiri embayment but undertaking this further offshore than the current inshore area of Pakiri. This sand is a vital resource for the ongoing sustainable growth and development of the Auckland region, not least because of its importance to the construction sector. In light of this, the following section details both the regional significance of the sand resource at Pakiri, but also its role in addressing the strategic growth and economic pressures facing Auckland.

Figure 3-1: Sand Delivery at the Port of Auckland during June 2018 (Source: Jacobs)

3.1 The Pakiri Sand Resource

Sand is a ubiquitous resource in modern life. It is the key component in the manufacture of concrete and glass. It is used for the restoration of eroding beaches and as a surface treatment in many of Auckland's parks. However, not all sand is created equal. Given its origins from weathered rock and ground shells, the chemistry, grain size and sediment content of sand can differ greatly between marine, freshwater or land-based locations. These differences affect the usefulness and overall importance of sand resources for the construction sector.

As noted in the Concrete Industry Report by Brett Beatson (Appendix E), East Coast sands (i.e. Pakiri sand) are ideal for concrete production and the construction sector. Mr Beatson states that coastal sand is:

"very clean, has consistent grading, good particle shape, is strong and durable and contains very few ultra-fine particles; these characteristics greatly reduce the risk of early plastic shrinkage or long-term drying shrinkage issues."

In comparison, sand extracted from the Waikato is less useful for concrete production given its chemical and physical properties. These sands contain a number of minerals which are of a volcanic origin and consequently have a higher reactivity to cement alkalis. This has resulted in cases of Alkali Silica Reaction (ASR), leading to significant damage in structures. The potential adverse outcomes of using high alkali reactive sands is reflected in construction standards (NZS 3104:2003), which places a maximum limit of 2.5 kg/m^3 of total alkali in

concrete when potentially reactive aggregate or sand is used[6]. Therefore, complying with this standard can be quite challenging where Waikato sourced sands are used.

The Kaipara Harbour is also used as a source of sand for Auckland. However, given the ecological importance of the harbour (including to West Coast fisheries), its largely undeveloped nature and high cultural values, the future of continued sand extraction within the Kaipara Harbour is uncertain. This uncertainty in its long-term availability increases the strategic importance of other sand resources to ensure continuity of supply.

Furthermore, the location of the Mangawhai-Pakiri resource on Auckland's East Coast assists in the transport of this bulk commodity to market. Given that sand is a low value, high volume commodity, its transport and handling costs must be kept to a minimum to make extraction economically viable. Extraction on the East Coast can be undertaken by sea vessel and then easily transported to the Port of Auckland. Other sand resources, such as those on the Kaipara Harbour, Tomorata or from the Waikato, require additional handling and road transport of a significant distance to reach Central Auckland and the region's urban growth hubs. The closest resource to Auckland is from the Kaipara Harbour, which has a travel distance of 55 km one way to Central Auckland. Other resources are located even further from Auckland's urban core.

Having undertaken a wider assessment of the regional marine sand resource, Market Economics (Appendix D) have identified that sand extraction at Pakiri supplies at least 43% of all sand to the Auckland market, with the remaining supply mainly coming from operations in the Kaipara Harbour. This figure highlights the importance of the Pakiri sand resource to the Auckland region and the importance of continued access for its extraction, especially given the technical difficulties and environmental sensitivities associated with extraction in the Kaipara Harbour, as well as the reduced usefulness and travel distance required from the Waikato and other relict dune sourced sand for the construction industry.

3.2 Auckland's Sand Demand

The second strand to the importance of this sand resource is Auckland's high demand for low cost building materials as the city grows. As noted by the Auckland Plan, one of the key challenges facing the region is population growth[7]. From an existing population of 1.66 million, this growth is expected to generate a population increase of 720,000 people over 30 years, with Auckland reaching 2.4 million residents. These additional residents need new homes (313,000 extra dwellings), workplaces, schools, roads, rail lines, hospitals and utilities[8]. All of these features of modern urban life will require concrete and as such, a steady and reliable source of sand.

Underlying this future urban growth is the Auckland Council's strategic direction for a quality compact urban form[9]. This direction is reflected in the Auckland Plan's development strategy, which details that the majority of growth is to occur within the existing Rural Urban Boundary (RUB). While some greenfield locations exist within the urban area (e.g. Flatbush, Red Hills and Whenuapai), most development within the RUB is categorised as "brownfield" (including development in metropolitan and town centres). Regardless of this brownfield and greenfield split, in order to accommodate the required extra dwellings, there will be a move to higher density housing typologies.

This move towards more multi-storey multi-unit residential building types is reinforced by the AUP(OP)'s own urban zonings. For instance, within the Residential – Terrace Housing and Apartment Buildings Zone, a maximum building height of 16m is provided for. Underpinning the new higher density urban form will be concrete. While some new buildings may use other materials such as steel or wood for their structures, almost all buildings will rely on concrete for foundations, their utility connections and the transport networks which serve them.

[6] NZS 3104:2003 - Specification for concrete production
[7] Page 13, Auckland Plan 2050.
[8] Page 13. *Ibid.*
[9] Page 89, *Ibid.*

This demand is further elaborated on by the report by Market Economics (Appendix D), who estimate that current market demand for sand from Auckland suppliers is 750,000 tonnes/year, with approx. 600,000 tonnes/year being used to produce ready mix concrete. This equates to approximately 450kg of sand required for every person living in the Auckland region. As shown in Figure 3-2, additional demand for concrete (as driven by Auckland's growth) will result in increases of at least 290,000 to 450,000 additional tonnes of sand per annum by 2043.

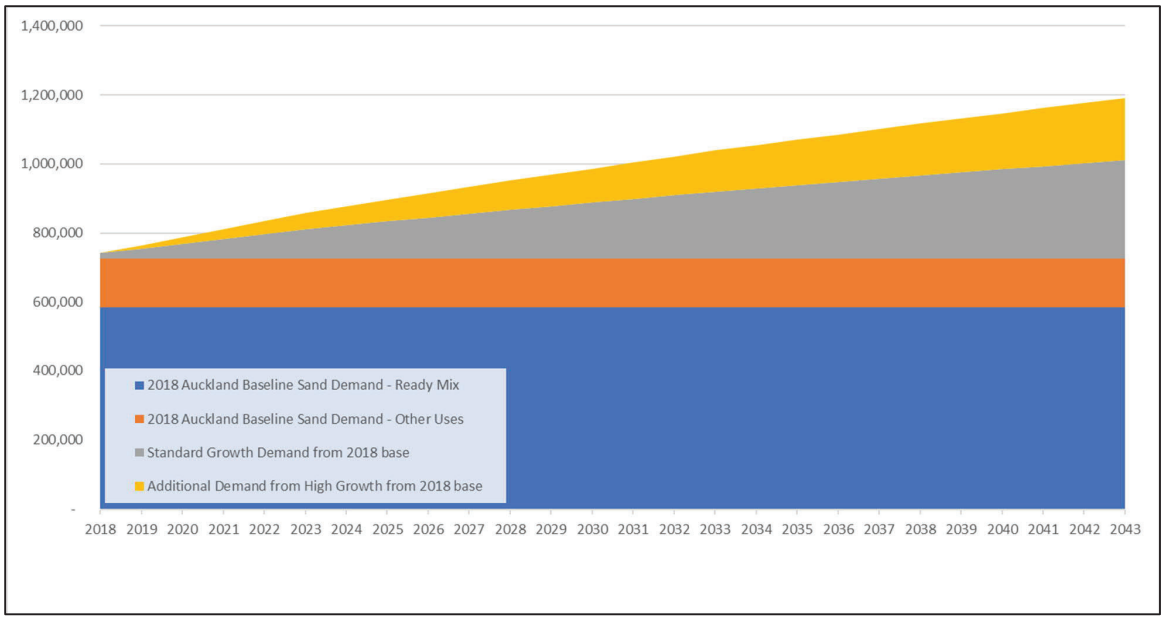

Figure 3-2: Projected Future Sand Demand (Standard- and High-Growth Scenarios) (Source: Market Economics)

This demand for additional concrete and sand is also driven by the planned infrastructure spend over the next three decades. Auckland Council's 30-Year Infrastructure Strategy document[10] details that up to $30 billion of infrastructure investment is needed to meet projected population growth. This infrastructure will include major assets for the three waters[11], transport, parks and community facilities. Further infrastructure investment will be required by Central Government for education, health, electricity transmission, state highways and rail; while private providers in the telecommunication and energy sectors will also need to upgrade and improve their networks. This infrastructure investment will place further pressure on sand supplies given the significant volumes of concrete required[12].

Given the above factors, the marine sands at Pakiri represent a strategic mineral resource for Auckland. They are uniquely placed for ease of transport to Auckland's urban core, are ideal for construction purposes and can provide an ongoing secure supply of sustainable sand to meet Auckland's significant growth pressures. The continued access to this resource and its ongoing extraction is critical to meet Auckland Council's own strategic goals and ensure the wellbeing of both the community and the economy.

[10] The 30 Year Infrastructure Strategy was prepared for the 2018 – 2029 Long Term Plan and does not include any budget responses to Covid-19.
[11] Three waters is defined as potable water, wastewater and stormwater infrastructure.
[12] It is noted that at the time of writing, Auckland Council has commenced operating under an "emergency budget" in response to the Covid-19's economic shock. While this budget impacts the discretionary spend by Council, it does not affect the planned budgets of KiwiRail, Waka Kotahi NZ Transport Agency or any other central government body. In addition, a number of large projects (housing and transport) in Auckland are being fast tracked under new legislation (COVID-19 Recovery (Fast Track Consenting) Act 2020), ensuring continued high demand for building materials. Additional projects are expected to also be fast tracked.

4. Site Location and Existing Environment

4.1 Location and Surrounding Development

The proposed sand extraction area is located at Pakiri, North Auckland between Poutawa Stream and the Auckland/Northland regional boundary (Figure 1-1). Pakiri itself is a 24 km long coastal beach on Auckland's East Coast, which runs between Cape Rodney in the south to Bream Tail[13] in the north.

The coastal edge includes a large dune system, several creeks (including the Poutawa Stream and Te Arai Stream) and the rocky headland Te Ārai Point. Historically, the area has been used for pastoral farming, forestry, and tourism/recreation, which is reflected in the presence of the Pakiri Beach Holiday Park (to the south), two regional parks (Te Ārai and Pakiri) and holiday homes/baches along the length of the beach. Recreational activities undertaken at Pakiri Beach include surfing, fishing (both from vessels and surf casting), swimming, horse trekking and walking/hiking. It is noted that no permanent mooring or berthing facilities are provided at Pakiri. The nearest boat ramp is at Mangawhai, with any boat launches at Pakiri reliant on a beach launch.

Plantation forestry, featuring exotic pines, is spread over two large blocks north and south of Te Ārai Point. These forestry blocks were established in the 1970s to stabilise the natural dune system and are now reaching harvest maturity. At the time of writing, significant forestry clearance has commenced, thereby altering the appearance of the coastal environment.

More recently, the Tara Iti Golf Course and associated development has occurred at the Northern edge of Te Ārai Beach. It is also understood that the owner of the golf course has plans to undertake further expansion of the golf course and visitor facilities. South of Te Arai development of the forest is underway with two golf courses and a series of residential sites being developed. North of the Tara Iti Golf Course and immediately outside the Auckland Region is Mangawhai, including Mangawhai Harbour. Mangawhai is home to approximately 1,400 residents and is a popular holiday destination.

4.2 Auckland Unitary Plan Controls and Overlays

The AUP(OP) is the primary planning document for the Auckland Region, and both the zoning for the Pakiri area as well as the controls and overlays present must be considered.

4.2.1 Zoning

As shown in Figure 4-1, the proposed extraction operation will be located within the General Coastal Marine Zone. Chapter F2 describes the purpose of the zone as:

"to provide for use and development in the coastal marine area, in particular those forms of use and development that have a functional or operational need to be undertaken or located in the coastal marine area, while:

- *Enabling people and communities to provide for their social and economic wellbeing, through the appropriate use and development of the coastal marine area;*
- *Enabling the construction, operation, maintenance and upgrading of infrastructure within the coastal marine area (that cannot be practicably located on land) where it has a functional or operational need;*
- *Protecting natural character, landscape values and natural features;*
- *Maintaining and enhancing water quality and the life-supporting capacity of the marine environment;*
- *Protecting significant ecological values;*
- *Protecting historic heritage values;*

[13] It is noted that Mangawhai Heads is in the Northland Region.

- *Recognising and providing for mana whenua values in accordance with tikanga Māori;*
- *Maintaining and enhancing public access, open space, recreational use, amenity values, and access to and along the coastal marine area;*
- *Not increasing the risk of subdivision, use and development being adversely affected by coastal hazards; and*
- *Managing conflicts between activities within the coastal marine area.*[14]*"*

It is noted that the zone recognises the importance of enabling social and economic wellbeing and the operational or functional need for certain activities (e.g. mineral extraction) to take place in this zone.

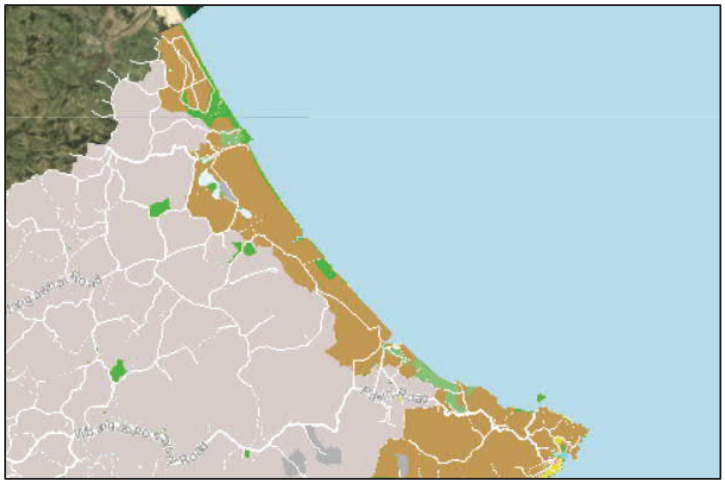

Figure 4-1: AUP(OP) Coastal Zoning – shown as light blue colouring (Source: Auckland Council GeoMaps)

4.2.2 Significant Ecological Areas

Four marine Significant Ecological Areas (SEAs) are present within the Pakiri Area (Figure 4-2Figure 4-2: SEA Locations - shown by the light green hatching (Source: Auckland Council GeoMaps)[15]. These are identified by the AUP(OP) as:

- SEA-M2-87a (Pakiri Beach);
- SEA-M2-87b;
- SEA-M2-87c (Poutawa stream mouth); and
- SEA-M1-87d (Te Ārai Stream Mouth).

The largest of these SEAs is SEA-M2-87a, which is described by the AUP(OP) as:

"Pakiri Beach is the only exposed mainland east coast surf beach free of housing and backed by extensive sand dunes and dune lakes and is of regional significance. The endemic threatened sedge, pingao (Ficinia spiralis) ('relict'), is found on the dunes along the Pakiri coast.

Regionally significant populations of the threatened sand coprosma (Coprosma acerosa) ('Declining') are also present on the back dunes. Mangawhai is a breeding area for the largest flock of New Zealand dotterels ('nationally vulnerable') in the Auckland Region and is one of only three nesting sites in the country for the 'nationally critical' New Zealand fairy tern[16]*.*

[14] Chapter F2, AUP(OP)
[15] No extraction activities are proposed within these SEAs.
[16] It is noted that that there are actually four such nesting sites - Waipu, Papakanui Spit, Mangawhai and Pakiri River Mouth

Other birds in the Pakiri area include white-faced heron, blue reef heron ('nationally vulnerable'), banded rail ('naturally uncommon'), pied stilt ('declining') and variable oystercatcher ('declining'). The beach exhibits a gradation in the type of sediment and associated fauna from the shore out to the edge of the off-shore sand-body. The fauna diversity decreases getting closer to the shore because of the decreasing stability of the substrate, but the population densities increase.

The sands of the beach are an important habitat for a variety of plants and animals. The areas of natural vegetation include important areas of pingao/spinifex, Muehlenbeckia shrubland, manuka scrub, and pohutukawa forest. The Department of Conservation has selected this area as an Area of Significant Conservation Value (ASCV).

Pakiri Beach and River has been identified as an Important Bird Area for NZ fairy tern and NZ dotterel. The NZ fairy tern forage both within the Pakiri River and up to 2 km out to sea."[17]

Further discussion of the area's ecological values is provided in sections 4.4.9 and 4.4.9.3.

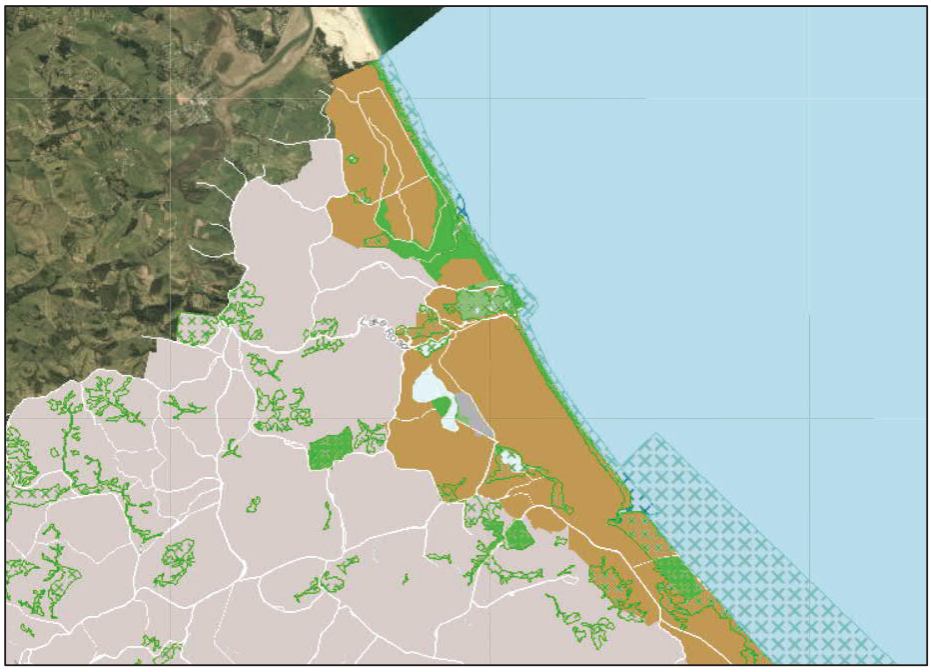

Figure 4-2: SEA Locations - shown by the light green hatching (Source: Auckland Council GeoMaps)

4.2.3 Landscape Overlays

While the landscape values of the area are discussed in Section 4.4.6 of this report, it is noted that two landscape related overlays are present at Pakiri. The first of these is a "High Natural Character Overlay – Te Ārai and Pakiri Beach[18]", which runs for the length of Pakiri Beach[19]. This overlay extends up to approx. 1650 m inland and approx. 1340 m offshore, with the AUP(OP) describing this area as:

"An extensive unit comprising remote beaches, sand dunes and dramatic coastal cliffs and scarps which descend to rock shoals and coves. Very little development is evident throughout the unit, which adds to the feeling of remoteness. Natural vegetation is variable – being influenced to the north by adjacent forestry vegetation – but is

[17] Schedule 4, AUP(OP)
[18] Area 48, Schedule 8, AUP(OP)
[19] It is noted that no extraction activities are proposed within these overlays.

extensive in the upper reaches of the Pakiri River, with the regenerating native forest on the ridges above Pakiri Road and the remnant native forests on the coastal scarps between Leigh and Pakiri."[20]

The other landscape overlay present is an "Outstanding Natural Landscape Overlay – Pakiri Beach[21]. This overlay runs the length of Pakiri Beach and extends approximately 130 m inland to approximately 1340 m offshore. The AUP(OP) describes the area within the boundaries of this overlay as:

"Coastal Wild nature (coastal) - Pakiri Ocean Beach extending into dune system for most of its length together with some coastal terrace landforms at the southern end near Pakiri Stream[22]."

It is noted that mineral extraction is currently undertaken within these overlays, but this application would mean the activity moves to be outside of these overlays. In addition, forestry clearance, house construction and the establishment of the golf course has occurred within these overlays. A number of these recent dwellings are of a significant size, occupying a footprint greater than found with historical bach development.

4.2.4 Surf Breaks

As shown in Figure 4-3 and Figure 4-4, the AUP(OP) has identified three surf breaks at Pakiri[23]. These three breaks are described by the AUP(OP) as:

- Te Ārai Beach - *"Exposed beach break that is frequently suitable for wave riding. Good wave quality suitable to all skill levels. Offers a 'wilderness' experience with lack of development. Good access."*
- Pakiri Beach (North - 'Forestry') – *"Exposed beach break that is frequently suitable for wave riding. Good wave quality suitable to all skill levels. Offers a 'wilderness' experience with lack of development. Good access."*
- Pakiri Beach (South) – *"Exposed beach break that is frequently suitable for wave riding. Good wave quality suitable to all skill levels. Offers a 'wilderness' experience with lack of development. Good access."*

It is noted that the AUP(OP) does not include any specific rule associated with surf breaks, rather any activities in the CMA are required to consider their potential effects on them. Furthermore, it its recognised that all three surf breaks are located outside of the extraction area and are not identified by the New Zealand Coastal Policy Statement 2010 (NZCPS) as nationally significant surf breaks.

[20] Ibid
[21] Area 22, Schedule 7, AUP(OP)
[22] *Ibid*
[23] Referred to as Breaks 1, 2 and 3 (AUP(OP) Appendix 4)

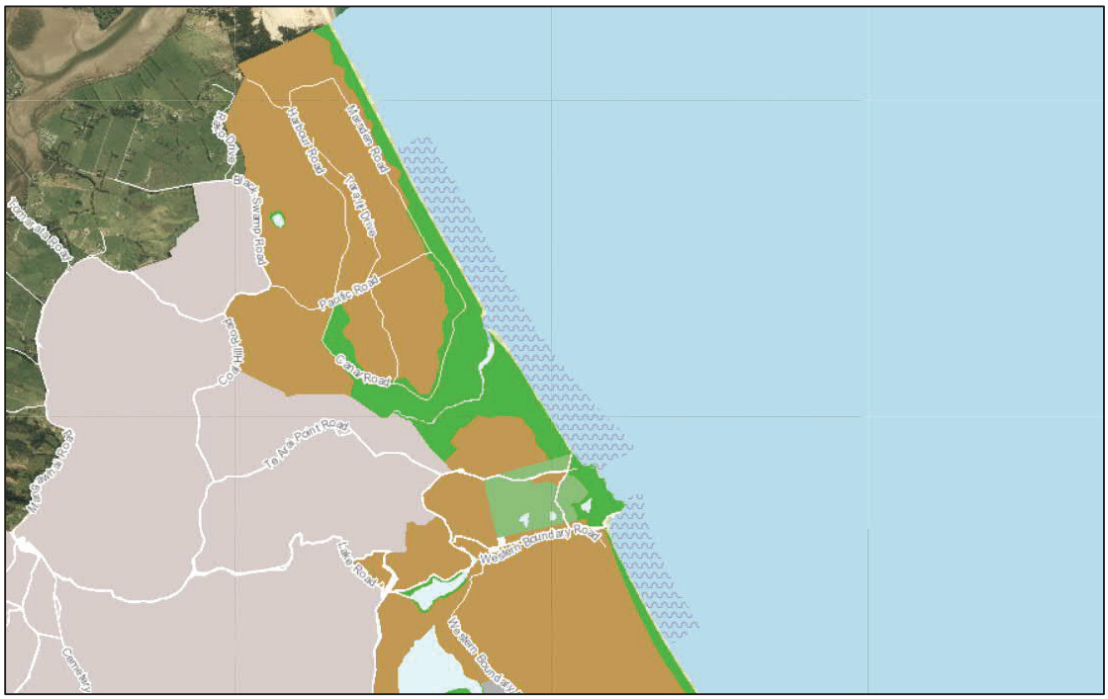

Figure 4-3: Surf Breaks 1 (Te Ārai Beach) and 2 (Pakiri Beach North) (Source: Auckland Council GeoMaps)

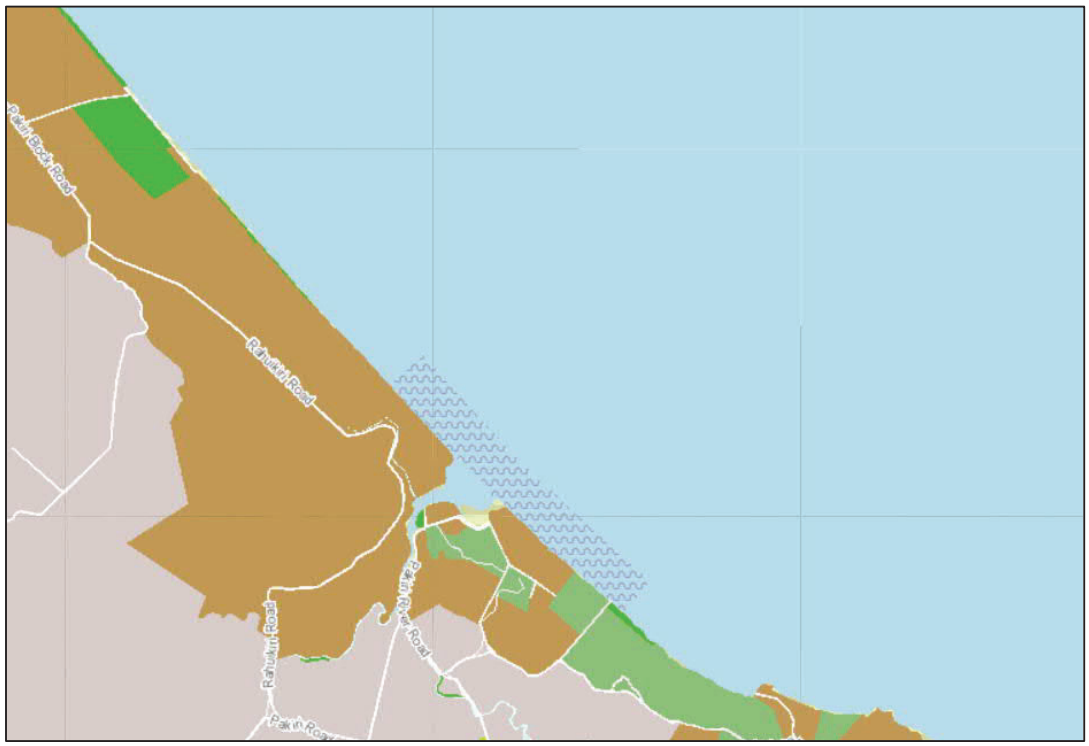

Figure 4-4: Surf Break 3 (Pakiri Beach South) (Source: Auckland Council GeoMaps)

4.3 Cultural Aspects

An examination of Auckland Council GeoMaps records for the Pakiri area show the following iwi and hapū as having an interest in the Pakiri onshore and/or offshore areas (in no particular order):

- Ngāti Manuhiri;
- Ngāi Tai ki Tāmaki;
- Ngāti Maru;
- Ngāti Te Ata;
- Ngāti Wai;
- Ngāti Whanaunga;
- Ngāti Whātua o Kaipara; and
- Ngāti Whātua Ōrākei.

