Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

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Making Sustainability Happen

Revision Record

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Basis of Report

This report has been prepared by SLR Consulting NZ (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Port of Tauranga Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Executive Summary

To enable the Port of Tauranga to accommodate growth in cargo and vessel sizes while also catering for projected export and import volume in the future, Port of Tauranga Ltd (**POTL**) is proposing development within the existing port area consisting of reclamations and wharf extensions on both sides of Stella Passage and dredging to extend the shipping channel in Stella Passage. These activities will occur over two stages and are collectively referred to as the “project activities”.

Scope of Assessment Undertaken

This report assesses the potential effects of the project activities on marine mammals. The purpose of this assessment is twofold:

- To appraise the available marine mammal data that exists in relation to Tauranga Harbour/Te Awanui and surrounds and describe what is known about marine mammal occurrence in and around the project area; and
- To undertake a robust assessment of the actual and potential environmental effects of the project activities, including the development of recommendations to ensure that effects on marine mammals can be managed to acceptable levels.

Environmental Effects Identified

The potential environmental effects of the project activities on marine mammals were considered in the context of expected marine mammal presence and significance of the project area as marine mammal habitat. To enable this analysis, marine mammal occurrence and habitat use was determined using Department of Conservation (**DOC**) sighting and stranding data and published and unpublished literature. An Area of Interest (**AOI**) was defined to encompass the coast from the north end of Waihi Beach to a point just east of Maketu, including a 20 km buffer offshore. However, sightings within Tauranga Harbour/ Te Awanui were further interrogated to gain a more comprehensive understanding of how frequently species occur here, noting that marine mammals present inside the harbour are most likely to be exposed to effects of the project activities.

There are no resident populations of marine mammals within Tauranga Harbour/Te Awanui. Sightings data and acoustic monitoring data indicate that only dolphins (mostly bottlenose), killer whales and New Zealand fur seals occasionally use waters inside Tauranga Harbour/Te Awanui, despite the high existing levels of shipping traffic there. Overall, waters of the AOI are used by at least 20 marine mammal species for foraging, breeding, resting and migratory behaviours. However, this habitat has not been specifically identified as ecologically significant to any marine mammal (relative to other habitat along the east coast of the North Island). All species that use the AOI have large home ranges, so the AOI only represents a very small part of their overall distribution.

The actual and potential effects on marine mammals from the project activities were identified as: underwater noise, the presence of objects in the water column, habitat modification, ship strike, exposure to contaminants, marine debris, artificial lighting and cumulative effects.

Assessment of Environmental Effects

Each of the potential effects have been thoroughly described and assessed. The results of this assessment are summarised in the table below. The assessment concludes that with the adoption of the recommended mitigation measures, the likelihood of adverse effects occurring to marine mammals from the project activities are (at worst) moderate to remote and the magnitude of any adverse effects that do occur will be (at worst) minor or negligible.

Table 1: Summary of Assessment of Effects Results for Marine Mammals

Potential Effect	Summary of Recommended Mitigations	Likelihood of Effect	Magnitude of Effect
Underwater noise from dredging	Regularly maintained dredge equipment. Compliance with the Marine Mammal Protection Regulations 1992 (**MMPR**).	Low	Negligible
Underwater noise from pile driving	Marine Mammal Observer (**MMO**) on-watch before and during piling. Implementation of soft start procedures. Implementation of shutdown zones. Carefully select pile driving equipment. Minimise daily piling duration/strike rate. Use cushion blocks and bubble curtains. Alert system for marine mammal sightings in Tauranga Harbour/Te Awanui. Conduct inner harbour observations. Keep records of sightings and mitigations. Validate model predictions. Compliance with Marine Mammal Management Plan (**MMMP**).	Moderate	Minor
Presence of structures in the water column	None.	Low	Minor
Habitat modification	None.	Remote	Negligible
Ship strike – during active extraction	Compliance with the MMPR.	Remote	Negligible
Ship strike – during transit to disposal site	Compliance with the MMPR.	Low	Minor
Exposure to contaminants	None.	Remote	Negligible
Marine debris	Comply with Resource Management (Marine Pollution) Regulations 1998 and any other relevant legislative requirements. Retrieve any waste or equipment lost to sea if safe to do so. Retrieve marine debris whilst dredging.	Remote	Negligible
Artificial lighting	None.	Remote	Negligible
Cumulative Effects	Implementation of larger shutdown zone during simultaneous pile driving.	Moderate	Minor

<u>Recommendations and Mitigation Measures</u>

The mitigation measures summarised in the table above are recommended to minimise any potential adverse effects on marine mammals from the project activities.

Of the effects identified, underwater noise from pile driving has the greatest potential to adversely affect marine mammals. Unmitigated piling noise could have significant ecological effects on marine mammals that may be present in Tauranga Harbour/Te Awanui during wharf construction. To address this, conservatively designed underwater acoustic modelling was used to predict the spatial extent over which underwater noise effects (physical, behavioural) could occur. Modelling results were used to underpin the development of mitigation zones that should be implemented during piling to ensure marine mammals are protected from AUD INJ. With the adoption of these mitigation measures, the potential effects on marine mammals of underwater noise generated by piling activities are considered to be of a minor magnitude.

With the exception of those recommendations pertaining to dredging (which are best dealt with through consent conditions), all recommended mitigation actions have been detailed in a draft Marine Mammal Management Plan (**MMMP**) which is included as an appendix to this report.

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Acronyms and Abbreviations

AEE	Assessment of Environmental Effects
AIS	Automatic Identification System
AOI	Area of Interest
AUD INJ	Auditory Injury
BoPRC	Bay of Plenty Regional Council
BHD	Back Hoe Dredge
CD	Chart Datum
DGV	Default Guideline Value
DOC	Department of Conservation
FTA	Fast Track Approval
HF	High Frequency
IBDA	Indigenous Biological Diversity Area
IMMA	Important Marine Mammal Area
IUCN	The International Union for Conservation of Nature
LF	Low Frequency
LSR	Listening Space Reduction
MMMP	Marine Mammal Management Plan
MMO	Marine Mammal Observer
MMOZ	Marine Mammal Observation Zone
MMPR	Marine Mammal Protection Regulations 1992
NZCPS	New Zealand Coastal Policy Statement
NZTCS	New Zealand Threat Classification System
OCW	Otariid Carnivore in water
PCW	Phocid Carnivore in Water
POTL	Port of Tauranga Limited
PTS	Permanent Threshold Shift
RCEP	Regional Coastal Environment Plan
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SPRC	Stella Passage Development Resource Consent
SST	Sea Surface Temperature
The port	Port of Tauranga
TSHD	Trailer Suction Hopper Dredge
TSS	Total Suspended Sediment
TTS	Temporary Threshold Shift
VHF	Very High Frequency

1.0 Introduction

The Port of Tauranga (**the port**) is the largest port in New Zealand, catering for numerous imports and exports of containers, bulk cargo (e.g., grains, fertiliser, coal and logs), break bulk cargo (e.g., kiwifruit, timber and steel) and bulk liquids and cement. Since 2000 the number of ships and the size of vessels has steadily increased. The port has been visited annually by up to 1,700 vessels, with the average container vessel length greater than 230 m (up to a maximum of 347 m). On this basis the port has high berth utilisation and delays to shipping lines are common as vessels wait for berth space. To enable the Port of Tauranga to accommodate growth in cargo and vessel sizes while also catering for projected export and import volume in the future, Port of Tauranga Ltd (**POTL**) is proposing development of the port, including reclamation works and wharf extensions on both sides of Stella Passage, and dredging to extend the shipping channel in Stella Passage. This report provides an assessment of environmental effects (**AEE**) of the Stella Passage Project ('the project') on marine mammals.

The overall purpose of this assessment is twofold:

- To appraise the available marine mammal data that exists in relation to Tauranga Harbour/Te Awanui and surrounds and describe what is known about marine mammal occurrence in and around the project area; and
- To undertake a robust assessment of actual and potential environmental effects of the project activities, including recommendations to ensure that effects on marine mammals can be avoided, remedied or mitigated.

2.0 Project Description

A full description of the proposed works associated with the Stella Passage Project is provided in the Assessment of Environmental Effects provided with the application. On this basis, extensive technical details of the proposed activities are not repeated here; however, in summary the project is comprised of the following components which are to be undertaken in two stages as detailed in **Table 2**:

- Sulphur Point Wharf Southern Extension;
- Sulphur Point Southern Extension Reclamation;
- Mount Maunganui Wharf Southern Extension;
- Mount Maunganui Southern Extension Reclamation; and
- Capital and maintenance dredging of the Stella Passage Shipping Channel Extension.

The scope of POTL's Fast-track Approvals Act 2024 (**FTA**) application includes the proposed works associated with both Stage 1 and Stage 2 (as summarised in **Table 2**).