4.3.1 Treaty Settlements and Other Claims

It is noted that the Pakiri area has been subject to claims under the Treaty of Waitangi and the Marine and Coastal Area (Takutai Moana) Act 2011. As a result of these processes (noting that the Marine and Coastal Area (Takutai Moana) Act 2011 claims are ongoing), the following mana whenua interests have been identified in the Pakiri Area:

- Coastal Statutory Acknowledgement Areas for Ngāti Manuhiri, Ngāi Tai ki Tāmaki, and Te Kawerau a Maki;
- Commercial redress settlement land at the South Mangawhai Forest for Ngāti Manuhiri;
- Financial and commercial redress settlement land at the Mangawhai Forest for Te Uri O Hau; and
- 27 applicants for customary marine title over some or all of the proposed extraction area[24].
- Cultural Values

MBL have engaged with mana whenua and have requested the preparation of CVAs. Copies of these CVAs will be provided to Council once they become available.

[24] At the time of writing, no customary marine titles have been issued for any area of the CMA at Pakiri.

4.4 Existing Environment

4.4.1 Introduction

This section provides a summary of the bio-physical characteristics of the existing environment. This information is obtained through field work, literature reviews and laboratory testing. The methodologies associated with each subject area are also detailed in the respective technical reports attached to this AEE. Areas considered and described include:

- Wave climate and currents;
- Sediment and sand quality;
- Geomorphology and bathymetry;
- Landscape and visual;
- Marine ecology;
- Water quality; and
- Noise (underwater and terrestrial).

4.4.2 Wave Climate and Currents

As an exposed coastal location, Pakiri features a marine climate with frequent sea breezes that influence the local wave climate. Sea breezes most frequently occur between November and March, on approximately 20% of summer days. According to NIWA:

"Between 8 am and 10 am, breezes are initiated from the harbours in the region (Waitemata, Manukau, Kaipara) and along Auckland's east coast, and in the late morning these 'elementary' breezes are augmented by 'mature' breezes from the main water bodies surrounding the region (Tasman Sea and outer Hauraki Gulf)."[25]

The effect of these sea breezes on the wave climate are augmented by sea swells. NIWA's summary of Auckland's wave climate states:

"On the east coast of Auckland, swells from an easterly or north-easterly direction tend to predominate. These can originate from tropical cyclones well to the north of New Zealand or from anticyclones far to the east. Of all swells observed on the east coast the frequency of those less than one metre is about 40%, while for those greater than two metres is 8%. The islands in the Hauraki Gulf form a buffer to large swells for the majority of the region."[26]

Wave hindcast modelling for the proposed extraction area over a 40-year period (Appendix G) confirmed this wave climate (as shown in Figure 4-5). These modelling results show around 6% of the waves reaching the proposed extraction area have significant wave heights greater than 2 m. Around 10% of the waves also have orbital velocities at the seabed of sufficient strength to entrain and transport the sand sizes found in this location. The majority of waves (86%) arrived from the northeast to east, promoting a net southerly alongshore sediment transport due to the shoreline orientation.

[25] Climate and Weather of Auckland, 2nd Edition, NIWA
[26] Ibid

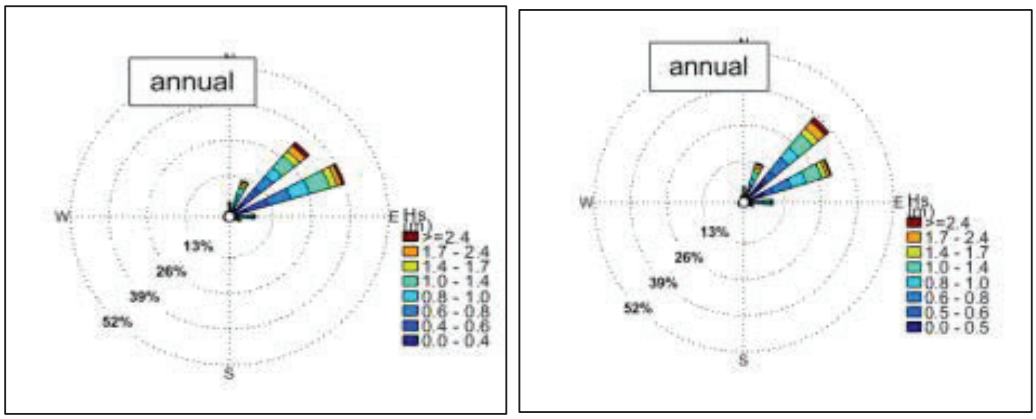

Figure 4-5: Wave direction-height roses for sites P1 and P2 from modelling of wave climate 1979-2018 (Source MetOcean Solutions (2019) .

There is also the potential of the Pakiri area to be affected by severe storm events, which can cause changes to shoreline topography (e.g beach and dune erosion) and nearshore geomorphology bathymetry of the embayment. As detailed in the coastal processes report, wave bouy records from Marsden Point show 70 storm events over a 13 year period (2007-2020) with significant wave heights above 2.5 m for three or more consective hours. Of these, 6 events had significant wave heights above 5 m (with a max recorded significant wave height of 6.37 m in July 2014). The 40-year modelled hindcast data for the extraction area predicted produced the same max modelled wave heights of up to 6.37 m. Although coastal storms may occur at any time of the year, the majority (62%) recorded occurred during winter months. It is noted that similar wave heights have also been recorded further north at Marsden Point (using a wave buoy).

Underpinning these wave conditions are the area's ocean currents. Modelling undertaken by MetOcean Limited and presented in the coastal processes report show similar non-tidal current conditions along the entire length of the Pakiri Beach proposed extraction area. In addition, only minor differences in non-tidal dominant current directions between the north and the south of the beach boundaries were found (Figure 4-6).

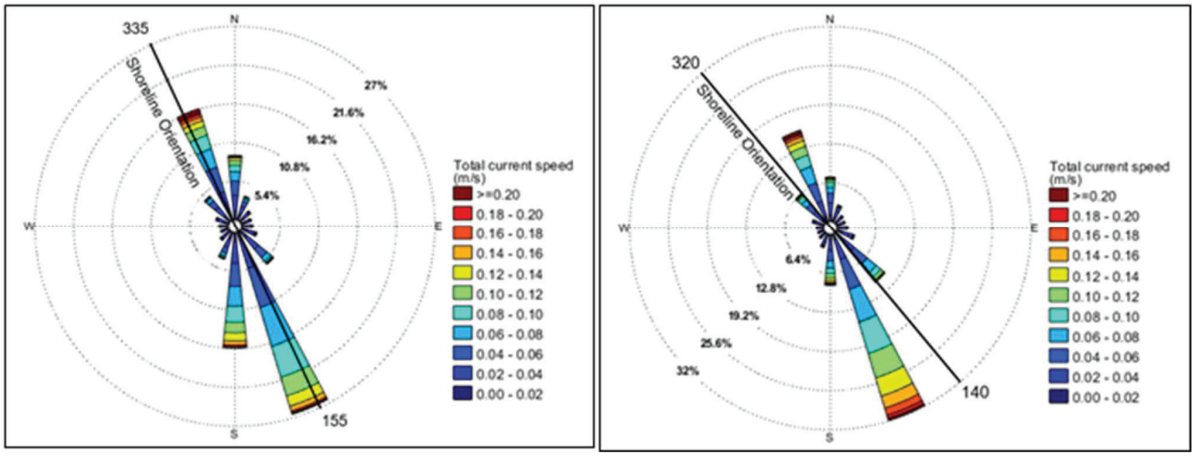

Figure 4-6: Modelled near bed non tidal current directional roses over 19 years (2000-2018) for a) P1 and b) P2 (Source: Jacobs)

As noted by the coastal processes report, once waves have entrained the sediment, these currents are capable of transporting sand into, across and out of the Pakiri embayment:

"While only about 5% of these near bed currents at 30 m water depth have sufficient speed to entrain fine sand (from sampling 15% of sediment at this depth) and only 2% have sufficient speed to entrain medium sand (from sampling 70% of sediment at this depth), the current velocities are sufficient to transport this sand for around 50% of the time if it has already been entrained by wave currents. Although the currents at both sites are bi-directional, as shown by the inclusion of the shoreline orientation on the directional roses, the near bed currents around the 30 m contour are net onshore (56% of the time near at P1 to the north of Te Arai Point, and 54% of the time on the P2 to the south of the Te Ārai headland) …. In comparison to the Mangawhai-Pakiri Sand Study (MPSS) current recordings, the modelled data indicates higher non-tidal current velocities in greater water depths, (e.g. max and 10 percentile near bottom velocities modelled at 30 m depth of 0.5 m/s and 0.11 m/s respectively compared to MPSS velocities of 0.27 m/s and 0.098 m/s near the bed (1 m) in 15 m water depth."

For tidal currents, the modelled results were for low velocities and a net alongshore current being near zero". The report concludes that *"these tidal currents are insufficient to initiate sand transport on the seabed and are likely to provide little additional assistance to the transport of sand already entrained."*

These currents and associated sand movements contribute to the area's sediment, sand and bathymetry characteristics as outlined in Sections 4.4.3 and 4.4.4 below.

4.4.3 Geomorphology and Bathymetry

The geomorphology of the Mangawhai-Pakiri sand body is formed from a wedge of sediment comprising dunes, beach and seabed sands extending seaward to a depth of approximately 40 m or 4 km from MHWS (as shown in Figure 4-7). The material which comprises the sand body is a mixture of modern Holocene quartz-feldspathic sands overlaying older consolidated Pleistocene sediments. The volume of this Holocene sand is estimated to be 174-694 million m^3, which includes 70-120 million m^3 located between mean high-water spring (MHWS) and 25 m water depth.

The original source of the local sand is believed to be the ancient Waikato River, which previously flowed into the Hauraki Gulf during periods of low sea level (during Pleistocene glacial periods), with this sand then transported via wave action during the Holocene sea level rise (approximately 6500 BP). It is also noted by the coastal processes report (Appendix G) that the underlying Pleistocene sand volume is estimated to be in the order of 2 billion m^3.

As highlighted in the coastal processes report, the sand in the inner Pakiri area embayment is sourced from outside the area, as well as from some local sources. Sand and sediment are transported into the area by wave induced and non-tidal water currents from the inner continental shelf and by longshore drift. These inputs are augmented by biogenic sand production (i.e. by shell production and breakdown), coastal cliff erosion from the ends of the embayment, and sediment from local rivers/streams. These sources highlight that the Pakiri area embayment is not a closed system, but rather has a sediment budget fed from a variety of sources.

It is noted that while some fluctuation in shoreline position has occurred fluctuated in modern times, this has included changes due to storm events (such as a significant regional wide storm in 1978 which affected much of the Auckland east coast). Shoreline dune stabilisation over this period has also been assisted by the forestry estates plantations established along the coastal edge for this purpose. Overall, the shoreline of the embayment, as determined by the seaward vegetation position, has been advancing at an average rate of 0.4 m/yr since the early 1960s. The accretion trend visible from aerial photography and is further detailed in Appendix G. The patterns and trends in shoreline movements are discussed further in Section 4.4.5.

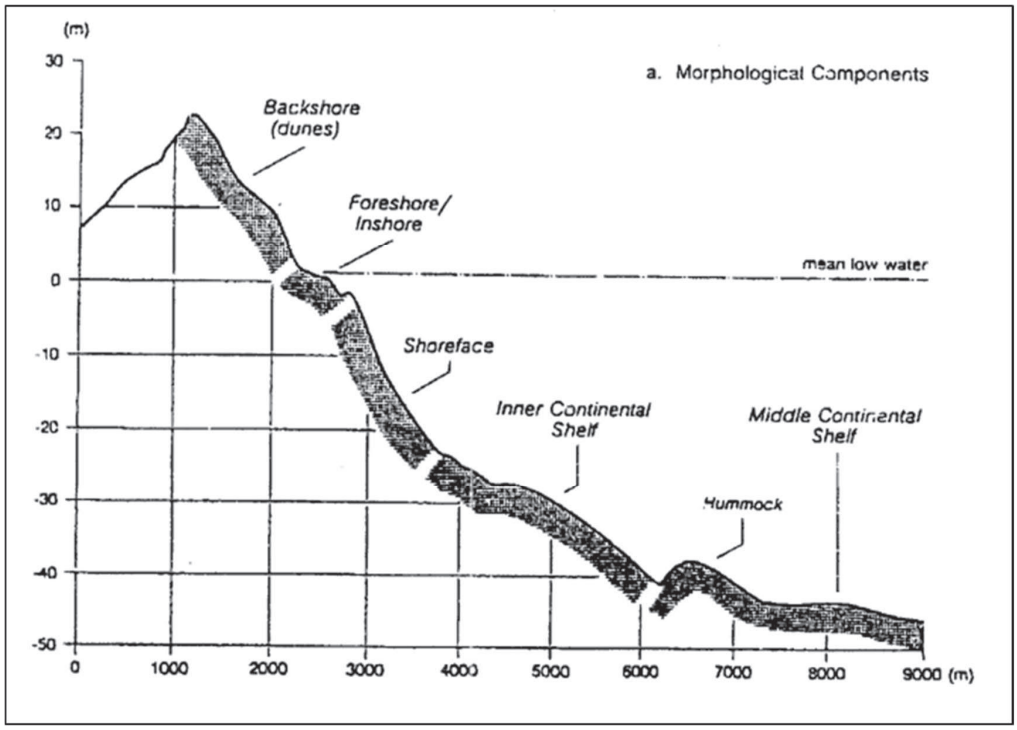

Figure 4-7: Morphological components of the Mangawhai-Pakiri embayment (Hilton, 1990)

Regarding bathymetry, hydrographic surveys undertaken by MBL during March and October of 2019 found that the shoreface bathymetry profiles along Pakiri Beach are largely similar along its entire length, with little longshore variation in seabed slopes. The results of these surveys are detailed in the coastal processes report (Appendix G). Finally, depths on the beach side of the existing extraction area were found to generally range from -6 to -8 m below MSL and on the seaward side from -14 m to -16 m.

4.4.4 Sediment and Sand Quality

The characteristics of marine sediment and sands at Pakiri were investigated in by sampling undertaken for the MPSS in the 1990's and by further sampling undertaken by MBL and Bioresearches Limited (Bioresearches) for the development of this application (an additional 421 samples were taken at water depth bands of 0-15 m, 15-25 m, 30 m and 40 m). From this sampling, the seabed sediment distribution can be described as:

- 0 m to -15 m contour (27 MBL samples), which includes the MBL inshore extraction area: Very well sorted Fine to Medium sand with sample mean grain sizes (mgs) in the range 0.22 mm to 0.48 mm and average mgs across all samples of 0.26 mm. The fine sand samples are scattered along the embayment, with a small concentration in the vicinity of Te Ārai Stream. No samples contained material finer than 0.075 mm, or had more than 5% coarser than 1.18 mm. The average medium grain size (D_{50}) was 0.25 mm. There does not appear to be any differences in the sediment size distributions between the extraction areas and the southern control area;
- -15 m to -25 m contour (49 MBL samples): Still a very well sorted sand but with a slightly coarser mgs of predominantly medium sand (38 samples) with areas of fine sand off the mouths of Te Ārai and Poutawa Streams (combined 11 samples). Across all samples in this contour band the mgs had a similar range (0.22 mm to 0.47 mm) but with a slightly higher average mgs of 0.32 mm. Again, no samples contained material finer than 0.075 mm, or had more than 5% coarser than 1.18 mm. The average medium grain size (D_{50}) was 0.33 mm;

- -25 m to -35 m contour (40 MBL samples): The MBL samples were predominantly very well sorted medium sands (90% of samples), with the remainder being well sorted coarse sand mostly located off the Te Ārai Point headland. Across all samples in this contour band the mgs had a range of 0.28 mm to 0.84 mm, with an average mgs of 0.46 mm. Again, no samples contained material finer than 0.075 mm, or had more than 5% coarser than 1.18 mm. The average medium grain size (D_{50}) was 0.43 mm. The samples presented by Bioresearches (2017) from this depth band tended to be coarse sand to the north of Te Ārai Point, fine sand offshore of the southern extraction area, and a combination of both size classes in the southern control area; and
- -35 m to -45 m contour: The Bioresearches (2017) samples from this contour band predominantly had mgs in the coarse sand class.

The source of these sands is from both inshore and offshore reservoirs in the Outer Hauraki Gulf (as identified in Section 4.4.2), as well as biogenic processes (i.e. from discarded shells and dead organisms).

In addition to the physical characteristics of local sediment, chemical testing of seabed samples taken at 5 m and 20 m depths offshore of the Pakiri River, Poutawa Stream, and Te Ārai Stream did not find any exceedances of heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs) or Total Polychlorinated Biphenyls (PCBs). The results of this sampling is provided as Table 4-1 and is further detailed in Appendix H[27].

Table 4-1: Analysis and Comparison between WETlabs WQM, Goat Island and In-Situ Sampling (Source: Jacobs)

Contaminant	ANZG DGV	ANZG GV-High	Pakiri River 5 m	Pakiri River 20 m	Poutawa Stream 5 m	Poutawa Stream 20 m	Te Ārai Stream 5m	Te Ārai Stream 20 m
Heavy Metals (mg/kg dry weight)								
Total Recoverable Arsenic	20	70	5.9	6.2	6.2	6.2	5.9	8.8
Total Recoverable Cadmium	1.5	10	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.011
Total Recoverable Chromium	80	370	10.8	11.7	9.4	12.4	10.5	14.1
Total Recoverable Copper	65	270	0.5	0.5	0.4	0.4	0.6	0.5
Total Recoverable Lead	50	220	0.89	1.79	0.84	1.48	1.06	1.7
Total Recoverable Mercury	0.15	1	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Total Recoverable Nickel	21	52	2.6	2.4	2.3	2.8	2.4	2.8
Total Recoverable Zinc	200	410	10.6	10.7	9.4	11.7	17.9	12.4

[27] As taken from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018.

Contaminant	ANZG DGV	ANZG GV-High	Pakiri River 5 m	Pakiri River 20 m	Poutawa Stream 5 m	Poutawa Stream 20 m	Te Ārai Stream 5m	Te Ārai Stream 20 m
Total Polycyclic Aromatic Hydrocarbons (PAH) (µg/mg dry weight)								
Total PAH	10,000	50,000	< 1,500 (0.2% TOC)	< 1,500 (0.2% TOC)	< 1,500 (0.2% TOC)	< 1,500 (0.2% TOC)	< 1,500 (0.2% TOC)	< 1,500 (0.2% TOC)
Total Polychlorinated Biphenyls (PCB) (µg/mg dry weight)								
Total PCB	34	280	< 5 (0.2% TOC)	< 5 (0.2% TOC)	< 5 (0.2% TOC)	< 5 (0.2% TOC)	< 5 (0.2% TOC)	< 5 (0.2% TOC)

4.4.5 Shoreline Movements

As outlined in the coastal processes report, Jacobs gave used a GIS Digital Shoreline Analysis System (DSAS) to calculate net shoreline position change and rates of shoreline movements as defined by the vegetation line or dune toe position from four sets of aerial photograph imagery between the early 1960s and 2018 (1961/63, 1982, 2007/08 and 2018) at 165 transects spaced at 100 m intervals for the area north of the Pakiri River to the northern boundary of the Auckland region. The spatial distribution of the rates of shoreline change over the total 50+ year period is presented as Figure 4-8.

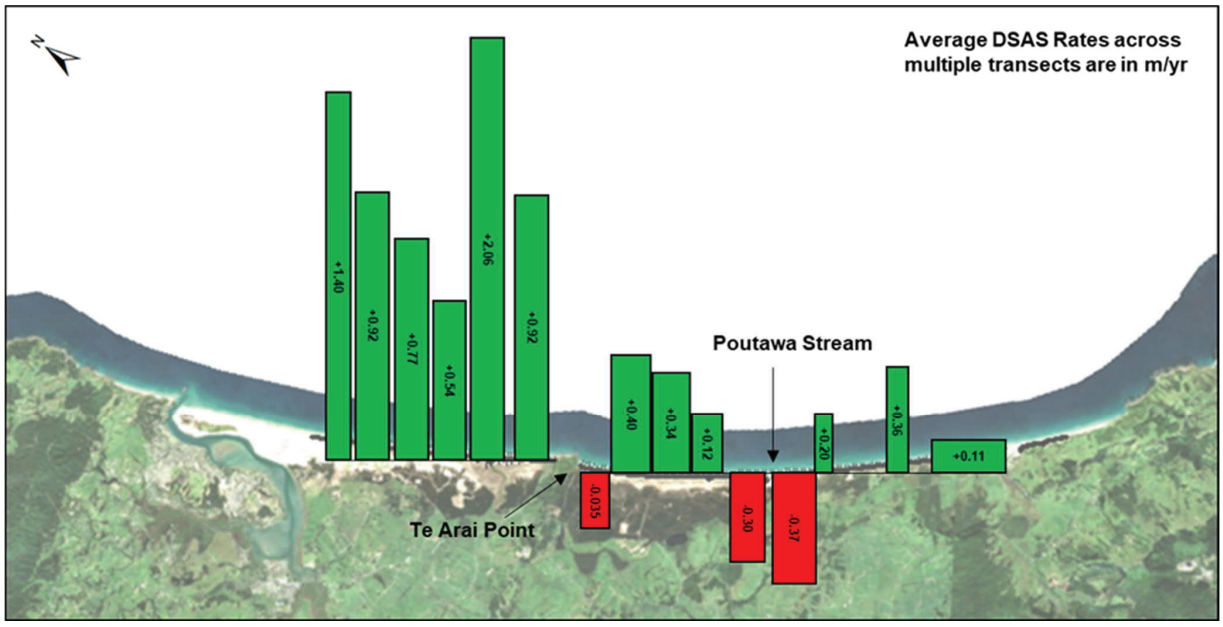

Figure 4-8: Spatial distribution of total shoreline change 1961/63 to 2018 from aerial photographs or from long-term beach profiles P5 & P6 since 1978 south of Poutawa Stream where 1960s aerial photographs were not available. (Source: Jacobs 2020)

The key points from the analysis included:

- The majority of the transects (77%) with images covering the total record from 1961/63 to 2018 displayed net dune line advance. The greatest advance was within two kms north of Te Arai Point, which is consistent with sand accumulating against the headland in net southerly longshore.
- All of the transects with net retreat over the 50+ years were either around the Poutawa Stream mouth and are likely to be influenced by mouth channel migration along the shore or immediately south of Te Arai Point, thereby influenced by headland processes in a net southern transport regime.
- In all transects, the average advance rate for the 50+ year period was +0.40 m/yr.

- Within the existing MBL inshore extraction areas, the average advance rate for the 50+ year period was +0.60 m/yr.

The coastal processes report also presents analysis of the 11 historical Auckland Council beach profile sites spread along the shoreline of the embayment, some of which have been regularly surveyed since 1978[28]. The results of net beach and dune movements and beach volume change from this analysis are presented in Table 4-2, from which the coastal processes report concluded:

"Although the profiles display a range of beach and dune morphologies and are spread throughout the embayment in both the extraction and control areas; all sites except the southernmost site P9, displayed net beach toe advance and net foreshore volume growth over the last 35-40 years from the severely eroded dune and foreshore morphologies present post the 1978 storm events. It is the same pattern for the dune face, except for P5 to the south of Poutawa Stream, where the -20 m retreat that has occurred in the last year is due to local site conditions within the dune blow out where this profile is located….. It is noted that all sites experienced a net volume increase over the total length of their respective survey records, with the average foreshore volume increases across all profiles of 1.1 m^3/m/yr, and across the dune-beach areas of 2.5 m^3/m/yr. These sediment accumulation volumes are an important storage element in the sediment budget considerations."