Table 2: Description of the staged approach to the project.

Site	Stage 1	Stage 2
Sulphur Point	Reclaim 0.88 ha of the coastal marine area south of the existing wharf.	Reclaim 0.93 ha of the coastal marine area south of the stage 1 reclamation.
	Develop a 285 m southern extension to the wharf in front of the stage 1 reclamation.	Develop a 100 m southern extension to the wharf in front of the stage 2 reclamation.

Site	Stage 1	Stage 2
Stella Passage	Dredge 6.1 ha and 850,000 m^3 within the footprint of dredging previously consented under permit 62920 to 16 m depth. Maintain this depth.	Dredge the shipping channel (outside the 62920 permit footprint) to 16 m deep: approximately 4.45 ha and 650,000 m^3. Maintain this depth.
Mount Maunganui	Nil	Reclaim 1.77 ha of the coastal marine area south of the existing Mt Maunganui wharf.
		Develop a 315 m southern extension to the Mt Maunganui wharf in front of the reclamation and install mooring dolphins.
		Provide the equivalent of 200 m of existing gull habitat south of the wharf extension.
		Install mooring dolphins beside the existing cement tanker berth.
		Move the existing ferry ramp northwards.
		Move an existing jetty north towards the ferry ramp and construct a third jetty.
		Develop a bunker barge jetty between Butters Landing and the ferry ramp.
		Develop penguin ramp and habitat at the south end of Butters Landing.

Of the proposed Stage 1 and Stage 2 activities, those with the potential to affect marine mammals are pile driving (associated with the wharf extensions and the installation of other minor structures) and dredging. A basic description of each of these activities is provided below.

2.1 Pile Driving

Piles for wharf construction will be steel tubes with capped ends that are required to be driven their entire length into the seabed. It is estimated that eight piles will be required for every c. 6 m of wharf length. Piles will range in diameter from 785 – 914 mm and will be driven to a depth of up to 30 m by impact hammers (10-14 tonne falling weight). The hammer would run at 50% energy for most of the driving and then 100% for the last 2-3 m. After driving to the appropriate finished depth, each pile will be integrity tested before a steel reinforcing cage is inserted and the pile is filled with concrete. The estimated number of piles required for each site and stage are provided in **Table 3**.

It is estimated that Stage 1 pile driving will extend over a c.260 day period using two crews. Two days of full driving time per week is a ‘likely’ intensity, equating to c. 78 cumulative days of driving time.

It is estimated that the full extent of the Stage 2 pile driving would extend over a c.466 day period using two crews. Two days of full driving time per week is a ‘likely’ intensity, equating to c. 140 cumulative days of driving time.

On days when pile driving occurs, it is estimated that up to 8,000 hammer strikes could occur, and typically construction will occur at only one piling location at any one time.

Pile driving will only occur during daylight hours. Noting that from Monday to Friday, piling will only be allowed between the hours of 7:30 am and 8 pm and will be further restricted to between 9 am and 7 pm on Saturdays. No pile driving will occur on Sundays or public holidays.

Table 3: Estimated number of piles required for the project

Site	Stage 1	Stage 2
Sulphur Point	Approximately 420 piles to complete the 285 m wharf extension.	Approximately 152 piles to complete the 100 m wharf extension.
Mount Maunganui	0	Approximately 600 piles in total, comprised of: • Approximately 464 piles to complete the 315 m wharf extension. • Approximately 120 piles to complete the mooring and breasting dolphins. • Approximately 12 piles to complete the Butters Landing Jetty. • Approximately 4 piles to complete the penguin ramp.

In addition to impact piling associated with wharf construction, vibro-piling will be used during the initial process of reclamation whereby small sections of sheet piling will be installed in order to create a platform on which the main wharf extension works will occur from. On this basis, vibro-piling will occur for short periods at the project outset but will only constitute a minor part of the overall project.

2.2 Dredging

Dredging is proposed to enable vessels to berth at the proposed wharves; specifically, the Stella Passage Shipping Channel Extension will enable large vessels (up to 347 m in length, 43 m beam, and 14.5 m draught) to visit the Port of Tauranga without restrictions relating to tidal and environmental conditions that they currently face.

The existing shipping channel in Stella Passage is currently dredged to 14.5 m below Chart Datum (**CD**) but consented to be dredged to 16.0 m below CD and the existing seabed depth ranges from 4-8 m below CD. The proposed extent of dredging for both Stage 1 and Stage 2 of the Stella Passage Shipping Channel Extension is illustrated in **Figure 1** with the intention that dredging will occur to a depth of 16 m below CD, comprising a total of 1,500,000 m^3 of material over an area of 10.55 Ha (of which 800,000m^3 of material is already consented). Spoil will be deposited offshore under existing resource consent 65806 that has capacity to cater for the proposed volume. Hence spoil disposal is not part of this FTA application.

It is envisaged that a Trailer Suction Hopper Dredge (**TSHD**) will undertake most of the proposed dredging, with a Back-Hoe Dredge (**BHD**) or a 'static ripper' being used for localised work as required[1]. At this stage, the actual dredge/s to complete the proposed work are unknown as dredge selection will be the subject of an international tender process in due course. However, the size of the TSHD to complete the work (based on hopper capacity) is likely to be between 1,800 m^3 and 15,000 m^3 which equates to an indicative vessel length range of 55 – 130 m (POTL, 2024), and a large BHD (45 – 60 m length), similar in size to that previously used by POTL, is envisaged. While it is possible that other dredging methods

[1] Due to the low productivity (hence increased time and expense) of a BHD compared to a TSHD, a BHD will only be used as a last resort for areas that cannot be reached by the TSHD.

(e.g. grab dredger, bucket hopper dredge, cutter suction dredge) could be utilised throughout the project, the employment of these methods is unlikely.

In order to minimise the sediment plumes generated by TSHD activities within the harbour, controls are proposed in relation to overflow[2] allowance, with no overflowing to occur while the dredge is operating on the flood tide in Stella Passage and overflow will be limited on the ebb tide. The area subject to dredging is primarily comprised of sand and/or silt.

Dredging operations will occur 24 hours/7 days a week, with the primary TSHD only berthing for refuelling, resupplying or maintenance. Dredge cycle times for the TSHD (the time taken to dredge a full load, then to sail to and unload at the disposal site before returning to the dredge site) are expected to range from 2 – 3 hours. The overall duration to undertake all capital dredging associated with the Stella Passage Shipping Channel Extension is predicted to be approximately 12 months (noting that this will be completed in stages). Periodic maintenance dredging will be required to maintain the 16 m depth in the Stella Passage shipping channel.

All dredging activities will be supported by crew boats and survey vessels. Survey vessels are critical to any dredging campaign to provide accurate and fine scale hydrographic information that the operating dredge can base its work programme on. Survey vessels are often around 9 - 15 m in length and can be fast moving when not surveying. Crew boats transfer shore based crew members and project staff to the dredging vessels as required. Sometimes a survey vessel will also double as a crew boat for efficiency.

[2] Once the dredged material enters the hopper the solids settle out in the hopper and the excess dredge water is decanted through an outlet at the bottom of the vessel. This decanting of dredged water is known as overflow.