Table 4-2: Net beach and dune contour movements and volume changes over the total survey record for historical beach profiles.

Profile	Period	Net Dune Face movements (5.5 m contour)	Net Beach Toe movements (3.5 m contour)	Net Beach Width change (3.5 m - 1 m contour)	Net Beach Volume change (3.5 m - 1 m contour)	Beach and foredune Volume change (>1m contour)
P1	1978-2020	+4.3 m @0.10m/yr	+4.7 m @0.11m/yr	+39.9 m	+59.8 m^3/m	49.2 m^3/m
P2	1988-2020	+8.9 m @0.28m/yr	+2.2 m @0.07m/yr	+25.4 m	+16.8 m^3/m	20.7 m^3/m
P2B	1993-2020	+68.9 m @2.55m/yr	+53.2 m @1.99m/yr	-34.2 m	+30.8 m3/m	238.5 m^3/m
P2A	1990-2020	+6.9 m @0.23m/yr	+11.4 m @0.38m/yr	+7.5 m	+33.2 m3/m	2.2 m^3/m
P3	1981-2020	+28.6 m @0.73m/yr	+19.8 m @0.51m/yr	-18.3 m	+18.3 m^3/m	137.6 m^3/m
P4	1978-2020	+3.8 m @0.09m/yr	+7.7 m @0.18m/yr	+15.8 m	+40.4 m^3/m	74.4 m^3/m
P5	1978-2020	-9.6 m @-0.23m/yr	+25.8 m @0.61m/yr	+34.6 m	+105.6 m^3/m	143.1 m^3/m
P6	1978-2020	0 m @0.00m/yr	+8.5 m @0.20m/yr	+30.5 m	+22.2 m^3/m	43.0 m^3/m
P7	1978-2020	+12.6 m @0.30m/yr	+15.2 m @0.36m/yr	+15.0 m	+48.3 m^3/m	78.9 m^3/m
P8	1978-2020	+5.1 m @0.12m/yr	+42.5 m @1.01m/yr	+30.0 m	+53.0 m^3/m	96.5 m^3/m
P9	2000-2017	-10.6 m @ -0.62m/yr	-13.1 m @ -0.77m/yr	+6.1 m	+21.5 m^3/m	N/A

[28] This includes at six monthly intervals since 2007 as part of the existing MBL inshore extraction consent monitoring.

4.4.6 Sediment Budget

The coastal processes report has undertaken a detailed assessment regarding the sources of sediment and the overall sediment volumes present for production of a sediment budget (as shown in Table 4-3 and Figure 4-9). A range of sediment sources contribute to the embayment including:

- Biogenic (i.e. biological) sources;
- Long and cross-shore movement from the inner continental shelf;
- From north of Bream Tail via longshore drift;
- Sediment discharges from local rivers/streams; and
- Cliff erosion from headlands at either end of the embayment.

Regarding biogenic sources, Bioresearches were commissioned to determine the volumes of sediment/sand produced by organisms (i.e. biogenic production). Using the results of Bioresearches work, 4,600 – 7,400 m^3/yr of biogenic sand production should be included in the sediment budget inputs for shell production within the - 25 m CD contour, with an additional 4,000 - 5,400 m^3/yr being part of the cross-shore transport from the inner continental shelf.

Long and cross-shore movement is also a major source of sediment, as material is carried by wave action and currents from the inner continental shelf into the embayment. This is due in part to the grain size of sediment, which is small enough to be picked and carried towards shore by wave induced and ocean currents on a frequent basis. This pattern of sediment source is reinforced by observations of the seabed, with numerous sand ripples found across the embayment in water depths of greater than 25 m CD. These ripples are formed from wave disturbance of the seabed, which produces repeated cycles of transport and deposition before it arrives onshore as beach sand. It is estimated from balancing the sediment budget, that up to 145,000 m^3/yr arrives in the embayment via this source.

Longshore drift of sand from around Bream Tail into the embayment is another source of sediment. The presence of sand sized sediment out to 30 m water depths, large sand ripples on the seabed, and the occurrence of current velocities capable of transporting sand all indicate the viability of this sediment supply route, involving material moving from Bream Bay in the north, around Bream Tail and then into the embayment. The 2006 Environment Court decision estimated that 25,000 m^3/yr of material arrives in the Mangawhai-Pakiri embayment from this source.

Finally, there is sediment feed into the embayment via both the discharges of rivers/streams and the erosion of coastal cliffs at the ends of the embayment. Both sources were previously identified in the 2006 Environment Court decision and respectively provide 17,000 m^3/yr and 6,000 m^3/yr.

It is noted that there are several sediment sinks (i.e. losses) to the local system. These include losses from onshore winds and currents transporting suspended sediments out of the embayment.

Another sink, or more correctly a storage of sand within the system, is the dune/beach accretion, which the aerial photography interpretation indicates has been occurring at an average rate of 0.4 m/yr since the early 1960s. The storage volume associated with this rate of shoreline advance over the 21 km of sand beaches from the Mangawhai Inlet to the Pakiri River was calculated to range from 90,000 to 135,000 m^3/yr, with 122,000 m^3/yr adopted as a best estimate for the sediment budget.

Overall, the sediment budget highlights the open and dynamic nature of local coastal processes. Significant volumes of sediment enter the embayment and while some is lost to both natural and man-made processes, the remaining sediment contributes to the ongoing accretion of the beach's dune system. It also highlights the large volume of sand available for extraction.

Table 4-3: Sediment budget out to 25 m CD water depth on basis that inputs exceed losses over last 50 years due to storage as shoreline accretion (Source: Jacobs).Sediment budget out to 25 m CD water depth on basis that inputs exceed losses over last 50 years due to storage as shoreline accretion (Source: Jacobs).

Sediment Sources (Inputs or credits)		Sediment sinks (losses or debts)	
Source	Volume (m^3/yr)	Sink	Volume (m^3/yr)
Cliffs	6,000	Onshore winds	2,000
Rivers	17,000	Mangawhai Inlet	3,000
Biogenic from <25 m depth	7,000	Around Cape Rodney	1,000
Around Bream Tail	25,000	Extraction from < 15 m depth (average from 50 yrs. of records)	72,000
Cross-shore supply (including longshore elements) from >25 m depth Calculated to balance budget	145,000	Total Sinks (Losses or debts)	78,000
		Storage/Surplus Storage in dune/beach/nearshore from +0.4 m beach accretion over 50+ years	122,000
Total Sources	200,000	Total Sinks + Storage	200,000

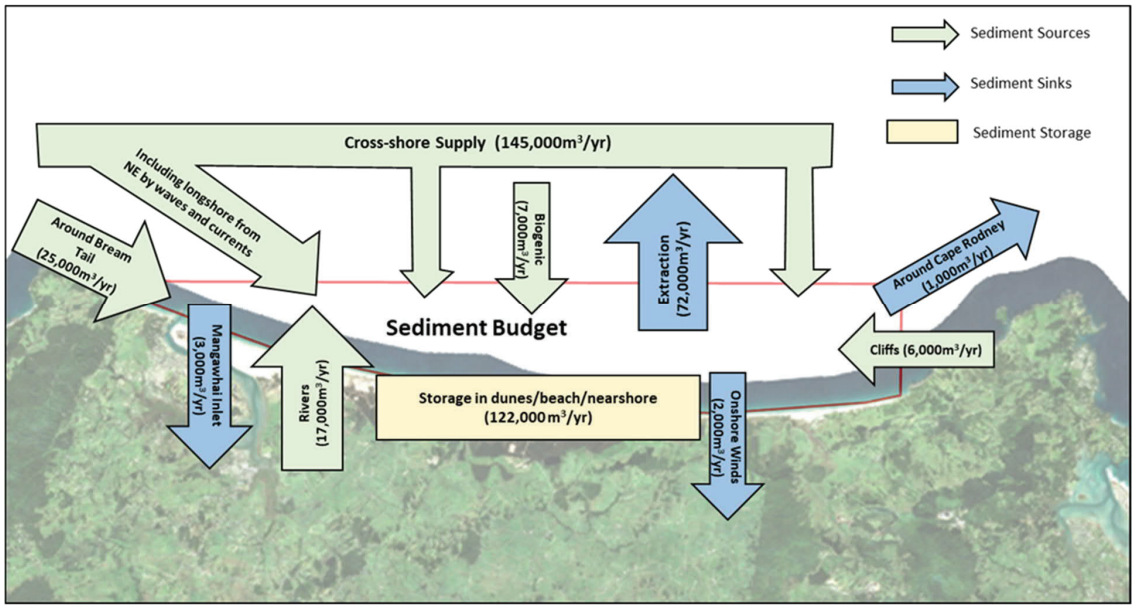

Figure 4-9: Schematic of sediment budget for the Mangawhai-Pakiri Embayment (Source: Jacobs)

4.4.7 Landscape and Visual Values

A detailed landscape assessment has been prepared for this application by Brown NZ Limited (Appendix M), Mr Brown has highlighted in significant detail the existing landscape values for the Pakiri area, including those described in the AUP(OP), which are summarised as:

"Pakiri Beach, extending either side of Te Ārai and Eyres Points, is the largest of the Region's eastern ocean beaches. Its broad crescent, defining the coastal edge of the Jellicoe Channel (which extends out to the Hen and Chicken Islands to the north, and Little Barrier Island to the south), provides an expansive 'gateway' to the Pacific Ocean, with its rolling seas and surf backed by a series of dune formations that culminate in the massive dunes of Mangawhai Heads. This dune corridor, much lower down most of the rest of the beach, spreads out to enclose three dune lakes south of Te Ārai Point: Slipper Lake, Spectacle Lake and Tomarata Lake; while behind the northern-most of these dunes, low lying, formations of sand, mud and peat underpin a coastal terrace that extends from near Mangawhai to Te Ārai Point Road. A mixture of underlying mudstone and sandstone

formations combine to then form a sequence of more elevated, rolling to gently rolling, ridges and foothills, that provide the backdrop to most of the beach and its dune / terrace hinterland."

Within this underlying natural form, Mr Brown has described the variety of contributing factors to the existing landscape, including those both on and offshore. Onshore, he has noted the significant contribution that exotic pine plantations provide to the delineation between sea and land. These plantations run along the coastal edge (between 230 m and 1000 m from mean highwater spring) at the coastal edge and are only interrupted by Te Ārai Point at their centre and the Tara Iti Golf Course at the northern edge of the extraction area. Behind these plantations is a pastoral landscape, with interspersed rural-residential development, country roads and patches of regenerating bush. While some clearance of the pine plantations is underway, Mr Brown notes that:

"even so, there remains a clear demarcation and separation of Pakiri Beach from its more immediate hinterland that is frequently accentuated by the shelterbelts criss-crossing pasture behind both arms of the Mangawhai Forest."

Looking offshore, open and uninterrupted views are provided to the outer Hauraki Gulf, including those towards Little Barrier Island and the Hen and Chicken Islands. Within the offshore area are also numerous vessels, including large container ships transiting to and from the Port of Auckland. This offshore environment is also dynamic, with the view changing with passing weather.

Figure 4-10 and Figure 4-11 show the largely undeveloped nature of Pakiri, including the extensive dune systems and limited development.

Figure 4-10: View of Pakiri Beach looking south (Source: Jacobs)

Figure 4-11: Pakiri Beach looking north (Source: Jacobs)

Overall, the open and largely natural landscape of Pakiri is a contributor to its sense of place and its importance to both residents and visitors.

4.4.8 Water Quality

A water quality investigation for Pakiri has been undertaken by Jacobs, including field work between May and July 2019 to measure current ambient water quality conditions (Appendix H). Ambient water quality monitoring was undertaken using a µWQ (micro water quality) buoy at a water depth of 25 m immediately north of the proposed extraction area. This included a downward-facing RDI Sentinel V50 500kHz Acoustic Doppler Current Profiler (ADCP) mounted to the base of the buoy and a WETlabs WQM (water quality instrument) attached via a 20 m line to a position just above the seabed. The ADCP measured water column current velocities and near-surface temperatures, whilst the WETlabs WQM measured:

- Temperature;
- Salinity;
- Chlorophyll-a;
- Turbidity;
- Conductivity; and
- Dissolved oxygen.

Site-specific water quality sampling was undertaken in December 2019 prior to the dredge plume sampling, with samples taken at the surface, mid water and at the seabed with the Van Dorn water sampling bottles[29]. Additional in-situ sampling was undertaken, using a Seabird SBE19plus CTD instrument with integrated WETlabs fluorometer (Chl-a and Turbidity) and Van Dorn. These samples were tested for:

[29] Van Dorn bottles provide a means of obtaining water samples at selected depths below the surface. They consist of an open-ended clear plastic cylinder that can be attached to the hydrographic wire (the steel wire wound on the winch) and lowered to any desired depth.

- Temperature;
- Salinity;
- Turbidity;
- Conductivity;
- Dissolved Oxygen;
- Density; and
- Photosynthetic Active Radiation (PAR).

Overall, the samples and their subsequent testing show that the CMA at Pakiri has high water quality value[30]. For instance, the WETlabs WQM results show consistent Total Suspended Solids (TSS) and turbidity concentrations across the two-month sampling period to be relatively stable (Figure 4-12, Figure 4-13 and Table 4-4: WETIlabs WQM Results).

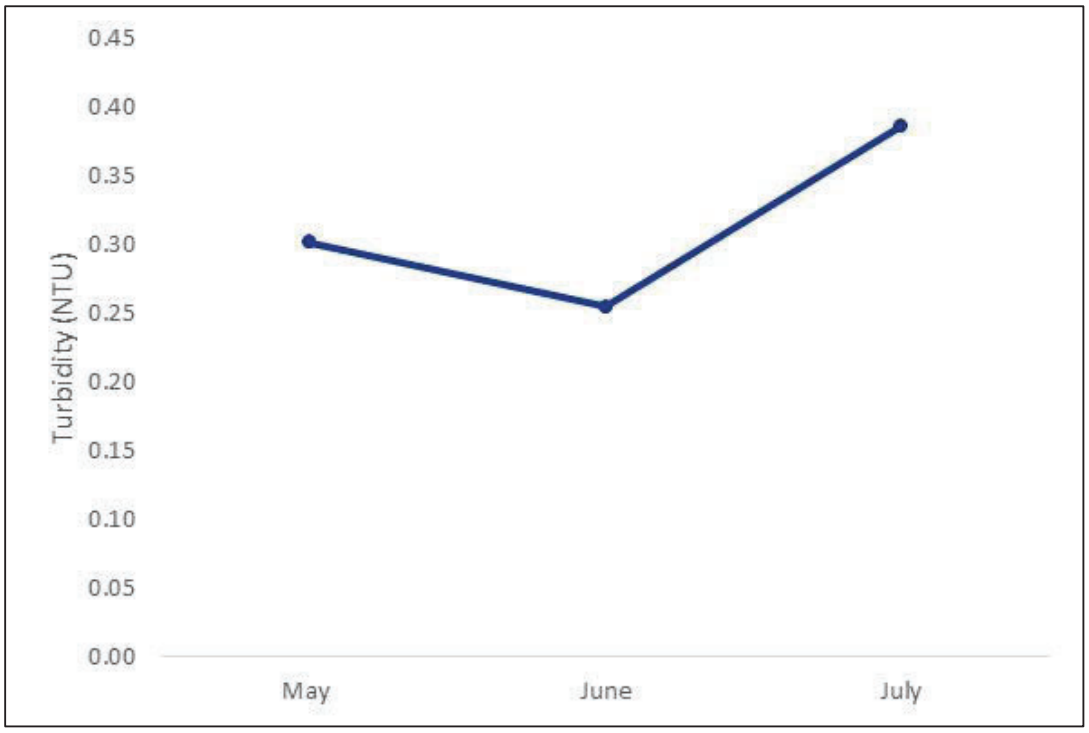

Figure 4-12: WETlabs WQM Mean Turbidity Results

[30] When considered under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018.

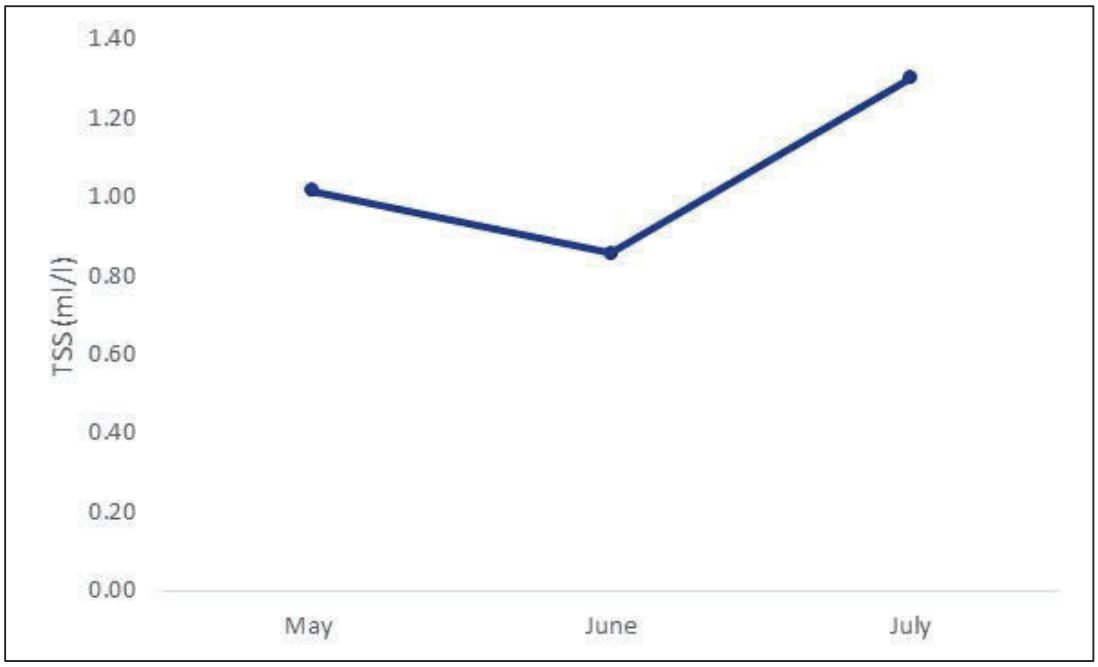

Figure 4-13: WETlabs WQM Mean TSS (mg/l) Results

Table 4-4: WETllabs WQM Results

Parameter	Analysis	Goat Island	WQM	In-Situ Sampling		
				WQM Deployment	WQM Retrieval	Pre-Plume Sampling
Turbidity (NTU)	Result	*N/A*	*N/A*	1.29	1.28 – 2.33	0.13 – 0.14
	Mean	0.58	0.31			
	Median	0.40	0.29			
	Max	13.30	3.11			
	Min	0.15	0.14			
	80th Percentile	0.64	0.34			
	90th Percentile	0.95	0.39			
	Standard Deviation	0.86	0.15			
TSS (mg/l)	Result	*N/A*	*N/A*	<3	<3	2.4 – 2.9
	Mean	4.03	1.04			
	Median	3.10	0.98			
	Max	28.00	10.46			
	Min	0.40	0.47			
	80th Percentile	5.68	1.14			
	90th Percentile	7.65	1.31			
	Standard Deviation	3.27	0.51			

While some variation in samples did exist, these are naturally occurring and are like other test locations on the East Coast (e.g. Goat Island), as determined by the literature review that was undertaken. In addition, the sediment testing did not indicate any local sources for heavy metals, PABs or PAHs which could contaminate coastal waters.

4.4.9 Marine Ecology

The marine ecology values of the extraction area have been considered by the assessment of ecological effects by Bioresearches (Appendix K), the marine mammal assessment by the Cawthron Institute (Cawthron) (Appendix L) and the assessment of effects on coastal birds by NIWA (Appendix N).

4.4.9.1 Invertebrate and Benthic Ecology

In order to assess the current ecological values, Bioresearches undertook analysis of the field work (including tow dredging and box dredge sampling) in the proposed extraction areas and a control, as well as a literature review of earlier surveys undertaken by Dr Roger Grace[31].

With regard to sampling techniques, both towed and box dredging was undertaken to ascertain the benthic communities present both within the extraction areas and control locations in 2019 and 2020. In addition, macrofauna sampling was undertaken from the extraction vessels to determine survivorship after passing through the pump and screening systems.

Box Dredging Results

A total of 118 box dredge samples were collected across the Pakiri area, with each of these samples taken from a seabed area of 180 mm wide, 0.9 m long and 75 mm deep, providing up to 4.5 L of sand and sediment[32]. Following each sample collection, a 200 mL subsample was taken and screened through a 1 mm mesh, while the remaining sample was passed through a 3.15 mm mesh. Any benthic organisms found in the screened material were then preserved in methylated spirits and stored for later taxonomic identification.

The box dredging found a total of 181 identified species/taxa and a total of 3683 individuals. Of those samples taken in the proposed mid-shore extraction area, 150 species were identified, with 1440 individuals counted from both the 1mm and 3.15mm screens. Analysis showed distinctive groupings based on water depth, with in shore samples showing significantly different species to mid shore samples. In addition, mid-shore samples showed species overlap with offshore samples. Analysis revealed that the dissimilarity between inshore and mid-shore was driven by the wheel shell (*Zethalia*), the sand dollar *Fellaster*, the Lancelet *Epigonichthys hectori* and the clams *Myadora* and *Dosinia*, which were found to be abundant in the inshore samples. Taxa characteristics of the mid-shore samples were the presence of polychaetes (Maldanidae), the speckled whelk *Cominella quoyana* and the amphipods Phoxocephalidae being more prevalent in mid-shore and offshore samples.

Tow Dredging Results

Tow dredging was employed to collect larger epibenthic macrofauna that may have been missed by using the box dredge, with each tow being undertaken for a distance of approximately 300 m. The 650 mm wide dredge head utilised a 15 mm square mesh bag, with dredge tows undertaken at the 5, 10, 15, 20 and 25 m bathymetric contours. All species captured during each tow were removed and immediately sorted, photographed, identified, measured and then returned to the sea alive.

Within the proposed mid-shore extraction area, the combined fauna samples showed the biota was numerically dominated by hermit crabs *Paguristes*, the gastropods *Striacolpus* and *Cominella*, and the starfish *Astropecten*.

[31] Dr Grace undertook field work in 1990 and 2005 for earlier extraction applications.
[32] Any sample with less than 3.75 L of material was discarded and the sample retaken.

Macrofauna Survivorship Sampling Results

This field work involved the collection of replicate samples in February 2020, with the sand extraction dredge William Fraser operating along the offshore edge of the inshore consent area, in similar locations to those collected in May 2019[33]. Another set of five replicate samples were collected the same day along the inshore edge of the KL offshore sand extraction area. The sampling method involved running the sand extraction intake pump at normal operating rates and collecting the discharged unwanted material through a 1m wide box net[34].

The results of this sampling found that while there were a higher number of individual organisms at 10 m depth when compared to 25 m, there was greater diversity in species present at 25 m. The most common taxum found at both depths was the surf clam *Dosinia* sp., while other taxa included gastropods, a few crabs and shrimps, annelids, fish and echinoderms[35].

Summary

The samples taken found that the benthic ecology of the proposed extraction area is dominated by large populations of polychaete worms *(Maldanidae* and *Capitellidae)*, hermit crabs, *Phoxocephalidae* amphipods, the bivalves *Nucula* and *Myadora*, the gastropods *Striacolpus* and *Cominella*, and the Lancelet *Epigonichthys hectori*.

No reefs or any coral were identified in the study area. Furthermore, no unique or endangered benthic species were found to inhabit the extraction areas. As such, the benthic ecology within the proposed mid-shore extraction area is typical of similar coastal locations and features species that are able to survive in a dynamic, exposed marine environment.

Overall, the Pakiri benthic community is comprised of 30 species of polychaetes, 10 species of amphipods, 10 species of decapods, with 16 additional crustacea, 22 gastropods, 27 bivalves, 7 echinoderms, 4 sponges and 12 other species from a range of taxa groupings (making total diversity of 139 species or taxa). It is also noted that among these species, some variation was found along the mid-shore dredging transects. For instance, scallops were only found in the northern sections of the mid-shore, whereas Hermit crabs, starfish, and *Cominella* were more common in the southern sections.

4.4.9.2 Fin Fish

In regard to fin fish, it is noted that only limited surveys have historically been undertaken in the Pakiri area. However, species that are known to inhabit further offshore or are likely to occupy parts of the proposed extraction area include:

- Snapper (*Pagrus auratus*);
- Red gurnard (*Chelidonichthys kumu*)
- Blue cod (*Parapercis colias*);
- Sole (*Peltorhamphus novaezeelandiae*);
- Tarakihi (*Nemadactylus macropterus*);
- Kahawai (*Arripis trutta*);
- John Dory (*Zeus faber*); and
- Yellowtail Kingfish (*Seriola lalandi*).

[33] The May 2019 sampling was undertaken to support the resource consent application to renew the existing inshore resource consents.
[34] This sampling method differs from that used for the renewal resource consent application given the design of the William Fraser and the inability to safely access the discharge point in the moon pool.
[35] The shrimps, annelids, fish and echinoderms were only found in samples taken at 25 m depth.

These species will be transitory visitors to the proposed extraction area, with no known spawning areas present. As such, juvenile fish are unlikely to be found within the extraction area.

Lastly, it is anticipated that shark species, such as bronze whalers (*Carcharhinus brachyurus*), will also be present in the Pakiri area. It is noted that a number of these fish species are also commercially fished in the Hauraki Gulf or are sought by recreational fishermen.