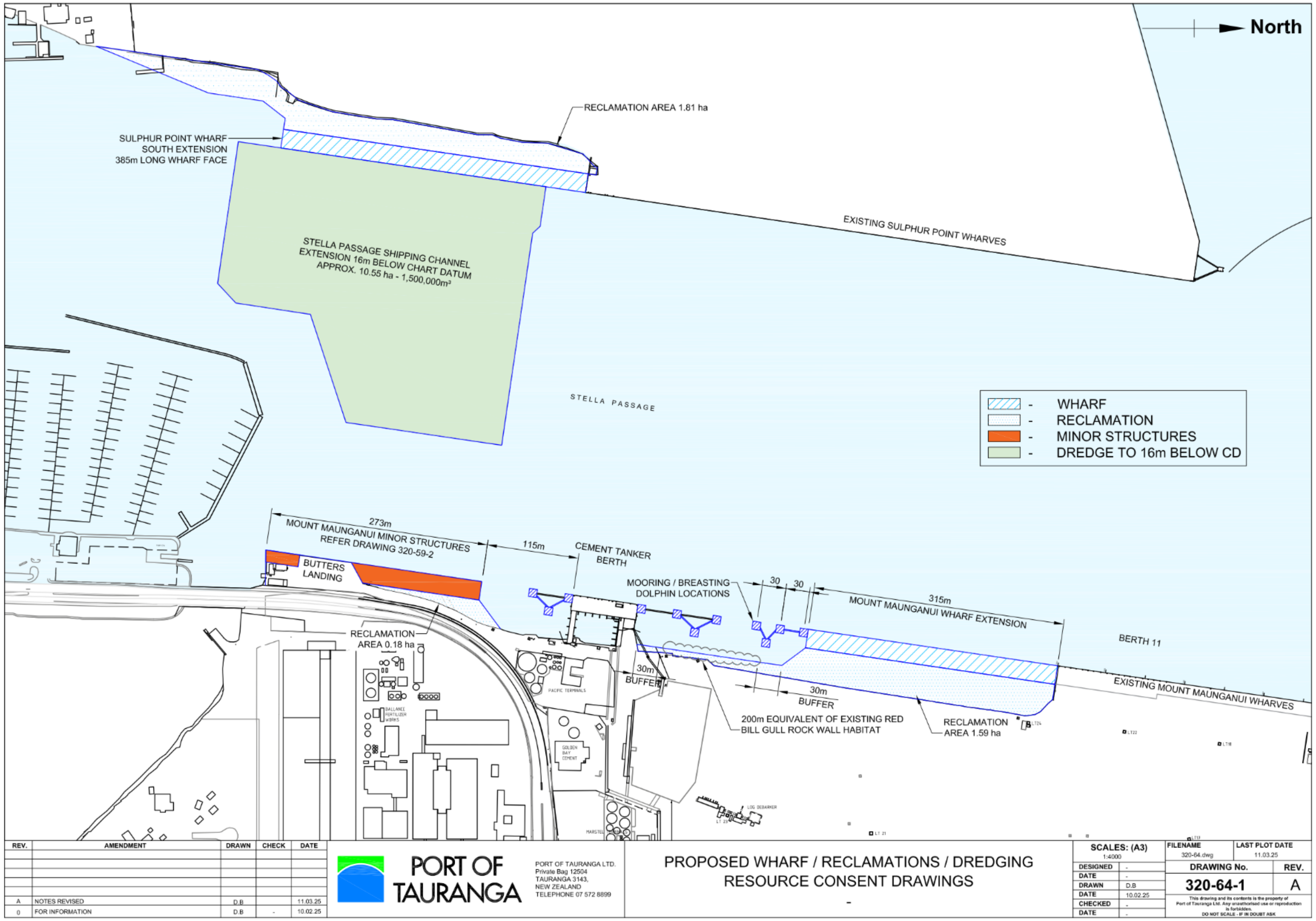

Figure 1: Proposed scope of works for the FTA application.

3.0 Description of the Existing Environment

This section describes marine mammal presence and habitat use of Tauranga Harbour/Te Awanui and surrounds.

3.1 Methodology

Knowledge of marine mammal distribution is typically amassed over long temporal periods utilising a combination of data collection techniques (e.g., stranding data, opportunistic sightings, systematic survey data, etc.). It is therefore important to assess multiple data sources when considering marine mammal distribution. The following data sources were used to assess the likelihood of marine mammal species being present in the vicinity of Tauranga Harbour/Te Awanui:

1 Sightings data as recorded in the DOC Marine Mammals Sightings Database from 1968 to 2023 (DOC Sightings Database) (supplied by M. Ogle, DOC, 29/06/2023).

2 Stranding data as recorded in the DOC Marine Mammals Incident Database from 1873 to 2023 (DOC Incident Database) (supplied by M. Ogle, 29/06/2023).

3 Additional marine mammal sighting data that was provided by the DOC Tauranga Area Office in 2022.

4 Habitat modelling and distribution descriptions (Stephenson et al., 2020; Mackenzie et al., 2022).

5 Knowledge of species distribution and habitat use obtained from published and unpublished literature. Two studies were of particular importance, namely:

   a) Meissner (2015), a Massey University PhD thesis that investigated marine mammal occurrence in the Bay of Plenty using both historical and contemporary sightings data with a focus on the effects of tourism on common dolphins; and

   b) Gaborit-Haverkort (2012), a Massey University MSc thesis that investigated cetacean (whale and dolphin) occurrence in the Bay of Plenty with a focus on the effects of tourism on common dolphins.

6 Acoustic monitoring data collected by Styles Group from August 2022 to July 2023.

The combination of the six different data sources listed above represents the best available information on marine mammal distribution in and around Tauranga Harbour/Te Awanui and is considered sufficient for the purpose of assessing the potential effects of the project on marine mammals. In particular, site specific acoustic monitoring has been undertaken inside Tauranga Harbour/Te Awanui to quantify marine mammal presence in close proximity to the project site.