4.4.9.3 Marine Mammals

While no specific marine mammal studies have been undertaken for the Pakiri area, a number of studies have been undertaken in the Bay of Islands and Hauraki Gulf since the mid-1990s. Cawthron's assessment was based on these earlier studies, as well as sighting data. They note that:

"the proposal area itself is not considered ecologically more significant in terms of feeding, resting or breeding habitats for any marine mammal species relative to nearby coastal regions or those further along the north-eastern coastline based on current knowledge. "[36]

Current data indicates that at least 27 cetacean and two pinniped species have been observed or stranded along the north-eastern coastline of New Zealand and include:

- Common dolphin (Delphinus delphis/capensis);
- Bottlenose dolphin (Tursiops truncates);
- New Zealand Fur Seal (Arctocephalus forsteri)
- Orca (Orcinus orca);
- Bryde's whale (Balaenoptera rydei/edeni); and
- Pilot whale (Globicephala melas /macrohynchus).

It is also noted that while some of these species are seasonal visitors or semi-resident, others will only be migrating through the area. However, none of these species are expected to have home ranges solely restricted to the Pakiri area, with their distribution and conservation status further detailed in Table 4-5 below.

Table 4-5: Residency patterns of marine mammal species known to frequent Mangawhai / Bream Bay and nearby waters

Common Name	Species Name	NZ Threat Classification System	IUCN Listing	Residency Category in Northland	Patters of Seasonality
Common dolphin	*Delphinus delphis/capensis*	Not Threatened	Least Concern	Seasonal to Year-Round Resident	Common throughout north-eastern waters year-round. Feed on schooling or more pelagic fish species. Generally observed in waters deeper off Mangawhai / Bream Bay with occasional inshore sightings in the proposal area.
Bottlenose dolphin	*Tursiops truncatus*	Nationally Endangered	Data Deficient	Seasonal to Year-Round Resident	Resident sub-population to north in Bay of Islands that ranges between Doubtless Bay, Great Barrier Island and Tauranga. Occasional visits to Mangawhai / Bream Bay perhaps more over

[36] Page 12 of Cawthron Report.

Common Name	Species Name	NZ Threat Classification System	IUCN Listing	Residency Category in Northland	Patters of Seasonality
					summer months. Generalist feeders. Currently in decline.
NZ fur seal	*Arctocephalus forsteri*	Not Threatened	Least Concern	Seasonal to Year-Round Resident	Present year-round with multiple haul-out sites and breeding colonies in the Hauraki Gulf and regular sightings on offshore islands and Bay of Islands. More susceptible to human effects in breeding colonies. Feed mainly over shelf waters but inshore regions as well.
Orca (killer whale)	*Orcinus orca*	Nationally Critical	Data Deficient	Seasonal to Semi-Resident	Frequent north-eastern waters year-round, more common in late winter / early spring. Forage in harbours, estuaries and sandy beaches on rays, fish and other marine mammal species.
Bryde's whale	*Balaenoptera brydei/edeni*	Nationally Critical	Data Deficient	Seasonal to Semi-Resident	Most commonly observed whale species in north-eastern waters year-round. Feed on small schooling fish and sometimes krill. Regularly move through Mangawhai / Bream Bay travelling between Bay of Islands and Hauraki Gulf.
Pilot whale	*Globicephala melas / macrohynchus*	Not Threatened to Data Deficient	Data Deficient	Offshore Semi-Resident	While a more offshore species, inshore sightings occur mainly over summer months. Forages off shelf waters. Known for frequent and mass strandings in Bream Bay and surrounding waters.
Southern right whale	*Eubalaena australis*	At Risk – Recovering	Least Concern	Seasonal Migrant	Frequent more inshore, shallow regions of Northland during seasonal migration periods, particularly with new-born calves. Once present, they can remain in the Northland region for several days to weeks. Most often seen between August and November.
Humpback whale	*Megaptera novaeangliae*	Migrant	Endangered	Seasonal Migrant	Pass by Mangawhai / Bream Bay on both north and south migrations but more prevalent and closer to shore on southern return migration when with calves (mainly Oct to late Dec).
Sperm whale	*Physeter macrocephalus*	Not Threatened	Vulnerable	Offshore Visitor	Increased sightings along the north-eastern coasts, mainly over summer and autumn months. Taonga species.

4.4.9.4 Avifauna

NIWA has been commissioned to prepare a report in regard to the proposed mid-shore extraction's effects on seabirds (Appendix N). While no specific bird population studies have been undertaken at Pakiri, a review by NIWA of previous bird sightings and relevant literature has indicated that there are 26 bird taxa which may be present at or near to the proposed extraction area (Table 4-6). These include species which are known to breed at locations around the Hauraki Gulf, while other species are migratory. It is also noted that 21 of these taxa are classified as either nationally critical or threatened.

In addition to these species, NIWA have identified that some other species are likely to either nest (e.g. Northern New Zealand dotterel - *Charadrius obscurus aquilonius)* or feed/forage at the shoreline (variable oystercatcher - *Haematopus unicolor*) given their presence at other Upper North Island coastal locations.

Table 4-6: Seabird species possibly present at Pakiri (Source: NIWA)

Common Name	Scientific Name	NZTCS Conservation Status	IUCN Red List Classification
Black-billed gull*[37]	*Larus bulleri*	Threatened – Nationally Critical	Endangered
New Zealand fairy tern*	*Sternula nereis davisae*	Threatened – Nationally Critical	Vulnerable
New Zealand storm petrel*	*Fregetta maoriana*	Threatened – Nationally Vulnerable	Critically Endangered
Caspian tern*	*Hydropogne caspia*	Threatened – Nationally Vulnerable	Least Concern
Black petrel*	*Procellaria parkinsoni*	Threatened – Nationally Vulnerable	Vulnerable
Flesh-footed shearwater*	*Puffinus carneipes*	Threatened – Nationally Vulnerable	Near Threatened
Northern little penguin*	*Eudyptula minor iredalei*	At Risk - Declining	Least Concern
Red-billed gull*	*Larus novaehollandiae scopulinus*	At Risk - Declining	Least Concern
Sooty shearwater*	*Puffinus griseus*	At Risk - Declining	Near Threatened
White-fronted tern* Sterna striata	*Sterna striata*	At Risk - Declining	Near Threatened
Northern giant petrel	*Macronectes halli*	At Risk – Recovering	Least Concern
Pied shag*	*Phalacrocorax varius*	At Risk – Recovering	Least Concern

[37] Common names marked with * are those taxa that are known to breed within the greater Hauraki Gulf.

Common Name	Scientific Name	NZTCS Conservation Status	IUCN Red List Classification
Pycroft's petrel*	*Pterodroma pycrofti*	At Risk - Recovering	Vulnerable
Fairy prion	*Pachyptila turtur*	At Risk - Relict	Least Concern
White-faced storm petrel*	*Pelagodroma marina maoriana*	At Risk - Relict	Least Concern
Northern diving petrel*	*Pelecanoides urinatrix*	At Risk - Relict	Least Concern
Cook's petrel*	*Pterodroma cookii*	At Risk - Relict	Vulnerable
Fluttering shearwater*	*Puffinus gavia*	At Risk - Relict	Least Concern
Black shag	*Phalacrocorax carbo novaehollandiae*	At Risk – Naturally Uncommon	Least Concern
Little black shag	*Phalacrocorax sulcirostris*	At Risk – Naturally Uncommon	Least Concern
Buller's shearwater*	*Puffinus bulleri*	At Risk – Naturally Uncommon	Vulnerable
Arctic skua	*Stercorarius parasiticus*	Migrant	Least Concern
Southern black-backed gull*	*Larus dominicanus*	Not Threatened	Least Concern
Australasian gannet*	*Morus serrator*	Not Threatened	Least Concern
Little shag*	*Phalacrocorax melanoleucos brevirostris*	Not Threatened	Least Concern
Black-winged petrel*	*Pterodroma nigripennis*	Not Threatened	Least Concern

Specific note is made regarding the New Zealand fairy tern, which is New Zealand's rarest native breeding bird and is known to have approximately 45 individuals present in the wild. It is also ranked as a critically endangered species and carries a 'Category A' priority for conservation action. Its only nesting locations are located on the east coast between Auckland and Whangarei at Waipu, Mangawhai, Pakiri and the South Kaipara Head. The NIWA report notes that fairy terns do appear to prefer estuarine and very nearshore habitats for foraging, given their diet of small/juvenile fish and crustaceans (i.e. locations unlike the proposed extraction area). This is supported by recent field studies which found that out of 598 recorded dives, only 29 or 4.8% occurred at nearshore coastal locations.

4.4.10 Terrestrial Noise Conditions

Terrestrial noise conditions were measured and recorded for this application by Styles Group (Appendix I). As noted in that assessment, noise measurements were undertaken in a range of swell and weather conditions to enable an accurate dataset of existing noise conditions. In all instances, noise measures were taken from either the top of the dune system or grassed areas above the beach with a Bruel & Kjaer 2250 or 2270 sound level meter on a tripod and with wind screens employed[38].

The measurements taken showed that ambient noise levels can vary considerably depending on local weather and swell conditions, with the assessment stating:

"In the calmest of the conditions measured, the LAeq(15min) levels are typically around 50 dB, with background L_{A90} levels typically between 40 dB and 45 dB. The lowest L_{Aeq}(1sec) levels are between 30 dB and 35 dB. By our observations, the lowest noise levels are observed over very short periods of time (1-2 seconds) when there is a lull between the breaking waves.

On days when the wind is blowing on shore, the L_{Aeq}(15min) noise levels are typically as high as 65 dB, with background L_{A90} levels generally around 60 dB. The L_{Aeq}(1sec) noise level typically stays above 60 dB on the windy days. The breaking waves are constant along the beach and there are no 'lulls' or quiet periods."

In summary, there are few human generated noises in the Pakiri area, with most noise generated by either wind or waves.

4.4.11 Underwater Noise Conditions

As with surface noise conditions, Styles Group have also been employed to undertake measurements and recordings of the ambient underwater noise conditions (Appendix J). These measurements utilised four SoundTrap 300HF recorders (two arrays, providing sampling redundancy) at the locations shown in Figure 4-15. The sampling rates were at 96 kHz, while the click detectors operated at the full sampling rate of 576 kHz. The arrays were deployed along the 30m depth contour between 19 March and 25 April 2019, and then again between 9 May and 10 June 2019.

In addition to the above monitoring and in recognition that the existing environment includes the current extraction activity, underwater noise measurements of the William Fraser were also undertaken in November 2019[39]. This involved the use of a measurement array comprising six SoundTrap 202STD recorders as shown in Figure 4-15. Using GPS tracking, the William Fraser undertook a sand extraction run through the KL offshore consent area and was recorded by the array, with any noise contamination (e.g. from other vessels) excluded from the subsequent assessment by Styles Group.

Further contributing to the noise environment is the area's bathymetry, its sea-floor composition (i.e. sediment and sand types), water temperature and density (salinity). With the on-site monitoring and measurements collected and the technical data available regarding the physical attributes of Pakiri, Styles Group was able to determine that the existing noise conditions are those typical of a sandy beach habitat with limited vessel passage. While some noise level increases did occur due to vessel traffic, these were infrequent enough to have limited impact on the averaged and median sound levels. These underwater noise results were also shared with Cawthron to assist them in undertaking a marine mammals effects assessment (Appendix L and Section 6.5.4 of this AEE).

[38] All noise measurements were performed in accordance with NZS6801:2008.
[39] The monitoring was undertaken in fine weather conditions (i.e. variable 10 knot breeze, sea state zero and no swell).

Figure 4-14: Location of hydrophone arrays (Source: Styles Group)

Figure 4-15: PS track of the TSHD William Fraser in relation to the measurement (hydrophone) array (ST1 through 6) (Source: Styles Group)

4.5 Other marine activities

Further to MBL's own activities in the CMA, there are a number of other commercial operations undertaken in the coastal environment of the Outer Hauraki Gulf. These include fishing, scallop dredging, aquaculture, shipping and the sand extraction performed by MBL on-behalf of KL.

Species commercially fished in the Hauraki Gulf include snapper, John Dory, scallops and crayfish using a variety of fishing methods. Within the Pakiri area seasonal exclusions of trawl of Danish seine nets are imposed, while permanent bans on such fishing techniques from vessels larger than 20 m are also imposed.

The outer Hauraki Gulf is also the main transit point for commercial vessels entering and exiting the Port of Auckland. Such vessels must remain at least 5 nautical miles offshore upon entering the Hauraki Gulf and the Jellicoe Channel. No anchorages or permanent moorings are provided at Pakiri Beach.

Lastly, KL is also engaged in sand extraction at Pakiri Beach, although this extraction is currently undertaken on-behalf of KL by MBL (as noted in Section 2). KL's consented extraction regime allows for a total of 2 million m^3 of sand to be removed over a 20-year period (having started in February 2003)[40]. Annual extraction is limited to a maximum of 150,000 m^3/year inside the 30 m bathymetric contour (with further extraction allowed outside that depth), with sand permitted to be removed at seabed depths greater than 25 m and within the area off Pakiri shown in Figure 1-1, which includes a 3 km exclusion area from the Leigh/Cape Rodney Marine Reserve.

[40] It is noted that KL are currently in the process of obtaining resource consent to continue this extraction activity.

5. Consent Requirements

5.1 Reasons for Consent

The following regional resource consents have been triggered under the AUP(OP):

Table 5-1: Relevant Auckland Unitary Plan (Operative in Part) rules

Reference	Rule	Activity status	Assessment
Chapter F2 - Coastal – General Coastal Marine Zone			
F2.19.2 (A15)	Disposal or storage of waste or other matter arising directly from, or related to, the exploitation and associated offshore processing of seabed mineral resources	Discretionary activity	The proposal involves disposal of materials arising directly from the offshore processing of a seabed mineral resource within the General Coastal Marine Zone.
F2.19.4 (A28)	Coastal marine area disturbance for mineral extraction (excluding petroleum)	Discretionary activity	The proposal involves the disturbance of coastal marine area for mineral extraction, with the following rate of extraction proposed over a 35-year period: • "An annual average rate of 125,000 m^3/year over any consecutive 5 year period and a maximum rate of 150,000 m^3 over any 12-month period, with the temporal distribution of the extraction volume being limited to a maximum of 15,000 m^3 over any consecutive 30 day period and to be spatially balanced between a series of extraction cells located along the beach and between the 15 and 25 m depth contours.

5.1.1 Consents Required

MBL seeks coastal permits under sections 12 and 15 of the RMA.

Overall, consent is required as a discretionary activity. As such, assessment against sections 104 and 104B is required.

6. Assessment of Effects on the Environment

The following sections present an assessment of the actual and potential environmental effects of the proposed works. The following effects are considered relevant to the current application[41]:

- Positive effects;
- Water quality effects;
- Coastal erosion effects;
- Ecological effects;
- Cultural effects;
- Biosecurity effects;
- Surface and underwater noise effects;
- Effects on recreation; and
- Landscape and visual effects.

The assessment of effects[42] has taken into account the existing environment as detailed in Section 4 and includes:

- The presence of marine SEAs and a terrestrial SEA outside the proposed extraction area;
- An outstanding natural landscape and high natural character area overlays adjacent to the proposed extraction area; and
- Active resource consents held by MBL and KL for sand extraction.

Furthermore, consideration has been given to the permitted baseline, which is considered appropriate to the application. The permitted baseline includes:

- The passage of vessels through the General Coastal Marine Zone; and
- The noise standards of Chapter E25 for the General Coastal Marine Zone.

Reference should also be made to the assessment methodology utilised for the attached technical assessments. This methodology details how each technical specialist was to approach determining effects and a description of this methodology is provided as 0.

6.1 Crown Minerals Act

It is noted that Section 5(2)(a) of the RMA excludes the sustainable management of minerals from the purpose of the Act. In principle, this means that the long-term depletion of a mineral[43] resource is not an effect or matter for consideration under the Act and as such, has been excluded from the following assessment and is not a matter for Auckland Council to consider when processing the current resource consent application.

[41] Where relevant, the assessments also address the cumulative effects of both MBL and KL's consented activities.
[42] The assessment of a proposal's adverse effects against the existing environment is an established principle in law (Hawthorn Estate Limited NZRMA 424). Under this case, the existing environment may include unimplemented resource consents and utilisation of rights to carry out permitted activities under a district or regional plan. It does not include future possible resource consents or the ecological potential of waterbodies.
[43] "Mineral" is defined under section 2 of the Crown Minerals Act 1991 as "*a naturally occurring inorganic substance beneath or at the surface of the earth, whether or not under water; and includes all metallic minerals, non-metallic minerals, fuel minerals, precious stones, industrial rocks and building stones, and a prescribed substance within the meaning of the Atomic Energy Act 1945*". As such, sand is a mineral.

6.2 Positive Economic and Environmental Effects

As identified in Section 3, the sand resources at Pakiri are of regional importance to Auckland, principally due to their use for concrete production. Market Economics (Appendix D) has identified that sand at Pakiri provides approximately 43% of Auckland's sand for concrete production. With demand for sand production growing at a rate of at least 2.5% per annum, as well as the large projected population growth and construction requirements of the Auckland Plan, the sand resource at Pakiri will be of increasing importance to Auckland's economic and social wellbeing. Pakiri sand provides several advantages over those sourced from either the Kaipara Harbour or the Waikato, thereby delivering numerous benefits to Auckland.

Firstly, it is a low-cost resource in comparison to the other sources available to Auckland. As highlighted by Market Economics:

"Transporting sand is a costly process. Industry information indicates that to move a tonne of sand 1km along the road network costs 17 cents[44]. Given that the nearest available source of sand within Auckland is from the Winstone/Atlas storage yards in Helensville which are 55 km away from Ports of Auckland, this means that every truck movement (with 30 tonnes of sand into the CBD) along the road network costs $280.50. With sand costing approx. $35 per tonne delivered to a concrete plant ($1,050 per truckload), road transport to the Auckland CBD area from Helensville represents a 27% increase in the overall price. Furthermore, this transport cost can effectively be doubled, as the truck needs to return to the plant and is unlikely to have any backload to offset the price. This means that the delivered cost of that sand is significantly higher than sand delivered by barge to the CBD."

The cumulative transport cost to move this extra sand from Helensville, rather than from Pakiri, would be an additional $6.1M to $7.6 M per year. When applying the same costs to Winstone Aggregate's Pukekawa Sand Plant (located in the Waikato) a further $7.2 M and $9.0 M per year of additional costs would be borne by the construction industry and ultimately home buyers. These costs increase even more when other sand sources (e.g. those from Cambridge or Tomorata) are considered. It is also noted that these costs would increase with rises in fuel use, road user charges and the inclusion of costs for additional road repair and maintenance.

A further benefit is a reduction in greenhouse emissions, given the energy efficiencies when sea shipping to truck transport is compared. Market Economics has calculated that a reliance on Kaipara Harbour sourced sand would require an additional 21,000 return truck journeys to move sand between Helensville and Central Auckland. Based on current volumes, this equates to an additional 2.3 million kilometres of truck movements on Auckland's roads, resulting in a CO_2 emission increase of 1,304 tonnes per year, with further emissions generated as demand and transported volumes grow. These CO_2 emissions and truck distances will also increase further if Waikato source sands are used and/or if any emission related taxes are applied in the future. Incremental to this are the increased congestion created by these trucks, increased wear and tear on Auckland roads and the increased risk of traffic accidents between heavy vehicles and other road users.

The high quality of Pakiri sourced sand also provides cost savings and improved performance when producing ready mix concrete, as identified in the concrete industry report (Appendix E). Due to its chemical and physical composition, Pakiri sourced sand used in ready mix concrete production allows the manufacturer to reduce the cement content whilst still achieving the same target strength. A saving of between 20 and 40 kg of cement per cubic metre of concrete is common but depends on the fines content of the crushed rock (termed a PAP) also being used in the mix[45]. Given that the current market price for cement is approximately $220/tonne, this equates to $4.40 per tonne of sand used versus a Waikato sourced sand. This cost saving is doubled if 40 kg of cement per cubic metre is saved. This reduction in cement requirement also delivers further CO_2 reductions, with an estimated reduction of 12,600 tonnes as compared to concrete manufactured using Waikato sourced sand[46].

[44] Based on the average cost to run a truck a specified distance. The average cost is calculated based on a full load one-way priced at 34 cents and an empty load back at 0 cents. This does not include any profit margin for contractor rates.
[45] Based on a 20mpa mix, the amount may be higher depending on the quality of the other aggregates used in the mix.
[46] Based on 20kg per cubic metre of concrete.

The reduced costs associated with using Pakiri sand are of significant benefit to Auckland and its economy. Without access to this sand resource or a greater reliance on more distant/less useful sand, the increased costs associated with concrete production will be passed onto the consumer, while any disruptions to concrete supply would affect the stability of the construction sector. These factors would impact on the affordability of concrete and subsequently on the cost of home ownership and infrastructure investment. This would be harmful to both the social and economic wellbeing of the community, not least due to the projected demand for new homes, business premises and related infrastructure projects. Given that 313,000 new homes are required, as well as the current concerns regarding affordability and ownership, the sand resource at Pakiri is needed to avoid both a disruption to concrete supply and the availability of new homes in Auckland[47].

In summary, the continued extraction of sand from Pakiri will deliver significant economic and environmental benefits to Auckland. Pakiri sourced sand is critical for the delivery of housing, infrastructure and other construction projects planned for Auckland over the coming decades. It provides a reliable low-cost building material, which if removed from market supply, would have detrimental effects on construction costs and delivery timeframes. Furthermore, the use of sea transport helps remove 2.3 million kilometres of truck movements of Auckland's roads, with the delivery of the sand directly to the Port of Auckland. This reduction of truck movements limits the wear and tear of roads, helps improve road safety, and CO_2 savings of 1,306 tonnes per year. It is also noted that Pakiri sourced sand is a high-quality material, reducing the need for cement in concrete manufacturing and providing further CO_2 savings of 12,600 tonnes per year when compared to other sand sources.

6.3 Water Quality Effects

As discussed in Section 4.4.8, Jacobs has undertaken an assessment of the extraction activity's water quality effects (Appendix H). The ambient water quality monitoring undertaken shows that Pakiri has high water quality value, due in part to the sandy seabed and lack of contaminants. In addition, the receiving environment has a good capacity to absorb the proposed changes and a negligible sensitivity to discharges.

The fieldwork for the water quality assessment involved two techniques. The first of these involved the collection of water samples from the immediate discharge point (i.e. from the weir boards on the William Fraser as samples could not be collected form the moon pools which is the ultimate discharge source). These samples represented the "worse-case" scenario for total suspended solids concentrations (TSS) and a baseline to understand discharge plume dispersion/content. While the overall TSS results are shown in Table 6-1 and Table 6-2 details the breakdown of TSS between silts and sand, the sampling shows that the majority (between 70% to 76%) of the TSS is formed by either fine sands or coarse silts.

Table 6-1: TSS (mg/l) Concentrations for Weir Board Sampling Locations

	Weir Board 1	Weir Board 2	Weir Board 3
TSS (mg/l)	450	1,010	1,240

Table 6-2: PSD Results from Weir Board Samples

Sample	Mean particle size µm	Percentage (%) of Silts (10.0 – 62.5 µm)	Percentage (%) of Sands (62.5 – 500 µm)
Weir Board 1	93.50	29.94	70.06
Weir Board 2	115.42	26.46	73.53
Weir Board 3	125.40	23.63	76.37

[47] The requirement for an additional 313,000 dwellings is taken from the Auckland Plan.

The other water quality monitoring technique involved collecting samples from behind the William Fraser on two 2 km transects. Using a Van Dorn, water samples through the discharge plume were then collected at three depths (surface (<1 m), mid (15 m) and bottom water (35 m) in order to ascertain TSS concentrations. Concurrently, a CTD was cast to collect data on turbidity, temperature, dissolved oxygen, salinity, pH, PAR, conductivity and fluorescence through the water column.

As shown in Figure 6-1: Transect One TSS (mg/l) Concentrations at 250 m Intervals from Plume Source Compared to Ambient, TSS in surface water at the point of discharge (on the first transect) were slightly elevated compared with the other depths (8 mg/l) but it declined rapidly within a short distance (250 m). Both the midwater and bottom water TSS concentrations remained between 2- 4 mg/L across the 2 km sampling distance, which is similar to ambient water conditions. Similar concentrations were found on the second transect (Figure 6-2: Transect Two TSS (mg/l) Concentrations at 250 m Intervals from Plume Source Compared to Ambient, with TSS concentrations ranging from between1.5 – 4.5 mg/L through the water column.

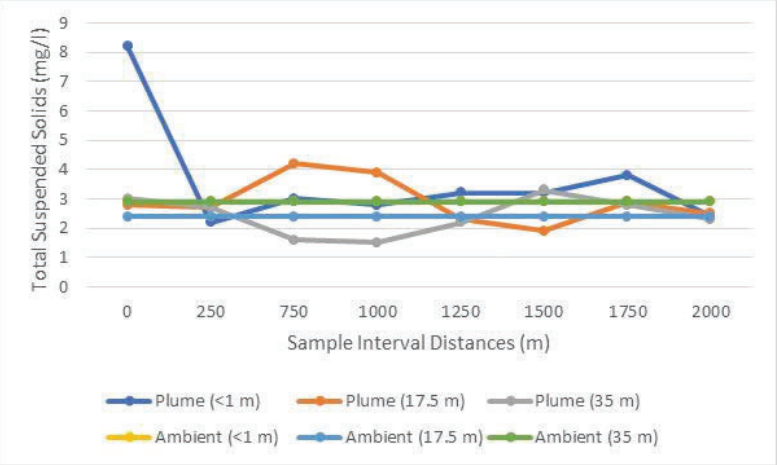

Figure 6-1: Transect One TSS (mg/l) Concentrations at 250 m Intervals from Plume Source Compared to Ambient[48]

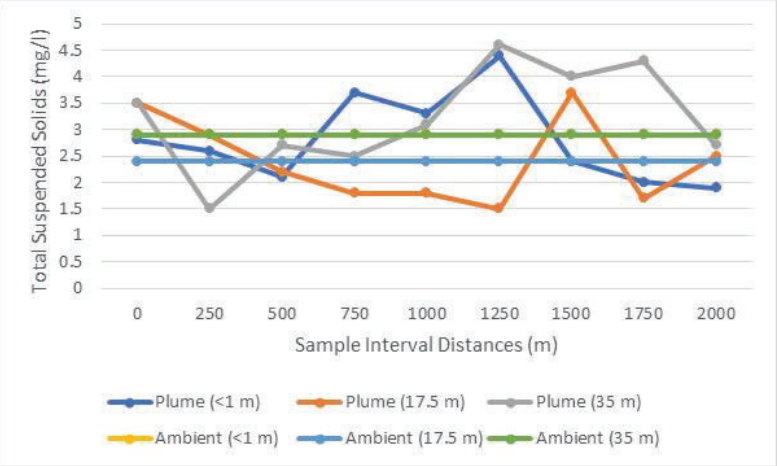

Figure 6-2: Transect Two TSS (mg/l) Concentrations at 250 m Intervals from Plume Source Compared to Ambient[49]

[48] The sample at 500 m was not collected due to survey methodology. Additionally, the yellow line is not seen as it is beneath the blue ambient line
[49] The yellow line is not seen as it is beneath the blue ambient line.

Similarly, turbidity was found to be generally consistent with ambient transient values, as shown in Figure 6-3 and Figure 6-4. The maximum turbidity level was 2 NTU, dropping to 0.15 NTU in the lowest recorded sample. In addition, it is noted that these turbidity values are well below those reported in Stat NZ Tatauranga Aotearoa data.

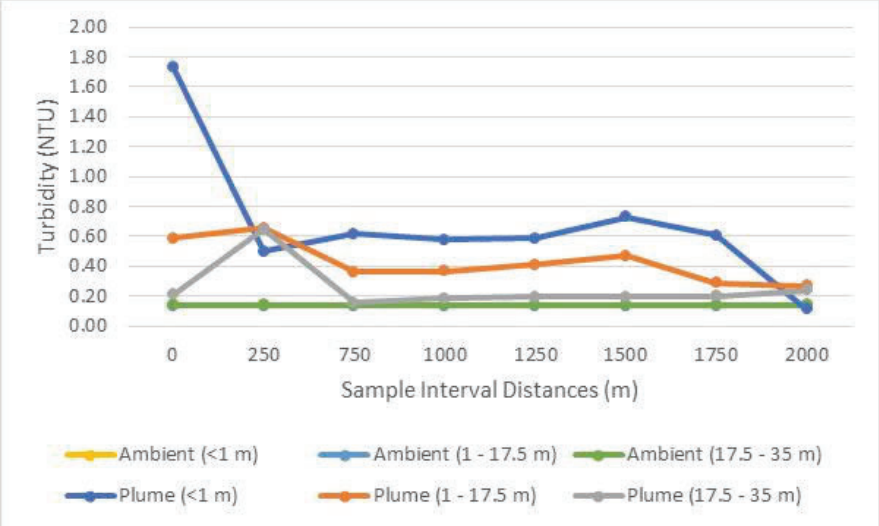

Figure 6-3: Transect One Turbidity (NTU) Values at 250 m Intervals from Plume Source Compared to Ambient

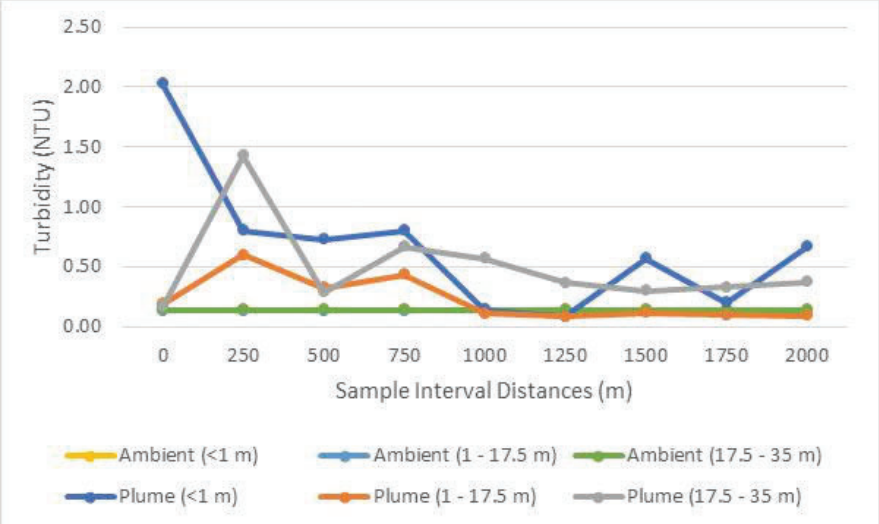

Figure 6-4: Transect Two Turbidity (NTU) Values at 250 m Intervals from Plume Source Compared to Ambient

The above described TSS and turbidity results demonstrate that the discharge generated by the extraction activity will have less than minor adverse effects on water quality. In particular, the water quality assessment highlights the rapid decline in both TSS and turbidity, so that within a short time and distance water quality values reach the ambient levels expected in a coastal environment. This is due to the majority of discharged material being oversized and rapidly descending through the water column to the seabed, with any remaining material dispersing via water currents and wave action.

In addition, this discharged material is only material extracted from the Pakiri environment and does not contain any foreign contaminants. This when combined with the limited frequency of seabed disturbance (at any one location), further limits the potential for water quality effects on any biota.

It is also noted that MBL currently undertakes extraction activities for KL. As such, the activities under the KL offshore consent area will not occur in parallel with those in MBL's proposed extraction area, as the William Fraser is used to extract sand from both consent areas. This combined with the temporary and limited effects from discharge plumes will avoid any cumulative water quality effects from either extraction consent regime.

Lastly, even if sand extraction was to occur in parallel, due to the temporary nature and small extent of any plume generated from the current consented area, there are no anticipated cumulative effects on water quality within the area.

Regardless of the above, MBL is aware of the cultural, ecological and social importance of water quality at Pakiri. As such, MBL proposes to employ the following controls as good practice:

- All project associated vessels to have and implement a waste management plan compliant with the International Convention for the Prevention of Pollution from Ships (1973/1978) (Marpol 73/78) and its Annexes;
- An Oil Spill Prevention and Response Plan;
- All project associated vessels are to work to Maritime New Zealand standards or similar[50] and the International Maritime Organisation (IMO) standards;
- Any non-routine discharges to be kept to a minimum through the use of good practice codes on collision avoidance and vessel manoeuvring; and
- All staff and any contractors will be required to undertake training and maintain good housekeeping standards, including appropriate occupational health and safety.

In summary, the proposed extraction activity and related discharge will have a less than minor adverse effect on water quality given the type of discharge proposed, the bio-physical characteristics of the disturbed material and the management measures proposed by MBL.

6.4 Coastal Processes Effects

As noted in Sections 4.4.2 ,4.4.3, and 4.4.5 a coastal processes report has been prepared by Jacobs (Appendix G). As well as identifying natural sediment sources, transport routes and losses in the embayment, this report also considers the effects of the sand extraction on shoreline movements and bathymetry.

Using the information gathered during the discharge of the current extraction permits, monitoring undertaken for the current extraction activity and investigations undertaken during 2019 and 2020, it is possible to determine the sand budget for the Pakiri area, the effect of the proposed extraction on this budget and what, if any, effects there are on shoreline position and nearshore sea bed elevations of the Mangawhai-Pakiri embayment.

6.4.1 Effects on Shoreline Position – Aerial Photography and Excursion Distance Analysis

The coastal processes report highlights that the extraction activity will have less than minor adverse effects on shoreline position. This is confirmed by both the analysis of historic aerial photographs of the embayment since the early 1960s (including those taken while the current extraction activity has been in operation) and the results of repeated beach profiles since 1978, and topography surveys since 2007.

[50] The standards will depend on the country the vessel is registered in.

As shown by the coastal processes report, there has been erosion at times along the Pakiri shoreline. However, the assessment has determined that only at limited locations is the beach in a state of long-term erosion, which in all circumstances is due to natural processes and cannot be attributed to the extraction activity itself. Furthermore, as presented in section 4.4.5, the assessment determined that overall net accretion has occurred while extraction activity has been occurring, which confirms the previous Environment Court determination on the extraction activity, during which the Court stated:

"We find that signs of shoreline retreat and erosion cannot be attributed to past sand extraction, and that past extraction has had no detectable effect on the environment".[51]

With regard to the topographic and profile results, the coastal processes report employed an EDA on the survey data since 2007, which allows for the identification of any trends in coastal morphology changes over this time frame. The assessment used EDA of the 1 m, 2 m, 3.5 m and 5.5 m contours as proxies of beach, berm, dune toe and dune face positions at the historic profile sites. Given the issues with the high degree of sensitivity of both the 1 m and 2 m contours to tide levels and wave action, the assessment of effects from the EDA relied on the 3.5 m (dune toe) and 5.5 m (dune face) contours. Overall, the assessment identifies the following trends from EDA over the last 13 years of monitoring:

- *"Over the total 13-year period, apart from the dune face at P4, and the large recent dune toe advance at profile P8, the profiles in the extraction areas have performed better than the profiles in the southern control area, with either more advance or less erosion of both the dune toe and dune face positions in the extraction areas.*
- *The profile sites in the northern extraction area can be seen to generally perform better than those in the southern extraction area. Since extraction volumes were equalised across both areas throughout the survey period, this indicates that natural processes rather than extraction are the reason for these differences.*
- *Dune toe and face erosion was greater in the July 2007 storm than the July 2014 storm, indicating that the earlier event was the larger.*
- *Dune toe retreat in response to both storm events over the survey period was greater at the profiles in the southern control area than the profiles in either of the extraction areas.*
- *There was a similar pattern for dune face storm response for the July 2007 storm event, with the storm erosion being greatest in the southern control area, but not for the July 2014 event.*
- *Storm dune toe erosion was greater in the southern extraction area than in the northern extraction area. in both events.*
- *Post storm recovery duration was variable across profile sites, with all areas having sites where recovery back to pre- July 2007 positions has not occurred, however this is more frequent in the southern control area than the extraction areas."*

These coastal erosion observations provide a useful baseline for the assessment of moving the sand extraction further offshore and increasing the overall volumes extracted. With regard to moving the extraction activity, the coastal processes report states that both the current and proposed areas are located within the same sediment zone and should have a similar lack long-term effect on shoreline movements. Furthermore, by moving further offshore, the sand extraction has a reduced connection to the dry beach/dune system, limiting the potential for any related short-term storm erosion effects.

Furthermore, the change from stationary to trailing suction dredging assists in reducing potential erosion effects. While previous stationary dredging could result in "holes" in the seabed, the use of a TSHD only generates shallow trenches (with an average depth of 100 mm), which can refill faster. It is also noted that the extraction area has been made larger. This has the benefit of reducing the frequency of extraction from the same trench, providing more time for seabed recovery and trench refilling. Regardless, any effects resulting from the

[51] ENV-2006-AKL-000548 and ENV-2006-AKL-000533

movement of the extraction area will also be addressed through the use of an EMMP, with the requirement for the EMMP included in the draft conditions (Appendix F).

6.4.2 Effects on Sediment Budget

The potential effects on shoreline position can also be assessed by the use a sediment budget, which was a conceptual tool accepted by the Environment Court during the previous consenting process. As discussed in section 4.4.6, the sediment budget for the embayment was calculated using information from a range of sources[52]. To reiterate, the calculated sand budget demonstrates the open system character of sand movements at Pakiri, the large volumes of sediment/sand entering the embayment and the volumes available for extraction (above that which MBL is seeking). This reinforces observations made during the monitoring of the current consents, which have not identified any significant erosion which can be attributed to sand extraction.

Table 6-3 below presents the adjusted sediment budget for the proposed increase in extraction rate to 125,000 m^3/yr under this application.

Table 6-3: Sediment budget out to 25 m CD water depth on basis that inputs exceed losses over last 50 years due to storage as shoreline accretion (Source: Jacobs).

Sediment Sources (Inputs or credits)		Sediment sinks (losses or debts)	
Source	Volume (m^3/yr)	Sink	Volume (m^3/yr)
Cliffs	6,000	Onshore winds	2,000
Rivers	17,000	Mangawhai Inlet	3,000
Biogenic from <25 m depth	7,000	Around Cape Rodney	1,000
Around Bream Tail	25,000	Extraction from < 25 m depth	125,000
Cross-shore supply (including longshore elements) from >25 m depth Calculated to balance budget	145,000	Total Sinks (Losses or debts)	131,000
		Storage/Surplus Storage in dune/beach/nearshore from +0.4 m beach accretion over 50+ years	69,000
Total Sources	200,000	Total Sinks + Storage	200,000

The sediment budget highlights that there is a broad range of sediment sources into the embayment, including from the inner continental shelf and from around the Bream Tail. The sand grain size in these sources is such that it can be transported by wave action and ocean currents (as confirmed by observations of the seabed) into the proposed extraction area, therefore ensuring the replacement of any sediment removed from the system. To put this volume into perspective, if there were no inputs of sand into or across the proposed 6.6km^2 extraction area, the annual depth of sand taken at the maximum levels applied for would be approximately 19mm per annum. Based on the known sediment pathways and total size of the embayment, the change in depth will be immeasurable, although the EMMP will be used to ensure this is the case.

Overall, the sediment budget shows that there is potential extra storage and supply routes in the local system to suggest that a total source volume of 200,000 m^3/yr is possible, with natural losses of 6,000 m^3/yr. Regardless, MBL have implemented a precautionary approach and have limited their proposed extraction to 125,000 m^3/yr on a five-year average, with the use of an EMMP to monitor any erosion effects. Leaving the remainder of material continues to provide storage volume to address short-term shoreline erosion and beach volume exchange to the nearshore in storms.

To reiterate, the calculated sand budget demonstrates the open system character of sand movements at Pakiri, the large volumes of sediment/sand entering the embayment and the volumes available for extraction (above

[52] These sources included previous Environment Court evidence, a biogenic sand supply assessment by Bioresearchers and modelling data by MetOcean Solutions.

that which MBL is seeking). This reinforces observations made during the monitoring of the current consents, which have not identified any significant erosion that can be attributed to sand extraction.

6.4.3 Sea Level Rise

The coastal processes report also addresses the potential effects of the extraction when consideration is given to sea level rise (given the capacity for sea level rise to affect coastal erosion/accretion rates). The report states that:

"It is well documented that rising sea level will theoretically result in a relative erosional response of sand beach systems in relation to their existing behaviour. Hence, in the long-term, assuming future sediment inputs remain the same, currently accretionary beaches may continue to accrete but at slower rates, currently stable beaches may become erosional, and eroding beaches are likely to have increased rates of retreat."

The theoretical impact of contemporary sea level rise (i.e. 2mm/yr) on erosion in the embayment is calculated to be in the order of 0.09-0.17 m/y, (equivalent to 4.5-8.5 m net shoreline retreat since the 1950s). This would have resulted in 26,000 to 50,000 m^3/yr of sediment loss from the beach-dune environment. However, there is no evidence of wide-spread beach erosion and volume loss over this time (as shown by the EDA and aerial photography). Furthermore, there is also no evidence in changes to nearshore seabed elevations. Therefore, sediment supply has been more than sufficient to accompany this contemporary rate of sea level rise.

Looking forward, it is recognised that the rate of sea level rise is projected to increase due to climate change, with the rate of rise for New Zealand predicted to increase to 5.5 – 13.6 mm/yr over the next 100 years[53]. This rate of sea level rise could see an estimated shoreline retreat within the embayment of between 7 to 20 m by 2070 and between 13 to 50 m by 2120. However, the coastal processes report states:

"these future retreat estimates do not account for shoreline advance that is known to be occurring with contemporary sea level rise at this embayment, with the shoreline continuing to advance to some degree until the erosional effects of sea level rise are greater than the advance due to surplus sediment inputs."

Therefore, taking into account the historic shoreline advance (0.4 m/yr since 1961/63), the coastal processes report determined that over the next 30 years the shoreline changes will range from between net accretion at a rate of around 0.2 m/yr to a stable position with no net accretion or erosion under the most extreme sea level rise projections[54].

6.4.4 Effects on Bathymetry

The coastal processes report has also considered potential effects on bathymetry. Using beach profile results, the report states that historic extraction at the embayment has not caused a discernible effect on bathymetry and summarises that:

- *There is no evidence of nearshore erosion in the central embayment, with all changes except during the 2010-2013 period being less than the level of survey accuracy.*
- *The profiles show that the morphology of the shoreface has not changed.*
- *There is no evidence of material difference in elevation changes between profiles in the MBL extraction areas, and those in the non-extraction control area to the south of Poutawa Stream.*
- *There is no evidence of seabed erosion within the MBL inshore extraction areas despite extraction of 677,600 m^3 of sand from this consent area since 2003.*

[53] This rate of sea level rise would see overall sea level to increase between 0.55 to 1.36 m by 2120 and is based on Ministry for the Environment reporting.

[54] It is noted that these shoreline accretion rate changes are under the most extreme sea level rise projection.

- *There is no evidence of any effect on seabed levels of the extraction of around 1.23 million m^3 of sand from the nearshore in water depths less than 30 m CD since 2003 (e.g. combined extraction from MBL and inner part of KL consent areas).*

These points provide a useful baseline to compare the potential effects of the current application. It is considered that the current application will result in less than minor effects on the embayment's bathymetry as:

- The trailing suction dredge used on the William Fraser creates shallower trenches on the seabed, with an average depth of 100 mm. These trenches will refill over a period of 1 to 2 months, based on infill rates of infill rates (between 0.01 to 0.18 $m^3/m/day$).

- The proposed extraction is 4 km larger that the historic nearshore extraction area (6.6 km^2 v 2.6 km^2). Using a larger area reduces the probability that any dredge trenches will be disturbed again prior to being infilled by natural processes. MBL plan to distribute the dredging evenly within and between management cells. Therefore, theoretically up to 40% of the seabed included in the application area would be dredged in any one year and any particular area of seabed would not be dredged more than once in any 30-month period.

Both these factors give any disturbed areas of the seabed the opportunity to return to their natural state prior to any further disturbance over the lifetime of the consent, thereby minimising any potential effects on bathymetry. It is also noted that significant volumes of sediment enter the embayment (as shown by the sediment budget), providing a supply of material to refill seabed trenches.

In addition, MBL will employ the EMMP as part of the proposed conditions (Appendix F). This plan will include recording dredging locations in the extraction area and regular monitoring of any bathymetric change. The use of this plan and associated monitoring will ensure the bathymetric effects of the extraction activity are limited to those described in the coastal processes report and allow for changes in extraction practices if any attributable effects do arise.

6.4.5 Cumulative Effects

Lastly, the coastal processes report has addressed the potential for cumulative effects from the extraction activities of both KL and MBL, with no discernible cumulative effects identified. This is due to:

- A lack of evidence of any effect on seabed levels less than the -30 m contour from the combined extraction of 2.2 million m^3 of sand since 2004;

- No evidence of beach erosion from the combined extraction since 2004;

- The extraction by KL will have no influence on the ability of wave and current processes to transport sand across the -25 m CD contour boundary to the sediment budget. This extraction will also not reduce the availability of the sand to be transported at this depth by these processes; and

- The cross-shore transport rates into the nearshore and the MBL extraction area will be unchanged to those previously calculated and the sediment budget will continue to be in surplus.

6.4.6 Summary of Effects on Coastal Processes

In summary, both the EDA and the aerial photography demonstrate that any coastal erosion in the Pakiri embayment can be attributed to natural coastal processes rather than as a result of the extraction activity. This is reinforced by the sediment budget and associated technical assessment, which highlights that large volumes of material must be entering the local Pakiri system and a lack of discernible cumulative effects of past extractions. This historical data also shows that accretion, rather than erosion, has also occurred at shoreline locations during previous extraction periods. As such, the proposed extraction activity, including the increased volumes, is assessed as having less than minor effects on coastal processes and coastal erosion.

6.5 Ecological Effects

The potential ecological effects of the activity have been discussed in detail by Bioresearches (Appendix K) , Cawthron (Appendix L) and NIWA (Appendix N) .These ecological reports cover benthic biota, fish, birds and marine mammals as detailed in the following section.

6.5.1 Benthic Ecology

With regard to benthic fauna, Bioresearches note that such fauna is sparse in the proposed extraction area as the environment is naturally harsh, with high wave energy and currents. Furthermore, the surveys identified that there are no shellfish of any conservation significance or rarity, while there are also no corals, kelp beds or reefs present which could provide a more diverse ecological environment within the extraction area.

The Bioresearches report details that benthic ecology present can be affected by the dredging due to:

- Seabed disturbance;
- Degraded water quality; and
- Macrofauna mortality due to organisms passing through dredging equipment.

Regarding seabed disturbance, it is noted that the dredge head used by MBL disturbs only has an average extraction depth of 100mm[55]. Diving observations have shown this shallow seabed disturbance allows for large burrowing worms, clams and crustacea to be retained in the sediment after passage of the dredge. This limited disturbance depth, the types of species present, the retention of larger burrowing fauna and colonisation from the areas outside the dredge track all support the recovery of any affected benthic communities. Given these factors, it is expected that the recovery of benthic communities within each disturbed area will occur within one year of dredging, and likely sooner. This is similar to observations made within the current inshore extraction areas.

Furthermore, the Pakiri-Mangawhai embayment is considered a dynamic environment with wave induced and ocean currents influencing the movement of the seabed surface (e.g. large ripples of sand visible on seabed photographs). Considering the naturally dynamic environment in the Bay and the shallow layer of sand extracted by the dredging, it is not expected to alter the benthic community over and above what is experienced naturally by weather events.

Bioresearches has also considered the potential effects due to the proposed discharge. They note that while biota in and on the seabed surface of extraction areas could receive some temporary minor smothering as particles settle, the volume of discharge created is not anticipated to result in full burial. In addition, it is noted that given the exposed nature of the seabed, biota will experience similar burial as the result of natural coastal processes. In addition, the material discharged by the dredge vessel does not contain any outside contaminants and does not contain any ecotoxic concentrations of PAHs, PABs or heavy metals.

In addition, the fieldwork demonstrates that macrofauna survivorship of individuals passing through the screening deck is high. While individuals do experience some damage, it is often non-fatal and they rapidly return to the local seabed (thereby aiding the recovery time of the benthic community). While echinoderms and polychaete worm species experience higher mortality than bivalves, crustaceans and gastropods; there are overall high rates of survivability for most species. It is also noted that while some predation will occur from fin fish (as discharged macrofauna descends to the seabed), the discharged fauna are camouflaged in part by the volume of material discharged. It is also noted that the William Fraser discharges material via moon pools

[55] Historic trailing suction dredging at Pakiri disturbed the seabed up to 300 mm depth.

(rather than over the side like earlier vessels). This and extraction at night reduces any predation by birds on discharged macrofauna at the or near to the surface.

Given the above factors, the extraction area and related discharges will have no more than minor adverse effects on benthic organisms.

6.5.2 Fish

The Bioresearches report also addresses the potential effects of the extraction activity on fish species. It is noted that fish can be affected by:

- Noise
- Entrainment;
- Sub-lethal effects from suspended sediment;
- Food source reduction; and
- Light spill.

The underwater noise report from Styles Group (Appendix J) has demonstrated that any underwater noise generated by the vessel and sand extraction will not have significant effects on any fish species given the low levels of noise generated during the extraction activity. Bioresearches also do not expect the activity to have an impact on fish through entrainment. This is due to the relatively low speed of the dredgehead (1.5 – 2.5 knots for the William Fraser) and the ability for most mobile species to avoid it at those speeds (given the swimming speeds of local fish species). Some slow moving or bottom dwelling fish (e.g. sole and sand-divers) could be expected to pass through the dredge and may experience mortality or injury, though overall impact on fish populations will be as limited as currently occurs.

Potential effects from suspended sediment are also expected to be limited. This is due to the short time that any sediment is suspended in the water column, as well as the limited concentrations of fine sediment in the discharged material. In addition, given the lack of significant effects on benthic species, only limited effects are anticipated on food sources for fish with the remaining undisturbed CMA providing food sources. Furthermore, some fish species will benefit from the feeding opportunities presented by the oversize material and live biota being exposed when returned to the water during extraction.

Lastly, it is noted that vessel borne lighting can act as an attractant to fin fish, bringing increased risk of their predation from both larger fish species, birds and marine mammals. However, MBL propose to minimise vessel lighting and associated light spill to minimise attracting fin fish during night-time extractions. Further detail regarding lighting management measures is detailed below in Sections 6.5.3 and 6.5.4.

Given the above, the proposed extraction activity is considered to have less than minor adverse effects on fish species.

6.5.3 Birds

As previously noted, an assessment of the effects of the extraction activity on avifauna has been prepared by NIWA (Appendix N). The assessment has reviewed effects separately between shore and seabirds, with the assessment summarised below:

Effects on shore birds

NIWA has considered what potential effects, if any, the extraction activity could have on the foraging and roosting sites of shore birds (such as the New Zealand fairy tern). Principally, any adverse effects would be generated through coastal erosion. Such erosion could result in the loss of roosting sites and the modification in food supplies/foraging habitat. However, as noted by the coastal processes report (Appendix G), the proposed

extraction is not expected to generate any coastal erosion beyond that expected by natural processes[56]. As such, little or no effects are anticipated through the loss of roosting and foraging habitat.

The NIWA report also notes that adverse effects could also be caused through the unplanned loss of diesel or oil from MBL's vessels. The scale of such effects would depend on the volumes spilled, weather conditions, distance from shore and season. However, it is noted that such events are rare and the exposed nature of the Pakiri-Mangawhai embayment would assist with fuel disbursement. In addition, MBL do not propose to undertake any at-sea refuelling of their vessels, while an Oil Spill Prevention and Response Plan will be employed during all operations to ensure that any accidental discharges of hydrocarbons are addressed appropriately and as required by Maritime New Zealand.

Effects on seabirds

The NIWA report notes the following regarding seabirds:

"Sand extraction could potentially affect seabirds negatively in several ways, both directly and indirectly. Potential effects include disturbance from routine sand extraction activity, interaction with sand extraction vessels, reduced prey abundance or prey availability within and around the extraction area, exclusion from habitat within the extraction area and effects of spilled fuel or oil from sand extraction vessel(s)."

While disturbance effects are possible, the NIWA report highlights that the activity is proposed to occur primarily at night, when most seabirds are roosting. In addition, the nearest seabird colonies are located some distance away at Mangawhai, Goat Island, Little Barrier Island and several islands to the north. Birds nesting at these colonies are unlikely to hear and be disturbed by the vessel while it is operating.

It is noted by the NIWA report that the vessel lights used during night-time operations can act as an attractor to seabirds, causing birds to collide with vessels. While any collisions with more common bird species would have negligible effects on their populations and conservation status, it is recognised that the New Zealand storm petrel (which is considered nationally vulnerable) is particularly attracted to bright lights. Given the potential for adverse effects on seabirds and in particular the storm petrel, MBL propose to employ the following controls to minimise potential ship light related effects:

- The use of minimal deck lighting (other than that required for safe operations and navigation);
- Directing lights downwards wherever possible; and
- Employing screens or blackout drapes on portholes and windows to minimise light spill.

A condition limiting light spill from extraction vessels has been included with the draft conditions (Appendix F).

A further potential effect arises from reductions in bird prey populations, both through disturbing the seabed and affecting water quality. However, as noted by Bioresearches (Appendix K) and Jacobs (Appendix H), the extraction activity has minimal effects on benthic/fin fish communities by either seabird disturbance or water quality reductions. Furthermore, the NIWA report highlights that the spatial extent of both seabed disturbance and related discharges are small in comparison to the wider area used by seabirds for foraging. As such, any effects on bird prey accessibility or foraging exclusion are considered to be minimal.

Lastly, as with shore birds, there is the potential for adverse effects due to accidental fuel or oil spills. However, as previously discussed, the exposed nature of the extraction area, the rarity of such events, the lack of any at-sea refuelling and the use of spill management plans mitigates any related effects.

Given the above, the effects of the proposal on avifauna is less than minor.

[56] It is noted that historically the shoreline within the embayment has experienced long-term accretion and not erosion.

6.5.4 Marine Mammals

The assessment by Cawthron (Appendix L) has identified four potential sources of adverse effects on marine mammals:

- Underwater noise;
- Vessel lighting;
- Entanglement; and
- Indirect effects due to habitat disruption.

With regard to underwater noise effects, Cawthron have relied on the underwater noise monitoring and associated modelling undertaken by Styles Group (Appendix J). Cawthron note that any effects from underwater noise will be transitory and non-injurious based on the findings of the operational noise assessment and measurements of the William Fraser's underwater noise. This is due to the limited noise generated by the vessel and its dredge, the presence of other louder vessels in the area (such as cargo and naval vessels),the likely limited population of marine mammals in the Pakiri area and the limited importance of the area as marine mammal habitat. Cawthron summarises any noise effects to be limited to the following:

"effects will be predominantly limited to the temporary masking of some noise signals when animals are within several kilometres of the dredge and a range of potential behavioural responses at closer proximity (< 400 m)."

While Cawthron acknowledges that the effects of artificial lighting on marine mammals is relatively unknown (given a lack of research), it is noted that any light spill from the vessel is likely to be confined to within a few hundred metres at both the surface and sub-surface. Such lighting has the potential to attract small marine species (e.g. bait fish and larvae) and consequently mammal species which would feed on them. Given this, MBL will seek to minimise the volume of lighting used on its vessels during night-time extraction activities (noting that navigation compliant lighting must still be used).

Cawthron also note that marine debris can pose a risk to mammals due to entanglement. However, such high-risk debris is typically loose and/or thin fishing lines and nets. No such equipment is proposed for the extraction vessels given the need to keep the dredgehead free of debris. In addition, MBL employ NZ Maritime compliant waste management procedures onboard their vessels, thereby avoiding the accidental release of debris into the Hauraki Gulf.

While resource consent is not required for the passage of the extraction vessels through the Hauraki Gulf, it is also noted that the risk of a collision between vessels and marine mammals is low. This is based on the path of the vessels to and from the extraction ground plus the slower speed of the William Fraser which travels at no more than 9.5 knots. This is less than the 10 knots recommended by the Ports of Auckland in its Marine Mammal Protocol for Shipping in the Hauraki Gulf. Regardless, the passage of the William Fraser through the Hauraki Gulf is a permitted activity under the AUP(OP).

With regard to indirect effects, the extraction activity will have less than minor effects on water quality and ecology as previously discussed. As a consequence of these limited effects, Cawthron have not identified any possible effects due to habitat disruption. Marine mammals will still have access to food sources in the Pakiri area, and they will also not be exposed to harmful contaminants due to seabed disturbance.

Further to the above, MBL will also employ a range of measures to avoid any potential conflicts between the extraction activity and mammals. These will be based on the following three management goals:

- Minimise the risk of dredge vessel collisions with any marine mammal and aim for zero injury/mortality (noting that the passage of MBL's vessels between Pakiri and the Port of Auckland is a permitted activity under the AUP(OP));

- Minimise the avoidance (attraction) or potential for injury of marine wildlife to dredging activities; and

- Aim to minimise entanglement with a goal of zero mortality.

Given the above, the activity will have less than minor adverse effects on marine mammals.

6.6 Cultural Effects

As identified in Section 4.3, the Pakiri area has a number of iwi owned sites, statutory acknowledgement areas and CMT applicants.

With regard to the physical effects of the extraction activity, it is noted that it will not affect the ability of iwi to undertake customary fishing. This is due to the no more than minor effects on marine ecology and the limited time that the extraction vessels are present. Important customary fish species, such as snapper and terakihi, will remain available to customary fishermen despite the proposed sand extraction.

Iwi onshore sites will also be unaffected by the proposal, including the two forestry blocks owned by Ngāti Manuhiri and Te Uri o Hau, as well as any undisturbed archaeological sites within the local dune system. This is due to the lack of erosion effects of the sand extraction and the lack of any onshore facilities needed by MBL to undertake the sand extraction. As such, the continued use of these sites and the preservation of their cultural values will be maintained.

Regardless of the above, MBL have engaged with mana whenua, as highlighted in Section 8. Through this engagement, MBL has commissioned CVAs for extraction from the new area and these will be provided to the Council once they are available. In addition, MBL are aware that Ngāti Manuhiri, Ngāi Tai ki Tāmaki, and Te Kawerau a Maki all have statutory management areas within the CMA and have been consulted with accordingly.

6.7 Biosecurity Effects

Given the frequent movement of MBL's vessels between the Port of Auckland and Pakiri, MBL is aware of its duties to avoid the transfer of pest marine species via its vessels. The potential for such a biosecurity incident is minimised by MBL undertaking regular cleaning of its vessels' hulls (this is also undertaken to maintain the vessels' performance and stay within Maritime NZ regulatory requirements) and avoiding the discharge of bilge water at Pakiri. As such, the likelihood of MBL's vessels introducing new pests to the Pakiri area is considered very low and the potential adverse biosecurity effects are therefore considered to be less than minor.

6.8 Surface Noise Effects

While the effects of underwater noise have been addressed in Section 4.4.9.3, the amenity effects arising from surface vessel noise has also been assessed. As discussed in the technical report from Styles Group (Appendix I), the highest noise levels that can be experienced by beach users will be between 20 dB and 35 dB. These noise levels are associated with no or close to no wind conditions. However, it is noted that recorded ambient noise levels do not drop below 30 dB (even for short periods) and the calm conditions required for noise to travel from the vessel to beach users are rare, particularly during daytime when the beach is mostly used). Furthermore, the modelling undertaken by Styles Group demonstrates that noise from the William Fraser will be inaudible inland from the shoreline, with maximum noise limits of 20-25dB L_{Aeq} generated.

Overall, the Styles Group monitoring and modelling demonstrates that the extraction activity is compliant with AUP(OP) noise standards. As such, the activity will have nil surface noise effects.

6.9 Recreational Effects

The potential adverse effects on recreational activities and beach users have also been considered by MBL. These effects include those on surfing and fishing/boating.

6.9.1 Effects on Surf Breaks

As identified in the coastal processes report (Appendix G), the extraction activity does not affect the three surf breaks at Pakiri Beach. In addition, no changes to the bathymetry or location of the breaks can be attributed to sand extraction activities, while no extraction occurs directly within the areas occupied by the three breaks. It is also noted that no impacts on the surf breaks have been observed during the 70-year operation by MBL.

Furthermore, given the lack of extraction within the surf breaks, MBL's vessels will not present a safety issue to surfers, with access to the surf breaks remaining unobstructed. It is also noted that with a greater reliance on night-time operations and reduced extraction times even less conflict between surfing and extraction activities will occur.

As such, the activity has nil effects on surfing.

6.9.2 Effects on Recreational Fishing and Boating

Pakiri Beach is a popular recreational fishing and boating location given its proximity to the Whangateau and Mangawhai Harbours, as well as two regional parks. However, the extraction activity is not anticipated to have any significant impacts on either recreational fishing and boating given its less than minor adverse effects on fish stock and the short duration that is required to extract sand from the seabed. Furthermore, the increased reliance on night-time and weekday extraction activities will ensure that MBL's vessels avoid operating when public use of the Pakiri area is highest.

As such, the activity is considered to have less than minor effects on recreational fishing and boating.

6.10 Landscape Effects

As noted in Section 4.2.3, the proposed extraction area is located outside any AUP(OP) landscape overlays. Regardless, a landscape effects assessment has been prepared in support of this application (Appendix M). This assessment by Mr Brown is based on observations of the extraction vessel made from five critical viewpoints:

- Viewpoint 1 - Te Ārai Regional Park Car Park
- Viewpoint 2 – Pakiri Beach North (near the Tara Iti Golf Course)
- Viewpoint 3 – Eyres Point Track
- Viewpoint 4 – Pakiri River Mouth; and
- Viewpoint 5 – M Greenwood Road and Pakiri Regional Park

Using these viewpoints, Mr Brown has assessed the landscape effects of the proposed extraction activity based on existing values, legibility, landscape and natural character. The effects of the activity, as assessed by Mr Brown are summarised below:

Table 6-4: Summary of landscape and visual effects

Viewpoint	Landscape Effects Rating	Natural Character Effects Rating
Viewpoint 1 - Te Ārai Regional Park Car Park	No Effect	No Effect
Viewpoint 2 – Pakiri Beach North (near the Tara Iti Golf Course)	No Effect	No Effect
Viewpoint 3 – Eyres Point Track	No Effect	No Effect
Viewpoint 4 – Pakiri River Mouth; and	No Effect	No Effect
Viewpoint 5 – M Greenwood Road and Pakiri Regional Park	No Effect	No Effect

The identification of no landscape effects is based on several factors. Firstly, the operation of sand extraction via sea vessels is an established part of the Pakiri landscape. MBL has operated at Pakiri for more than 70 years and their vessels are a familiar sight from onshore vantage points. Furthermore, Pakiri is located near the main navigation corridor for vessels travelling to and from the Port of Auckland, while fishing and pleasure vessels are also common within the wider area. It is also noted that the movement of any of these vessels through this coastal environment is permitted without the need for resource consent.

Furthermore, MBL has altered its extraction schedule to further reduce the potential for landscape effects. By moving to more night-time and weekday operations, MBL's vessels are now present at times when there are less observers at Pakiri and the surrounding area, while low light conditions obscure views of the vessels. The use of limited lighting on the William Fraser, as undertaken to minimise ecological effects, also helps further reduce the landscape effects of the activity. In addition, the proposed extraction area is further offshore than the historically used extraction areas. This additional distance further reduces the William Fraser's visual profile when viewed from onshore locations.

The introduction of the William Fraser has also reduced the visual effects of vessel discharges. As previously discussed, the William Fraser discharges unwanted material via moon pools at its keel whereas the Coastal Carrier and Pohonui discharged over their sides. This new discharge methodology avoids aeration of the discharge, reducing the time that it is present at surface level and the potential for the public to observe it occurring. In addition, the William Fraser has a greater sand storage capacity, reducing the frequency of vessels transiting between the Port and the location of the sand extraction activity.

Further to Mr Brown's report, it is also noted that the extraction activity does not affect coastal processes including either erosion rates or the morphology of the surf breaks. In addition, the extraction activity does not require any onshore infrastructure at Pakiri. All off-loading, refuelling and supplying of MBL's vessels occurs at the Port of Auckland. As such, both the coastal dune system and the inshore surf breaks (which are key components of the area's sense of wildness) will not be adversely affected by the continued extraction of seabed sand.

Given the above, the proposal will have no adverse effects on landscape values.

6.11 Summary of Effects

In summary, the continued extraction of sand at Pakiri will have no more than minor adverse effects on the environment, with any such effects either being temporary in nature or can be addressed via the EMMP and proposed conditions.

As demonstrated by the technical reports prepared for this AEE, these effects are also largely temporary in nature, with the natural environment able to adapt to ongoing extraction. While seabed disturbance and sediment discharge will occur, local benthic fauna are able to recolonise the disturbed areas and their populations are able to recover from any mortality caused by the extraction activity.

Larger and more mobile fauna, such as fin fish and marine mammals, will also be largely unaffected given the low noise generated by MBL's vessels, their ability to avoid the dredgehead due to the low speed of the vessel and the limited disruption to their local food sources. Seabirds and shorebirds will also be largely unaffected, with the protection of their habitat and the use of low-level lighting on the William Fraser. Marine ecology will also be protected through the use of spill management practices and the avoidance of at-sea refuelling. Regular checks of the William Fraser's hull and a ban on bilge water discharges will also avoid any biosecurity impacts on Pakiri.

Significant assessment of the extraction activity's potential effects on shoreline and seabed erosion has also been undertaken. As detailed in the coastal processes report, the past and contemporary extraction of sand at the embayment over the last 70 years has not been shown to contribute to any shoreline erosion. Analysis of aerial photography and monitoring survey results show that the shoreline has actually been in a state of net advance since at least the early 1960s. The sediment budget confirms the large volumes of material must be entering the embayment to accommodate sand extraction volumes without causing shoreline erosion. Consideration has also been given to the future environment, through both sea level rise and KEL's proposed extraction regime[57]. The coastal processes report demonstrates that MBL's proposed rate and volume of sand extraction can occur over the coming decades without contributing to shoreline retreat.

Effects on residents, mana whenua and beach visitors are also limited. This is due, in part, to the continued uninterrupted use of the wider coastal environment, the lack of erosion effects on the coastal edge and the altered extraction regime proposed by MBL. The continued extraction activity will not affect the ability for residents and visitors to enjoy the landscape values of Pakiri, while recreational fishing, boating and surfing activities will also remain unaltered by MBL's activity as has been the situation for the last 70 years of MBL's business.

The adverse effects of the activity are also mitigated in part by the recent introduction of a new vessel (the William Fraser), the modified extraction schedule and the management practices proposed by MBL. These measures reduce the time needed at Pakiri, minimising any visual effects or direct impacts on marine fauna.

The design of the William Fraser also reduces the time needed for the dispersal of the discharge plume, reducing effects on water quality and visual amenity.

Lastly, these minor adverse effects are offset by the significant benefits that the extraction activity provides to Auckland's social and economic wellbeing. The sand resource at Pakiri is a vital supply of sand for concrete manufacture, without which the economic and environmental costs of providing Auckland with this critical building material would be immense. Without access to this resource, the increase in truck movements, the limited usefulness of Waikato sands, the increased costs in construction and the rise in CO_2 emissions from accessing other sand sources would be detrimental to Auckland at a regional scale. A lack of a secure and affordable sand supply would also undermine the ability for the construction sector to deliver a quality, compact urban form, thereby raising the potential for additional urban sprawl and associated environmental effects. Consequently, access to the Pakiri sand resource must and can be retained.

[57] Noting that KEL's resource consent application has yet to be approved.

7. Notification assessment

MBL is aware of the significant public interest in this application and given the recent public notification of KL's own resource consent application, MBL request that this application for mid-shore sand extraction undergoes public notification pursuant to section 95B(3)(a).

8. Consultation

The purpose of the consultation undertaken to date is to assist interested persons to understand the ongoing operational extraction of marine sands, gather their potential concerns and where possible, minimise any adverse effects from MBL's operation. In addition, MBL is aware of its duties under the RMA to engage with stakeholders and in particular with iwi. A summary of this consultation is provided in the following section with further details provided in Appendix O.

8.1 Auckland Council

8.1.1 Regulatory Services

Meetings were held with resource consents department staff in September 2018, October 2019, June 2020 and October 2020 to discuss MBL's proposed continued extraction operation at Pakiri. Matters discussed with Auckland Council's planners, coastal specialists and landscape architect included the technical reports required and the confirmation of the methodologies employed for data gathering.

8.2 Mana Whenua

8.2.1 Local Mana Whenua Groups

MBL has engaged with the following mana whenua groups given the location of the activity within recognised rohe:

- Ngāti Manuhiri;
- Te Uri O Hau; and
- Ngāti Wai.

This engagement has involved e-mails to these parties, as well as follow up meetings and the sharing of documentation with those groups who have expressed an interest in the application. In addition, Ngāti Manuhiri and Te Uri O Hau were commissioned to produce CVAs and these will be provided to Auckland Council once they are available.

8.2.2 Customary Marine Title Applicants

In addition to the mana whenua groups identified in Section 8.2.1, MBL has also contacted the CMT claimants identified in Table 8-1. The majority of claimants have not responded to MBL's consultation within the required 15-day timeframe, but MBL will advise Council if any further correspondence is received.

Table 8-1: CMT Claimant Consultation[58]

CMT claimant	Feedback
Mahinepua Reserve Ririwha Trust	None received
Nga Hapu o Ngai Tahuhu	None received
Ngāti Kawau te Kotuku Te Uri o Te Aho Ngāti Kuri Te Waiariki Korora nga Hapu o ngapuhi nui tonu	Objection raised but based on requiring funding from the NZ Government
Nga Puhi Nui Tonu (Te Kotahitanga Marae)	None Received
Nga Puhi Nui Tonu (Waitangi Marae)	None received
Nga Puhi Nui Tonu (Awataha Marae)	None received
Nga Puhi Nui Tonu Kota - Toka - Tutaha - Moana o Whaingaroa	None received
Nga Puhi, Ngāti Wai, Haki Pereki and Ngawhetu Sadler Whanau Trust	Acknowledgement received.
Ngai Tai ki Tamaki Trust	None received
Ngāti Wai Whairepo Trust	None received
Ngāti Whanaunga	None received
Pakiri G Trust	None received
Reti Whanau	None received
Taumata A Whanau	None received
Taumata B Block Whanau - Hauturu	None received
Taumata B Block Whanau - Mahuki	None received
Taumata B Block Whanau - Motairehe	None received
Taumata B Block Whanau - Omaha 1	None received
Taumata B Block Whanau	None received
Taumata B Block Whanau - Pakiri T	None received
Taumata B Block Whanau -Pakiri U	None received
Taumata B Block Whanau - Rangiahau	None received
Te Hikutu Whanau and Hapu	None received
Te Iwi, Whanau and Hapu of Ngāti Wai	None received
Te Kaunihera Maori o Te Tai Tokerau	None received
Te Kawerau a Maki	None received
Te Parawhau Hapu	None received

8.3 Department of Conservation

MBL contacted the Department of Conservation early in the application process and is now waiting for all information to confirm a follow up meeting with its Senior RMA advisor. This is not expected to occur until all application documents have been provided and considered by the Department and its experts.

[58] These claimants have not been listed in any particular order.

8.4 NZ Fairy Tern Trust

The NZ Fairy Tern Trust was contacted in February 2019 with an offer to discuss the proposed continued extraction activity at Pakiri and any potential effects on the local fairy tern colonies. Since this initial contact, the Trust has advised that they wish to be kept informed of the proposal but that they would be unlikely to get formally involved in the RMA process.

8.5 Friends of Pakiri

Initial contact regarding this application was made with the Friends of Pakiri in February 2019. Contact between MBL and the Friends of Pakiri is ongoing and any matters in these discussions will be addressed by MBL.

8.6 Other groups

MBL has also engaged with Forest and Bird, the Environmental Defence Society (EDS), the Mangawhai Harbour Restoration Society, Surf break Protection Society, Te Ārai Preservation Society and Pelco NZ Fisheries about their activities in the Mangawhai-Pakiri embayment at various points through the application process. This has involved providing copies of application documents to these parties (where requested). It also is noted that the EDS expressed that they were unlikely to wish further involvement in the application process.

9. Statutory Considerations

The following assessment is provided in accordance with the relevant sections under the RMA applicable to this proposal.

9.1 Part 2 (Purposes and Principles) - Sections 5, 6, 7, and 8

Part 2 provides a common set of principles to be applied to the management of all resources.

9.1.1 Section 5 assessment

The RMA has a single overarching purpose: to promote the sustainable management of natural and physical resources. Sustainable management is defined in Section 5 as:

> *…managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while –*
>
> *(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(b) Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
>
> *(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

Assessment

As highlighted throughout this AEE, the sand resource at Pakiri is vital for the continued sustainable development of the Auckland Region. This includes the delivery of a quality compact urban core and a low carbon future. Pakiri is the source of at least 43% of the sand for Auckland's concrete production and without access to this resource the cost of concrete in Auckland would increase, while the availability of sand to the market would become critically short with a likely shortfall in availability. These increased costs would have adverse effects on the economic wellbeing of Auckland, as well as on the supply of affordable housing with subsequent negative impacts on social wellbeing.

Furthermore, the sand resource at Pakiri is the most efficient sand resource to transport, given its ability to be shipped directly into Central Auckland. Alternative sources in the Kaipara Harbour and Waikato require long-distance road transport, increasing transport costs, contributing to road congestion and generating additional CO_2 emissions. Also, Pakiri sand requires less cement than Waikato sourced sand (per cubic metre of concrete produced), improving the cost efficiency and minimising CO_2 generation during concrete production.

The proposed sand extraction will also be undertaken in a manner which protects the social and cultural values of Pakiri. The vessel operated by MBL will not obstruct the continued use of the CMA for other commercial and recreational activities, including surfing and fishing. In addition, no culturally important features will be affected and access to kaimoana will also be retained.

It has also been demonstrated that sand extraction can be undertaken while safe-guarding the life-supporting capacity of water and local ecosystems. The assessments undertaken for this AEE have detailed the limited effects on water quality and ecological values. The biodiversity of the Pakiri area will be retained and the food sources for fish, birds and marine mammals will be largely unaffected. Lastly, while the extraction activity will require the discharge of some sediment into the CMA, it has been shown that this discharge will not significantly affect water quality, is free of any noticeable contaminants and any effects generated will only be of a short duration, leaving benthic organisms, fish, birds and marine mammals largely unaffected.

Given these factors, the proposal is consistent with section 5 of the RMA.

9.1.2 Section 6 Assessment

In achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the matters of national importance as set out in Section 6 of the Act.

Matters of national importance relevant to this application include:

(a) *the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development.*

(b) *(the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development.*

(c) *the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.*

(d) *the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers.*

(e) *The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga.*

(g) *the protection of protected customary rights:*

(h) *the management of significant risks from natural hazards.*

Assessment

As detailed in this AEE, the natural character of the Pakiri area will be preserved. This is due to the limited duration needed on-station for extraction, the added distance off-shore from the existing extraction areas, the alteration to a weekday and night-time focused extraction schedule and the lack of any visual disruption caused by MBL's vessels. Furthermore, no boat handling facilities are required onshore nor are any permanent moorings required in the CMA.

It is also noted that the extraction activity will not affect the accretion or erosion of the coastal dune system or the bathymetry of the surf breaks. As such, the contributions that these features make to natural character of the landscape will be unaffected and retained for the ongoing enjoyment of residents and visitors.

The ecological assessments by Bioresearches, NIWA and Cawthron have not identified any significant marine habitats for native flora and fauna or significant effects on benthic, fin fish, marine mammal or seabird communities. Furthermore, the lack of erosion effects ensures that any adverse effects on terrestrial ecological values are avoided.

Furthermore, the short duration of each extraction period and the distance of MBL's vessels offshore allows for the continued access of the public to Pakiri. This includes continued enjoyment of its surf breaks, recreational fishing and boating. The lack of erosion effects also ensures that access to the beach remains available to the general public.

MBL is also cognisant of the area's cultural values and the relationship of Maori with this landscape. It has been demonstrated that kaimoana or other customary rights will be unaffected by the extraction activity, while the mauri of coastal waters will be protected given the limited effects associated with sediment disturbance and

discharge. Furthermore, the lack of erosion effects allows for the protection of any wāhi tapu and other taonga which may be present in the coastal dune system.

Lastly, the extraction activity will not exacerbate any natural hazard risks in the Pakiri area. The lack of erosion effects attributable to the activity ensures that any risks from coastal storms or climate change are not amplified by the continued extraction of sand.

Given these factors, the proposal is consistent with section 6 of the RMA.

9.1.3 Section 7 Assessment

Other matters that shall have particular regard to when managing the use, development and protection of natural and physical resources include;

(a) kaitiakitanga:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources

(c) the maintenance and enhancement of amenity values

(d) intrinsic values of ecosystems:

(f) maintenance and enhancement of the quality of the environment:

(i) the effects of climate change:

Assessment

MBL is aware of the importance of kaitiakitanga and has engaged with mana whenua throughout the development of the current proposal. This includes developing strong relationships with mana whenua representatives to ensure that cultural values were considered in the proposed operation of the extraction activity, while also ensuring that the ongoing access to culturally important resources is not impinged by MBL's operation.

As identified in Sections 3 and 6.2, the continued access to this sand resource is critical to the delivery of affordable housing and the quality-compact urban growth model sought by Auckland Council's strategic planning documents. By delivering a high-quality and affordable source of concrete, the proposed extraction activity will assist in the efficient use and development of resources across the Auckland region. As identified by the Auckland Plan and AUP(OP), the quality compact urban development of Auckland will help protect valuable soils, reduce congestion, help mitigate climate change, assist economic growth and provide housing choice. However, the ability to meet these efficient resource uses will be more difficult and expensive if the proposed extraction is not allowed for.

At a local level it is also considered that amenity values will be maintained. The extraction activity does not affect the rate of any erosion of the coastal dune system or the quality and appearance of the surf breaks. As such, both these landscape elements will continue to contribute to the high amenity values at Pakiri, while public access to the coast will also remain unaffected.

The extraction activity also recognises the intrinsic values of ecosystems and will not affect local biodiversity values. The food sources for marine mammals and fish species will also be largely unaffected, while the lack of

erosion protects any onshore species' habitat. It is also noted that benthic species are able to recolonise disturbed areas quickly, returning the seabed to its natural condition.

Overall, the activity will maintain the current quality of the environment, with no discernible effects beyond the existing extraction activity. The altered extraction regime, including the use of increased night-time and weekday operations, will also assist with the enhancement of amenity values. Public enjoyment of Pakiri will also remain uninterrupted, with the ability for the public to enjoy surfing, fishing and boating in the CMA continuing even while extraction is occurring.

Lastly, the effects of climate change, including coastal erosion have been considered in the development of this application. The extraction activity does not affect the rate of sand loss at Pakiri and MBL propose to continue to undertake regular monitoring of the dunes and foreshore for the duration of the consented activity.

Given the above, the application is consistent with section 7 of the RMA.

9.1.4 Section 8 Assessment

The principles of the Treaty of Waitangi shall be taken into account when managing the use, development, and protection of natural and physical resources.

Assessment

As previously discussed, MBL are aware of mana whenua's rights and roles in resource management, having engaged with a number of mana whenua through the development of the current proposal. This has included contacting CMT applicants, the iwi identified by Auckland Council as having an interest in the area and the three iwi with statutory acknowledgment areas at Pakiri.

Furthermore, it is recognised that the proposed extraction will not impact on the physical characteristics of local cultural resources. Access will still be retained to kaimoana and the wider CMA, while erosion of the dune system and the subsequent disturbance of any undiscovered taonga is not anticipated.

Lastly, CVAs were commissioned from Ngāti Manuhiri and Te Uri o Hau. These will be provided once they are completed.

9.2 Section 104(1)(a)

This section of the Act requires that regard is given to any actual and potential effects on the environment of allowing the activity.

A detailed assessment of the actual and potential environmental effects is included in Section 6 of this report. In summary, the extraction activity and associated discharge will have no more than minor adverse effects on the environment. However, these effects are largely transitory and will be reduced with the introduction of the William Fraser and the altered extraction regime.

In addition, the proposal has significant benefits for the social and economic wellbeing of Auckland. The sand resource at Pakiri is a vital resource for the production and supply of concrete, providing at least 43% of the sand used for Auckland's concrete production. Without access to this resource, more expensive, less appropriate and less secure sources of sand would be required. This would have subsequent adverse effects on the region's transport networks, housing affordability, housing supply, infrastructure delivery and regional climate change mitigation measures.

9.3 Section 104(1)(b)(i)

This section of the Act requires that regard is given to any relevant provisions of a national environmental standard.

Assessment

There are no national environmental standards relevant to the application.

9.4 Section 104(1)(b)(ii)

This section of the Act requires that regard is given to any relevant provisions of any other regulations.

Assessment

No other regulations are considered to be relevant to the application.

9.5 Section 104(1)(b)(iii)

This section of the Act requires that regard is given to any relevant provisions of a national policy statement (NPS).

Assessment

Section 9(4) of the Hauraki Gulf Marine Park Act 2000 requires consent authorities to have regard to sections 7 and 8 of that Act as if they were a National Policy Statement.

Section 7 of the Act states:

"(1) The interrelationship between the Hauraki Gulf, its islands, and catchments and the ability of that interrelationship to sustain the life-supporting capacity of the environment of the Hauraki Gulf and its islands are matters of national significance.

(2) The life-supporting capacity of the environment of the Gulf and its islands includes the capacity—

(a) to provide for—

(i) the historic, traditional, cultural, and spiritual relationship of the tangata whenua of the Gulf with the Gulf and its islands; and

(ii) the social, economic, recreational, and cultural well-being of people and communities:

(b) to use the resources of the Gulf by the people and communities of the Gulf and New Zealand for economic activities and recreation;

(c) to maintain the soil, air, water, and ecosystems of the Gulf."

The proposal is consistent with Section 7 of the Act as it will not adversely affect the life-supporting capacity of the Hauraki Gulf nor the matters raised in section 7(2). No more than minor adverse effects will be generated, with the majority of these effects temporary in nature. The water quality of Pakiri will be maintained, as will the existing biodiversity values. Cultural values will also be protected, via uninterrupted access to kaimoana and the

wider CMA, while the lack of erosion effects will avoid the disturbance on any onshore sites of cultural significance.

Furthermore, MBL's operation is vital for the social and economic wellbeing of the community given the importance of the sand resource to the construction sector. The high quality of the sand resource and the efficiency of its transport to Central Auckland make it vital to the delivery of affordable homes, business premises and infrastructure.

Section 8 of the Act states:

"To recognise the national significance of the Hauraki Gulf, its islands, and catchments, the objectives of the management of the Hauraki Gulf, its islands, and catchments are—

(a) the protection and, where appropriate, the enhancement of the life-supporting capacity of the environment of the Hauraki Gulf, its islands, and catchments:

(b) the protection and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments:

(c) the protection and, where appropriate, the enhancement of those natural, historic, and physical resources (including kaimoana) of the Hauraki Gulf, its islands, and catchments with which tangata whenua have an historic, traditional, cultural, and spiritual relationship

(d) the protection of the cultural and historic associations of people and communities in and around the Hauraki Gulf with its natural, historic, and physical resources:

(e) the maintenance and, where appropriate, the enhancement of the contribution of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments to the social and economic well-being of the people and communities of the Hauraki Gulf and New Zealand:

(f) the maintenance and, where appropriate, the enhancement of the natural, historic, and physical resources of the Hauraki Gulf, its islands, and catchments, which contribute to the recreation and enjoyment of the Hauraki Gulf for the people and communities of the Hauraki Gulf and New Zealand."

The extraction operation is consistent with section 8 of the Hauraki Gulf Marine Park Act 2000 Act given that it will have no more than minor adverse effects on the Hauraki Gulf's environment, including its natural resources, communities and cultural values. Both the ecological and landscape values of the Hauraki Gulf will be largely unaltered by the sand extraction, while public access to the CMA and their enjoyment of the wider coastal environment will remain uninterrupted by the activity. MBL have also engaged with mana whenua to ensure cultural values have been taken into account during the development of this application and commissioned CVAs will be provided to Auckland Council once they become available.

9.6 Section 104(1)(b)(iv)

This section of the Act requires that regard is given to any relevant provisions of a National Coastal Policy Statement (NZCPS).

Assessment

Given the activity's location, the NZCPS is relevant. In particular, the following objectives and policies are considered relevant to the current application:

- Objectives 1, 2, 3, and 6;
- Policies:
    - Policy 1: Extent and characteristics of the coastal environment;
    - Policy 2: The Treaty of Waitangi, tangata whenua and Māori;
    - Policy 3: Precautionary approach;
    - Policy 4: Integration;
    - Policy 6: Activities in the coastal environment;
    - Policy 11: Indigenous biological diversity (biodiversity);
    - Policy 13: Preservation of natural character;
    - Policy 15: Natural features and natural landscapes; and
    - Policy 23: Discharge of contaminants.

Firstly, the proposal is consistent with the objectives and policies of the NZCPS given that the integrity, form, functioning and resilience of the coastal environment and its ecosystems are maintained. As detailed in Section 6 of this AEE, the extraction activity has limited effects on biodiversity and the natural landscape at Pakiri. While seabed disturbance and sediment discharge does occur, these are temporary, and the local ecosystem is resilient to these activities in the CMA. There are no significant attributable effects of the existing activity on biodiversity or the wellbeing of fin fish, marine mammals or seabirds, including any at-risk or declining species.

In addition, the physical effects of the extraction on coastal forms and processes is also limited. Historically collected data shows that the extraction does not impact the coastal dune system, while the form and function of the surf breaks remain unaffected. Significant effects are avoided, while any effects caused by the presence of MBL's vessels or the discharge of sediment are limited to the short duration of each extraction period. These effects have been further reduced and mitigated from their historical level by the introduction of the William Fraser. This is due to its improved efficiency in extraction (i.e. shorter and fewer times on-station at Pakiri), as well as the change to more night-time and weekday operations. In addition, sand extraction at Pakiri has been occurring for more than seven decades, with the vessels operating during this time becoming part of the accepted landscape. It is also noted that numerous other vessels transit the area, as they enter and leave the Port of Auckland or undertake commercial/recreational fishing.

MBL also recognise the cultural relationship that mana whenua have in the Pakiri area and have engaged with various iwi to discuss any concerns or issues associated with the extraction activity. No customary fisheries will be affected by the activity, while access to the CMA will be maintained. Furthermore, the extraction activity will not cause any erosion of the dune system which could expose taonga or wāhi tapu.

The Pakiri area is also important to the general public and local residents given its landscape and recreational values. MBL's operation does not obstruct the public's access or enjoyment of the coastal environment, with the continued ability for the public to surf, fish and boat in the CMA. The extraction activity is also not a permanent activity, with only limited time needed at Pakiri to undertake the sand extraction. Effects are further limited as no onshore facilities are needed by MBL to undertake the activity.

Lastly, the extraction activity does not introduce new contaminants or human waste products into the environment. The discharge from MBL's vessels is limited to sediment, biota and seawater extracted from Pakiri itself. It is processed onboard the vessels and rapidly discharged without the addition of any other material or contaminants. On-site monitoring and testing have also shown that this discharge rapidly dissipates and does not affect local biodiversity.

Given the above, the proposal is consistent with the NZCPS.

9.7 Section 104(1)(b)(v)

This section of the Act requires that regard is given to any relevant provisions of a regional policy statement (RPS) or proposed regional policy statement.

Assessment

An assessment of the proposal against the RPS objectives and policies of the AUP(OP) is provided as Appendix B. In summary, the proposal is consistent with the RPS given the scale of effects generated and the importance of the sand resource to Auckland's social and economic wellbeing.

9.8 Section 104(1)(b)(vi)

This section of the Act requires that regard is given to any relevant provisions of a plan or proposed plan.

Assessment

An assessment of the proposal against the relevant objectives and policies of the AUP(OP) is provided as Appendix B. In summary, the proposal is consistent with these objectives and policies, including those associated with the General Coastal Marine Zone.

9.9 Section 104(1)(c)

This section of the Act requires consent authority to consider any other matter relevant and reasonably necessary to determine the application.

9.9.1 Auckland Plan 2050

As highlighted in Section 3.2, Auckland is predicted to experience significant population growth over the next 30 years, with an additional 720,000 residents living in the region at the end of this period. These residents will require an additional 313,000 homes based on the Auckland Plan's focus on achieving quality compact urban form. In order to meet this housing demand, while also achieving the desired urban form, an affordable and secure supply of concrete is needed.

Pakiri is an appropriate source for construction sand and it can be provided without the adverse effects on transport networks and the Auckland Plan's climate change objectives which other sources have. Furthermore, the proposed extraction activity can be undertaken in a manner which avoids significant effects on the natural environment or cultural values, thereby recognizing the Auckland Plan's wider environmental objectives.

Given these factors, the proposal is consistent with the Auckland Plan.

9.9.2 Hauraki Gulf Marine Spatial Plan

It is noted that the proposal is consistent with the desired outcomes of the Hauraki Gulf Marine Spatial Plan. In particular, it does not affect the biodiversity of the wider Hauraki Gulf, with limited effects on marine species and the provision of adequate food sources for seabirds, fish and marine mammals. As such, both commercial and recreational fish populations will be largely unaffected, while the conservation status of at risk, endangered or declining species will also be unaffected.

Minimal habitat disturbance will be caused, with local benthic populations readily able to recolonise any dredged areas. This disturbance and associated surface discharge will have limited temporary effects, with any plumes rapidly dispersing back in the receiving environment. Any discharges will not contain significant concentrations of contaminants and do not pose a risk to local fauna.

Lastly, engagement with mana whenua has also been undertaken in recognition of the cultural values or Pakiri and in the spirit of kaitiakitanga. This has included the commissioning of CVAs, as well as recognising the Treaty claims and CMT applications present in the area.

9.10 Consent duration

Given the no more than minor adverse effects generated by the extraction activity as demonstrated by the supporting technical assessments, the use of standard consent conditions and the strategic importance of the sand resource to Auckland, MBL seek consent durations of 35 years for both the coastal permit and discharge permit.

MBL has demonstrated that the extraction activity can occur for this duration without generating significant effects on the local environment, with the use of regular monitoring to ensure that the effects of the activity do not exceed those described in the application. Furthermore, MBL agree to the imposition of a condition under section 128 which allows Auckland Council to review the consents should any issues arise during the duration of the consents. Such a condition has been included in the draft conditions set (Appendix F).

9.11 Sections 105 and 107

It is also noted that s105 and s107 of the RMA address discharge applications. In particular, s105 states that a discharge permit under s15 of the RMA must have regard to:

(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(b) the applicant's reasons for the proposed choice; and

(c) any possible alternative methods of discharge, including discharge into any other receiving environment.

As addressed by this AEE and the associated water quality assessment, the discharge associated with the sand extraction does not contain any noticeable levels of contaminants. The ecological assessments by Cawthron, NIWA and Bioresearches further note that the local environment can receive this discharge without significant effects given its transitory nature and the lack of contaminants.

Lastly, no practicable alternatives exist for the discharge. Without undertaking a discharge directly after dredging, a much larger vessel would be required to carry the volume of target sand, unwanted material and seawater which is collected during the extraction process.

Section 107 states that a discharge shall not generate the following effects:

a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

b) any conspicuous change in the colour or visual clarity;

c) any emission of objectionable odour;

d) the rendering of fresh water unsuitable for consumption by farm animals; and

e) any significant adverse effects on aquatic life.

It is noted that the effects of the discharge will not create any conspicuous changes in water quality and will not include any grease films, scums or foam. Any discolouration from the discharge will be transitory and rapidly dispersed with the return of discarded material to the seabed. Furthermore, the discharge does not give rise to any objectionable odours and will not significantly affect marine species present at Pakiri.

10. Conclusion

Consents have been sought for the extraction of sand from mid-shore (15 m to 25 m water depths) at Pakiri and the associated discharge of unwanted material. A duration of 35 years is sought for both consents, with an extraction rate based on the following:

- An annual average rate of 125,000 m^3/year over any consecutive 5 year period and a maximum rate of 150,000 m^3 over any 12-month period, with the temporal distribution of the extraction volume being limited to a maximum of 15,000 m^3 over any consecutive 30 day period and to be spatially balanced between a series of extraction cells located along the beach and between the 15 and 25 m depth contours.

The discharge of seawater, sand and other material from the extraction activity has also been sought for the same duration, These consents will replace those associated with the existing inshore extraction areas, with the consent applications associated with the inshore area withdrawn once consent is granted for the mid-shore extraction area.

MBL have demonstrated through the operation of the current activity, the attached technical assessments and this AEE that the proposal will generate no more than minor adverse effects on the environment, including any effects on ecological, water quality, cultural and landscape values. The introduction of the William Fraser and the altered extraction regime have also reduced the potential adverse effects of the activity. In addition, the sand resource at Pakiri is a vital material for the construction industry, supplying at least 43% of the sand for Auckland's concrete production. Without the continued secure supply of this resource, Auckland will be reliant on more distant and lower quality sand resources. This would have significant impacts on building costs, road congestion and greenhouse gas emissions, with such an outcome being contrary to the Auckland Plan and other strategic documents.

Significant investment has been made in the William Fraser to ensure that its performance reduces environmental impacts of the activity. The addition of moon pools, electric pumps, new screens technology and under keel discharge significantly reduces the potential adverse impacts from those experienced from previous vessels used by MBL and others currently in use in the industry. MBL has also invested in the future and has sought to reduce its environmental footprint, thereby ensuring that a further 35 years of sand extraction is appropriate.

The proposal is also consistent with the relevant statutory tests and documents of the RMA. This includes the NZCPS, the AUP(OP) and Part 2 of the RMA

Accordingly, it is considered that resource consent can be granted for this application.

Appendix A. Previous Consent Conditions

Jacobs

Appendix B. Objectives and Policies

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
B4 – Natural Heritage			
Objective B4.2.1	(1) Outstanding natural features and landscapes are identified and protected from inappropriate subdivision, use and development. (2) The ancestral relationships of Mana Whenua and their culture and traditions with the landscapes and natural features of Auckland are recognised and provided for.	Yes	As demonstrated by the landscape assessment (Appendix M) and discussed in the AEE (Section 6.10), the proposal is considered to have no adverse effects on the landscape values at Pakiri, noting that the proposed mid-shore extraction area is located outside of both the ONL and HNC overlays. This assessment of landscape effects is supported by MBL's proposal to move the extraction operations towards more night-time and weekday periods, which limits the potential audience for the activity. Furthermore, the efficiency of the William Fraser (as opposed to earlier vessels) reduces the time needed at Pakiri to complete dredging. Further to the immediate visual effects associated with the operation of the extraction vessels in the inshore environment, the onshore landscape will also be largely unaffected by the activity. As discussed in the coastal processes report (Section 6.4), the proposed extraction levels will not accelerate natural coastal erosion at Pakiri. This will ensure that the coastal dune system and surf breaks will continue to contribute to the natural character of Pakiri and retain their own form. Lastly, it is also recognised that no onshore facilities are required at Pakiri for MBL to continue sand extraction. Ongoing erosion monitoring is also proposed to ensure that effects on landscape values from erosion are avoided. Finally, MBL have commissioned two CVAs and these will be provided once complete. It is also noted that the lack of physical effects on the landscape will avoid the disturbance of any culturally significant sites within the dune system or further onshore.
Policy B4.2.2	(8) Manage outstanding natural landscapes and outstanding natural features in an integrated manner to protect and, where practicable and appropriate, enhance their values.		

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
B6 – Mana Whenua			
Objective B6.3.1	(1) Mana Whenua values, mātauranga and tikanga are properly reflected and accorded sufficient weight in resource management decision-making. (2) The mauri of, and the relationship of Mana Whenua with, natural and physical resources including freshwater, geothermal resources, land, air and coastal resources are enhanced overall. (3) The relationship of Mana Whenua and their customs and traditions with natural and physical resources that have been scheduled in the Unitary Plan in relation to natural heritage, natural resources or historic heritage values is recognised and provided for.	Yes	MBL has engaged with mana whenua, including those iwi who have statutory acknowledgement areas at Pakiri and those who have an interest in the area registered with Auckland Council. In addition, MBL have contacted the CMT applicants for the Pakiri area. It is acknowledged that the Hauraki Gulf is culturally significant to mana whenua, including its importance for food gathering and as a traditional transport route. However, the extraction activity will not affect kaimoana resources at Pakiri, while uninterrupted access to the CMA will continue. As discussed above, the lack of coastal erosion effects will also avoid impacts on any onshore culturally significant sites or taonga. Both forestry blocks (as owned by two iwi) will also be unaffected by the extraction activity. In recognition of the broader cultural values associated with Pakiri, two CVAs have been commissioned. Any assessment of effects on the mauri of Pakiri and other cultural aspects will be undertaken once the CVAs for extraction from the new area are received.
Policy B6.3.2	(1) Enable Mana Whenua to identify their values associated with all of the following: (a) ancestral lands, water, air, sites, wāhi tapu, and other taonga; (b) freshwater, including rivers, streams, aquifers, lakes, wetlands, and associated values; (c) biodiversity; (d) historic heritage places and areas; and		

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(e) air, geothermal and coastal resources. (2) Integrate Mana Whenua values, mātauranga and tikanga: (a) in the management of natural and physical resources within the ancestral rohe of Mana Whenua, including: (i) ancestral lands, water, sites, wāhi tapu and other taonga; (ii) biodiversity; and (iii) historic heritage places and areas. (b) in the management of freshwater and coastal resources, such as the use of rāhui to enhance ecosystem health; (c) in the development of innovative solutions to remedy the long-term adverse effects on historical, cultural and spiritual values from discharges to freshwater and coastal water; and (d) in resource management processes and decisions relating to freshwater, geothermal, land, air and coastal resources. (3) Ensure that any assessment of environmental effects for an activity that may affect Mana Whenua values includes an appropriate assessment of adverse effects on those values.		

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(4) Provide opportunities for Mana Whenua to be involved in the integrated management of natural and physical resources in ways that do all of the following: (a) recognise the holistic nature of the Mana Whenua world view; (b) recognise any protected customary right in accordance with the Marine and Coastal Area (Takutai Moana) Act 2011; and (c) restore or enhance the mauri of freshwater and coastal ecosystems. (6) Require resource management decisions to have particular regard to potential impacts on all of the following: (a) the holistic nature of the Mana Whenua (b) the exercise of kaitiakitanga; (c) mauri, particularly in relation to freshwater and coastal resources; (d) customary activities, including mahinga kai; (e) sites and areas with significant spiritual or cultural heritage value to Mana Whenua; and (f) any protected customary right in accordance with the Marine and Coastal Area (Takutai Moana) Act 2011.		

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
B7 – Natural Resources			
Objective B7.2.1	(1) Areas of significant indigenous biodiversity value in terrestrial, freshwater, and coastal marine areas are protected from the adverse effects of subdivision, use and development. (2) Indigenous biodiversity is maintained through protection, restoration and enhancement in areas where ecological values are degraded, or where development is occurring.	Yes	It is noted that the proposed mid-shore extraction area is located outside any SEAs identified by the AUP(OP). Furthermore, no reefs or any coral were identified in the study area. Additionally, no unique or endangered benthic species were found to inhabit the extraction areas. The assessments undertaken by Bioresearches, Cawthron and NIWA (Appendix K, Appendix L and Appendix N) have identified that the proposed activity will have no more than minor effects on ecological values. The seabed within the extraction areas is a rapidly changing environment, given currents and wave energy, with populations of mobile marine fauna. While some benthic organisms and seabed dwelling fin fish species may experience increased mortality due to capture within the draghead, overall biodiversity remains largely unaffected through the relatively rapid re-colonisation of disturbed areas. Larger marine species, such as sharks and mammals, are also largely unaffected given their own transitory behaviour, the low noise levels emitted by MBL's vessels and the retention of adequate food sources within the extraction areas. Local bird populations are also largely unaffected by the extraction activity. With a move to more night-time operations, effects on daytime feeding bird species will be avoided, while lighting controls will limit effects on any night-time active species. It is also noted that the lack of coastal erosion effects avoids effects on onshore feeding and roosting habitats, while the limited effects on benthic and fin fish species also ensures that adequate food sources are retained in the Pakiri for these larger animal species.
Policy B7.2.2	(5) Avoid adverse effects on areas listed in the Schedule 3 of Significant Ecological Areas – Terrestrial Schedule and Schedule 4 Significant Ecological Areas – Marine Schedule.		
Objective B7.4.1	(1) Coastal water, freshwater and geothermal water are used within identified limits while safeguarding	Yes	During the extraction activity, excess seawater and unwanted extracted materials (e.g. silt) will be discharged back into coastal waters. These discharges will not

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	the life-supporting capacity and the natural, social and cultural values of the waters. (2) The quality of freshwater and coastal water is maintained where it is excellent or good and progressively improved over time where it is degraded. (6) Mana Whenua values, mātauranga and tikanga associated with coastal water, freshwater and geothermal water are recognised and provided for, including their traditional and cultural uses and values.		include any materials that are not already present at Pakiri (e.g. no fuels or foreign sediments). The water quality assessment (Appendix H) has demonstrated that this material readily disperses and settles on the seabed within a short period of time and distance from MBL's vessels. This discharge does not degrade the water quality values of Pakiri nor cause any significant effects on the area's ecological values.
Policy B7.4.2	(7) Manage the discharges of contaminants into water from subdivision, use and development to avoid where practicable, and otherwise minimise, all of the following: (b) adverse effects on the quality of freshwater and coastal water; (c) adverse effects from contaminants, including nutrients generated on or applied to land, and the potential for these to enter freshwater and coastal water from both point and non-point sources; (d) adverse effects on Mana Whenua values associated with coastal water, freshwater and geothermal water, including wāhi tapu, wāhi taonga and mahinga kai;		

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
Objective B7.6.1	(1) Auckland's mineral resources are effectively and efficiently utilised.	Yes	As noted throughout the AEE (in particular Section 3), Pakiri has a regionally significant mineral resource and is critical for Auckland's continuing development. With 43% of sand for Auckland's concrete coming from Pakiri, continued access to this resource is required to ensure that the quality compact urban model sought by Auckland Council's strategic plans is achieved. Concrete is a ubiquitous building material and will be increasingly important as higher density urban development is constructed. Without this sand resource, concrete production will be more costly, have a greater impact on the region's road network and generate higher levels of CO_2 emissions. MBL has also demonstrated that the extraction can occur without generating significant adverse effects on the environment. The effects of the extraction will be no more than minor and are largely transitory, while the environmental performance of MBL's operation will improve further given the recent introduction of the William Fraser and the proposed alterations to extraction timing.
Policy B7.6.2	(1) Provide for mineral extraction activities within appropriate areas to ensure a secure supply of extractable minerals for Auckland's continuing development. (4) Require mineral extraction activities to be established and operated in ways which avoid, remedy or mitigate significant adverse effects on the environment.		
B8 – Coastal Environment			
Objective B8.2.1	(1) Areas of the coastal environment with outstanding and high natural character are preserved and protected from inappropriate subdivision, use and development. (2) Subdivision, use and development in the coastal environment are designed, located and managed to preserve the characteristics and qualities that contribute to the natural character of the coastal environment.	Yes	As demonstrated by the landscape assessment (Appendix M) and discussed in the AEE, the proposal will have no adverse effects on the landscape values at Pakiri. The mid-shore extraction of sand only involves a temporary presence at Pakiri and avoids both the HNC and ONL overlays. In addition, MBL has moved towards more night-time and weekday extraction, thereby further limiting the potential audience for any visual effects. Further to the immediate visual effects associated with the operation of the extraction vessels in the inshore environment, it is noted that the onshore landscape will also be unaffected by the activity. As discussed in the coastal processes report (Appendix G), the proposed extraction levels will not accelerate natural coastal erosion at Pakiri. This will ensure that the coastal dune system and

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(3) Where practicable, in the coastal environment areas with degraded natural character are restored or rehabilitated and areas of high and outstanding natural character are enhanced.		surf breaks will continue to contribute to the natural character of Pakiri and retain their own form. It is also recognised that no onshore facilities are required at Pakiri for MBL to continue sand extraction. Lastly ongoing erosion monitoring is proposed to ensure that effects on landscape values from erosion are avoided.
Policy B8.2.2	(3) Preserve and protect areas of outstanding natural character and high natural character from inappropriate subdivision, use and development by: (a) avoiding adverse effects of activities on natural character in areas of the coastal environment scheduled as outstanding natural character; and (b) avoiding significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on natural character in all other areas of the coastal environment. (4) Avoid significant adverse effects and avoid, remedy or mitigate other adverse effects on natural character of the coastal environment not identified as outstanding natural character and high natural character from inappropriate subdivision, use and development.		
Objective B8.3.1	(1) Subdivision, use and development in the coastal environment are located in appropriate places and are of an appropriate form and within appropriate limits, taking into account the range of uses and values of the coastal environment.	Yes	MBL's operation has a functional and operational requirement to operate in the coastal environment. This is where the sand resource is most easily accessed, is of a high quality and can be transported to market with the least environmental effects.

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(2) The adverse effects of subdivision, use and development on the values of the coastal environment are avoided, remedied or mitigated. (3) The natural and physical resources of the coastal environment are used efficiently and activities that depend on the use of the natural and physical resources of the coastal environment are provided for in appropriate locations.		The sand resource at Pakiri is regionally significant and is critical to the ongoing social and economic wellbeing of Auckland. As a resource for the construction industry, the sand sourced from Pakiri will support the sustainable development of urban Auckland. It will help build the additional 313,000 homes required under the Auckland Plan, will form part of the regions' numerous new employment centres and the $30 billion infrastructure spend needed over the coming decades. It is also noted that the extraction activity does not require any onshore infrastructure at Pakiri, avoiding the need to modify natural character or appearance of the coastal edge. In addition, any adverse effects arising from the activity are no more than minor and transitory. In has been demonstrated that the extraction activity has limited effects on ecology and do does not contribute to any noticeable changes in coastal morphology. Lastly, the effects of the activity can be managed and mitigated by the measures proposed by MBL and the imposition of conditions (Appendix F).
Policy B8.3.2	(1) Recognise the contribution that the use and development of the coastal environment make to the social, economic and cultural well-being of people and communities (3) Provide for use and development in the coastal marine area that: (a) have a functional need which requires the use of the natural and physical resources of the coastal marine area; (c) have an operational need making a location in the coastal marine area appropriate and that cannot practicably be located outside the coastal marine area (4) Require subdivision, use and development in the coastal environment to avoid, remedy or mitigate		

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	the adverse effects of activities above and below the mean high-water springs, including the effects on existing uses and on the coastal receiving environment. (5) Adopt a precautionary approach towards proposed activities whose effects on the coastal environment are uncertain, unknown or little understood, but could be significantly adverse.		
Objective B8.4.1	(1) Public access to and along the coastal marine area is maintained and enhanced, except where it is appropriate to restrict that access, in a manner that is sensitive to the use and values of an area.	Yes	The extraction activity will not affect public access to the CMA. MBL's vessels do not currently exclude the public from using the Pakiri inshore area for fishing, surfing or boating, and will not do so in the future. In addition, no onshore structures are required to undertake the activity. Furthermore, the extraction activity does not contribute to any noticeable changes in coastal morphology, thereby avoiding any changes to onshore access points to the coastal edge.
Policy B8.4.2	(1) Subdivision, use and development in the coastal environment must, where practicable, do all of the following: (a) maintain and where possible enhance public access to and along the coastal marine area		
Objective B8.5.1	(1) The management of the Hauraki Gulf gives effect to sections 7 and 8 of the Hauraki Gulf Marine Park Act 2000. (3) Economic well-being is enabled from the use of the Hauraki Gulf's natural and physical resources without resulting in further degradation of environmental quality or adversely affecting the life-supporting capacity of marine ecosystems.	Yes	The proposed activity is consistent with sections 7 and 8 of the Hauraki Gulf Marine Park Act 2000. It does not affect the life supporting capacity of the CMA, nor does it adversely affect the social, economic, recreational, and cultural well-being of people, communities or mana whenua. The activity avoids any cumulative effects on ecological or amenity values, while the measures proposed by MBL ensure that any effects are identified and addressed appropriately. MBL have also engaged with mana whenua and will continue to do so in recognition of the various iwi interests in the area.

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
Policies B8.5.2	(2) Require the integrated management of use and development in the catchments, islands, and waters of the Hauraki Gulf to ensure that the ecological values and life-supporting capacity of the Hauraki Gulf are protected, and where appropriate enhanced. (3) Require applications for use and development to be assessed in terms of the cumulative effect on the ecological and amenity values of the Hauraki Gulf, rather than on an area-specific or case-by-case basis. (13) Require management and decision-making to take into account the historical, cultural and spiritual relationship of Mana Whenua with the Hauraki Gulf, and the ongoing capacity to sustain these relationships. (17) Provide for commercial activities in the Hauraki Gulf and its catchments while ensuring that the impacts of use, and any future expansion of use and development, do not result in further degradation or net loss of sensitive marine ecosystems.		Lastly, the extraction activity is a vital commercial operation for the social and economic wellbeing of Auckland. It has a functional need to occur in the CMA and it will not result in the degradation or net loss of any sensitive marine ecosystems.

CHAPTER B – REGIONAL POLICY STATEMENT			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
B10 – Environmental Risk			
B10.2.1	(2) The risks to people, property, infrastructure and the environment from natural hazards are not increased in existing developed areas. (3) New subdivision, use and development avoid the creation of new risks to people, property and infrastructure. (4) The effects of climate change on natural hazards, including effects on sea level rise and on the frequency and severity of storm events, is recognised and provided for.	Yes	As noted by the coastal processes assessment, the activity will not increase the risk of natural hazards (i.e. erosion or storm surge) affecting either the landscape features that contribute to the area's natural character or the risks to dwellings and infrastructure. Any potential issues with increased beach erosion (due to the increased frequency and severity of storm events) will be captured through regular erosion monitoring and the ability to modify the parameters of the activity via a review condition imposed under s128 of the RMA.

CHAPTER E – AUCKLAND WIDE			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
E1 - Water Quality and Integrated Management			
Policy E1.3	(26) Prevent or minimise the adverse effects from construction, maintenance, investigation and other activities on the quality of freshwater and coastal water by: (a) adopting best management practices and establishing minimum standards for the discharges; or (b) where Policy E1.3(26)(a) is not practicable, have regard to the following: (i) the nature, volume and concentration of the contaminants in the discharge; (ii) the sensitivity of the receiving environment to the contaminants in the discharge; (iii) other practicable options for the discharge, including reuse or discharge to the trade sewer; and (iv) practicable measures to reduce contaminant concentrations prior to discharge or otherwise mitigate adverse effects.	Yes	As discussed in the water quality assessment, the seabed disturbance and coastal discharge from MBL's vessel generates less than minor adverse effects on coastal water quality. Only minimal contaminants are present in the disturbed sediments, while no new contaminants are introduced by the activity. As such, less than minor effects on ecology will occur as result of the discharge. In addition, the proposed discharge represents the best practicable option for the disposal of excess sediment, seawater and organisms given that they are returned to their area of origin and are efficiently removed from the targeted sand resource.
E18 - Natural Character of the Coastal Environment			

CHAPTER E – AUCKLAND WIDE			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
Objective E18.2	(1) The natural characteristics and qualities that contribute to the natural character of the coastal environment are maintained while providing for subdivision, use and development.	Yes	As discussed in the AEE and the landscape assessment (Appendix M), the natural characteristics and qualities that contribute to the coastal environment will be maintained. The extraction activity does not noticeably contribute to coastal erosion processes, leaving the surf breaks and dune systems unaffected. The biological qualities of the Pakiri area are also largely unaffected, with adequate food sources remaining for fin fish, mammals and birds (all of which contribute to the sense of naturalness at Pakiri). The lack of any onshore structures also assists in retaining the natural character of the area, while the proposed move towards more night-time and weekday extraction events further limit the landscape effects of MBL's activity.
Policies E18.3	(3) Manage the effects of subdivision, use and development in the coastal environment to avoid significant adverse effects, and avoid, remedy or mitigate other adverse effects, on the characteristics and qualities that contribute to natural character values, taking into account: (a) the location, scale and design of the proposed subdivision, use or development; (b) the extent of anthropogenic changes to landform, vegetation, coastal processes and water movement; (c) the presence or absence of structures, buildings or infrastructure; (d) the temporary or permanent nature of any adverse effects; (e) the physical and visual integrity of the area, and the natural processes of the location; (f) the intactness of any areas of significant vegetation, and vegetative patterns; (g) the physical, visual and experiential values that contribute significantly to the wilderness and scenic values of the area;		

CHAPTER E – AUCKLAND WIDE			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(h) the integrity of landforms, geological features and associated natural processes, including sensitive landforms such as ridgelines, headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs, streams, rivers and surf breaks; (i) the natural characteristics and qualities that exist or operate across mean high-water spring and land in the coastal environment, including processes of sediment transport, patterns of erosion and deposition, substrate composition and movement of biota, including between marine and freshwater environments.		
E19 - Natural Features and Natural landscapes in the Coastal Environment			
Objective E19.2	(1) The characteristics and qualities of natural landscapes and natural features which have particular values, provide a sense of place or identity, or have high amenity value, are maintained while providing for subdivision, use and development in the coastal environment.	Yes	As noted in the assessment of Objective E18.2 and Policies E18.3, the characteristics and qualities of the natural landscape will be maintained. No onshore changes to landforms are proposed, either from the extraction activity itself or the construction of any related infrastructure. The lack of related effects assists in maintaining the ecological linkages between the sea and the shore, including protecting the breeding and feeding areas of seabirds and shore birds. The ongoing extraction will also be monitored, via the EMMP, to ensure that any changes to coastal features are identified and modifications to the extraction activity undertaken to prevent effects on landscape values. In addition, the use of a modified extraction schedule and the improved efficiency of the William Fraser will assist in the protection of Pakiri's natural character.
Policies E19.3	(1) Manage subdivision, use and development in the coastal environment adjoining scheduled outstanding natural landscapes or outstanding natural features to: (a) protect visual and biophysical linkages between the site and outstanding natural landscapes or outstanding natural features; and		

CHAPTER E – AUCKLAND WIDE			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(b) avoid adverse cumulative effects on the values of outstanding natural landscapes or outstanding natural features. (2) Manage the effects of subdivision, use and development in the coastal environment to avoid significant adverse effects, and avoid, remedy or mitigate other adverse effects on the characteristics and qualities of natural landscapes and natural features which have particular values, provide a sense of place or identity, or have high amenity values, taking into account: (a) the location, scale and design of the proposed subdivision, use or development; (b) the extent of anthropogenic changes to the natural characteristics and qualities; (c) the presence or absence of structures, buildings or infrastructure; (d) the temporary or permanent nature of any adverse effects; (e) the physical and visual integrity and the natural processes of the location; (f) the intactness of any areas of significant vegetation, and vegetative patterns; (g) the physical, visual and aesthetic values that contribute significantly to the natural landscape's values;		

CHAPTER E – AUCKLAND WIDE			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(h) the integrity of landforms, geological features and associated natural processes, including sensitive landforms such as ridgelines, headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs, streams, rivers and surf breaks;		
E25 – Noise and Vibration			
Objectives E25.2	(1) People are protected from unreasonable levels of noise and vibration.	Yes	As detailed by the Surface Noise Assessment (Appendix I), the noise generated by MBL's vessels is compliant with AUP(OP) standards and will be generally inaudible to persons onshore. In addition, MBL have proposed a condition limiting the amount of surface noise which can be generated by the activity (Appendix F).
Policies E25.3	(2) Minimise, where practicable, noise and vibration at its source or on the site from which it is generated to mitigate adverse effects on adjacent sites.		

CHAPTER F – Coastal			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
F2 – General Coastal Marine Zone			
Objective F2.6.2	(1) The extraction of minerals, sand, shingle, shell, petroleum, and other natural material occurs in a manner that does not have significant adverse effects on the coastal marine area or near-shore environments.	Yes	As detailed throughout the AEE, the proposed extraction activity will not have significant adverse effects on the CMA or near-shore environment.
Policy F2.6.3	(1) Provide for the extraction of minerals, sand, shingle, shell, and other natural material from appropriate areas, having regard to the values of the		

CHAPTER F – Coastal			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	area and the natural rate of sediment being deposited over sediment lost from the area where extraction is proposed. (2) Adopt a precautionary approach to applications for petroleum exploration and for mineral extraction within the coastal marine area, which may include using an adaptive management approach in terms of the following: (a) staging the operation; (b) the location of the activity; (c) the maximum volume of minerals, sand, shingle, shell and other natural material to be extracted; (d) the term of consent; or (e) environmental monitoring.		This sand resource is vital for the social and economic wellbeing of Auckland and can be extracted at a rate which does not exceed the natural rate of sediment supply to the coastal system. As such, the proposed rate of sand extraction can be accommodated for a period of 35 years and managed by the proposed consent conditions (Appendix F).
Objectives F2.11.2	(1) Water and sediment quality in the coastal marine area is maintained where it is excellent or good and progressively improved over time in degraded areas. (2) The life-supporting capacity and resources of the Hauraki Gulf are protected and, where appropriate, enhanced.	Yes	As detailed in the water quality assessment (Appendix H) and the AEE, the proposed discharge from the extraction activity will not detract from the life-supporting capacity of the Hauraki Gulf, while water and sediment quality will also be largely unaffected. Any effects from the disturbance of the seabed and the discharge of material from MBL's vessels are temporary, with the rapid dispersal and deposition of material assisting in minimising the effects of the activity. The proposed discharge is also the best practicable option available for disposal of unwanted sediment, biota and seawater. The immediate discharge of these substances and
Policies F2.11.3	(1) Avoid the discharge of contaminants where it will result in significant modification of, or damage to any areas identified as having significant values. (2) Require any proposal to discharge contaminants or water into the coastal marine area to adopt the best practicable option to prevent or minimise adverse effects on the environment, having regard to all of the following: (a) whether it is practicable or appropriate to discharge to land above mean high water springs;		

CHAPTER F – Coastal			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
	(b) whether there is a wastewater network in place that should be used; (c) whether the receiving environment has the capacity to assimilate the discharged contaminants after reasonable mixing, particularly within areas identified as degraded or as having significant ecological value; (d) the extent to which present or foreseeable future adverse effects have been avoided, remedied or mitigated on: (i) areas of high recreational use; (ii) relevant initiatives by Mana Whenua established under regulations relating to the conservation or management of fisheries; (iii) the collection of fish and shellfish for consumption (e) high ecological values; (f) cleaner production methods are used where practicable to minimise the volume and level of contaminants being discharged; and (g) the discharge after reasonable mixing, does not either by itself or in combination with other discharges results in any or all of the following effects: (i) oil or grease films, scums or foams, or floatable or suspended materials; (ii) conspicuous change in the colour or visual clarity; (iii) any emission of objectionable odour; (iv) any significant adverse effects on aquatic life; or (v) any significant effects of aesthetic or amenity values. (3) Provide for discharges that are unavoidable but intermittent, where: (a) the discharge occurs infrequently; (b) there are technical and practical difficulties which prevent measures being taken to avoid, remedy or mitigate adverse effects of the discharge;		material allows it to be returned to its source, preventing any cross-contamination and assisting with the re-colonisation of disturbed seabed. Effects are also avoided on recreational activities, with no risks presented to human health (such as recreational fisheries, contact activities or traditional food gathering) Lastly, the discharge is consistent with the requirements of sections 105 and 107 of the RMA, including avoiding any odours, greasy films or significant amenity effects.

CHAPTER F – Coastal			
Reference	Objective/Policy	Is the Proposal Consistent?	Comment
Objective F2.18.2	(1) Underwater noise from identified activities is managed to maintain the health and well-being of marine fauna and users of the coastal environment.	Yes	As detailed in the underwater noise and marine mammal reports (Appendix J and Appendix L), the extraction activity produces minimal underwater noise. This noise does will have less than minor effects on marine mammals or fish species and is only transitory in nature.

Appendix C. Effects Assessment Methodology

Overview

The AEE predicts and assesses the Project's likely positive and negative effects, in quantitative terms to the extent possible. For each of the environmental aspects listed above, the assessment determines the sensitivity of the receiving environment, identifies impacts, and assesses the magnitude and overall significance of environmental impacts. An AEE will always contain a degree of subjectivity, as it is based on the value judgment of various specialists and AEE practitioners. The evaluation of significance is thus contingent upon values, professional judgement, and dependent upon the environmental context. Ultimately, impact significance involves a process of determining the acceptability of a predicted impact.

Defining Effect

There are a number of ways that effects may be described and quantified. The RMA defines the meaning of effect as:

In this Act, unless the context otherwise requires, the term effect includes—

(a) any positive or adverse effect; and

(b) any temporary or permanent effect; and

(c) any past, present, or future effect; and

(d) any cumulative effect which arises over time or in combination with other effects— regardless of the scale, intensity, duration, or frequency of the effect, and also includes

(e) any potential effect of high probability; and

(f) any potential effect of low probability which has a high potential impact.

The assessment of the significance of effects and determination of residual effects takes account of any inherent mitigation measures incorporated into the Project by the nature of its design.

In broad terms, effect significance can be characterised as the product of the degree of change predicted (the magnitude of effect) and the value of the receptor/resource that is subjected to that change (sensitivity of receptor). For each impact the likely magnitude of the effect and the sensitivity of the receptor are defined. Generic criteria for the definition of magnitude and sensitivity are summarised below.

Direct vs Indirect Effects

A direct effect, or first order effect, is any change to the environment, whether adverse or beneficial, wholly or partially, resulting directly from an environmental aspect related to the project. An indirect effect may affect an environmental, social or economic component through a second order effect resulting from a direct effect. For example, removal of sand may lead to a risk of increased beach erosion (direct effect) which causes an indirect effect on terrestrial ecosystems through changes to the dune habitats (indirect effect).

Magnitude Criteria

The assessment of effect magnitude is undertaken by categorising identified effects of the Project as beneficial or adverse. Then effects are categorised as ‘major’, ‘moderate’, ‘minor’ or ‘negligible’ based on consideration of parameters such as:

- Duration of the effect – ranging from ‘well into operation’ to ‘temporary with no detectable impact’.
- Spatial extent of the effect – for instance, within the site boundary, within district, regionally, nationally, and internationally.

- Reversibility – ranging from 'permanent thus requiring significant intervention to return to baseline' to 'no change'.
- Likelihood – ranging from 'occurring regularly under typical conditions' to 'unlikely to occur'.
- Compliance with legal standards and established professional criteria – ranging from 'substantially exceeds national standards or international guidance' to 'meets the standards' (i.e. effects are not predicted to exceed the relevant standards) presents generic criteria for determining effect magnitude (for adverse impacts). Each detailed assessment in this AEE will define effect magnitude in relation to its environmental or social aspect.
- Any other effect characteristics of relevance.

Table C1 below presents generic criteria for determining effect magnitude (for adverse effects). Each detailed assessment will define effect magnitude in relation to its environmental or social aspect.

Table C1: General criteria for determining effect magnitude

Category	Description
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline; would violate national standards or Good International Industry Practice (GIIP) without mitigation.
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor	Detectable but small change to the specific conditions assessed.
Negligible	No perceptible change to the specific conditions assessed.

Sensitivity Criteria

Sensitivity is specific to each aspect and the environmental resource or population affected, with criteria developed from baseline information. Using the baseline information, the sensitivity of the receptor is determined – factoring in proximity, number exposed, vulnerability and the presence of receptors on site or the surrounding area. Generic criteria for determining sensitivity of receptors are outlined in Table C2 below. Each detailed assessment will define sensitivity in relation to its environmental or social aspect.

Table C2: General criteria for determining effect sensitivity

Category	Description
High	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes
Medium	Receptor with little capacity to absorb proposed changes
Low	Receptor with some capacity to absorb proposed changes
Negligible	Receptor with good capacity to absorb proposed changes

Effect Evaluation

The determination of effect significance involves making a judgment about the importance of project impacts. This is typically done at two levels:

- The significance of project effects factoring in the mitigation inherently within the design of the project; and
- The significance of project effects following the implementation of additional mitigation measures.

The effects are evaluated taking into account the interaction between the magnitude and sensitivity criteria as presented in the effect evaluation matrix in Table C3 below.

Table C3: Effect matrix

		Magnitude			
		Major	Moderate	Minor	Negligible
Sensitivity	High	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

The objective of the AEE is to identify the likely significance of effects on the environment and values of the project area. In this effects assessment, effects determined to be 'moderate' or 'major' are deemed significant. Consequently, effects determined to be 'minor' or 'negligible' are not significant. Where impacts are determined to be significant then mitigation measures are required to reduce these effects.

Mitigation

Mitigation measures are actions taken to avoid or minimise adverse environmental or social effects. Mitigation includes those embedded within the design (already considered as part of the impact evaluation) and any additional mitigation required thereafter. Additional mitigation will be implemented to reduce significant effects to an acceptable level, which is referred to as the residual effect. The mitigation hierarchy should be followed: avoid, minimise, restore or remedy, offset, compensate. Mitigation measures should be clearly identified and linked to specific proposed resource consent conditions and/or environmental management plans.

Monitoring

Monitoring is not linked to the effect evaluation but is an important component of the AEE. Monitoring and follow-up actions should be completed to:

- Continue the collection of environmental data throughout the lifespan of the resource consent.
- Evaluate the success of mitigation measures, or compliance with specific standards or requirements.
- Assess whether there are effects occurring that were not previously predicted.

Residual Effects

Those effects that remain once mitigation has been put in place will be described as residual effects and re-assessed using Table C3 set out above.

Cumulative Effects

The cumulative effect of the Project is the incremental effect of the Project when added to effects from other relevant past, present and reasonably foreseeable developments. Cumulative effects can result from individually minor but collectively significant activities taking place over a period of time. The AEE will consider cumulative effects that are recognised as important on the basis of scientific concerns and/ or reflect the concerns of stakeholders that are identified through consultation.

Appendix D. Economic Assessment

Appendix E. Concrete Industry Report

Appendix F. Draft Conditions

Appendix G. Coastal Processes Assessment

Appendix H. Water Quality Assessment

Appendix I. Terrestrial Noise Assessment

Appendix J. Underwater Noise Assessment

Appendix K. Ecological Effects Assessment

Appendix L. Marine Mammal Assessment

Appendix M. Landscape Assessment

Appendix N. Avifauna Assessment

Appendix O. Consultation Summary