While the above data sources represent the best possible information, it is important to note:

- DOC sightings data is generally collected in a non-systematic manner by non-experts;
- Data gaps in the DOC sightings record do not necessarily reflect an absence of marine mammals; rather they typically reflect a lack of observation effort. Conversely areas with high levels of sightings occur where marine mammal distributions overlap with well-populated areas, research programmes or regions that actively encourage public reporting of certain species;
- While the DOC stranding data gives a broad indication of species occurrence, dead animals can wash ashore well away from where they died; and sick or diseased animals may be outside of their normal range prior to death; and

- Entries in the DOC sightings and stranding databases that do not identify marine mammals to species level were excluded from the analysis.

Marine mammals have extensive home-ranges and because of this, marine mammal distributional data across a broad spatial scale must be assessed to establish a baseline understanding of potential marine mammal presence in the project area and surrounds. For this reason, an Area of Interest (**AOI**) was defined from Rapatiotio Point (at the north end of Waihi Beach) to Okurei Point (east of Maketu) including a 20 km buffer offshore. This AOI encompasses the entire project area and a large surrounding area. To gain a more comprehensive understanding of how frequently species occur in Tauranga Harbour/Te Awanui itself, the assessment further interrogated the sightings data to identify those sightings that were recorded specifically within the confines of the harbour on the basis that animals here may be disproportionately affected by the proposed activities due to the spatially restricted nature of the harbour. In terms of assessing use of Tauranga Harbour/Te Awanui, the acoustic monitoring results presented in **Section 3.2.2** were also highly valuable.

After reviewing all data sources, the likelihood of each marine mammal species being present in the AOI was determined as:

- Likely – species that have a frequent presence in the AOI; hence have a high chance of exposure to the potential effects of the proposed activities (noting that large home ranges mean occurrence will not be continuous in the project area);
- Possible – species that occur on a less frequent basis in the AOI, hence may or may not be exposed to the potential effects of the proposed activities; and
- Unlikely – species that are seldom reported from the AOI; hence probably only occur as rare visitors and are unlikely to be exposed to the potential effects of the proposed activities.

3.2 Results

3.2.1 Expected Marine Mammal Occurrence

Figure 2 provides a summary of all sightings data provided by DOC (including the national marine mammal sightings database, and supplementary sightings data provided by Tauranga Area Office) for locations within the AOI. **Figure 3** shows all reported strandings in the AOI.

My assessment of the DOC sightings and stranding data and the available scientific literature indicates that marine mammals are not resident to Tauranga Harbour/Te Awanui and instead occur relatively infrequently inside the confined harbour limits. There are however, three species - bottlenose dolphins, killer whales and New Zealand fur seals - that occur inside Tauranga Harbour/Te Awanui as occasional visitors. These three species, along with common dolphins, have a regular presence outside Tauranga Harbour/Te Awanui where sightings rates are higher.

Outside of Tauranga Harbour/Te Awanui several other species may also be present, including blue whales, minke whales, Bryde’s whales, false killer whales, Gray’s beaked whales, humpback whales, long-finned pilot whales, southern right whales, sei whales, and leopard seals.

While rare visits inside the harbour from these other species cannot be entirely dismissed (i.e. the DOC sightings record includes rare sightings of humpback whales, southern right whales, leopard seals, pilot whales, beaked whales, pygmy sperm whales, and common dolphins inside the harbour), in the Bay of Plenty these species are typically associated with more open coastal waters.

The remaining species represented in the DOC Sighting Database and the DOC Incident Database probably only occur as rare visitors to the AOI, hence, at any one time, are unlikely to be present in the AOI, and highly unlikely to be present in Tauranga Harbour/Te Awanui.

While known whale migration routes occur through Bay of Plenty waters, most individuals travel in waters greater than 30 m deep (Gaborit-Haverkort, 2012), with only southern right whales known to spend time consistently close to shore during migrations (Patenaude, 2003).

A full description of the assessment findings in relation to expected occurrence of all marine mammal species is presented in **Appendix A**. Further to this, full ecological descriptions of the key species that are likely to be present in the AOI are provided in **Appendix B**.

Table 4 below provides a summary of important ecological considerations for those species which are considered to have a likely or possible presence in and around Tauranga Harbour/Te Awanui.

In light of the New Zealand Coastal Policy Statement 2010 (**NZCPS**), it is important to identify:

- Indigenous taxa that are identified as ‘threatened’ or ‘at risk’ in the New Zealand Threat Classification System (**NZTCS**) (NZCPS policy 11(a)(i));
- Taxa listed by the International Union for Conservation of Nature (**IUCN**) as ‘threatened’ (NZCPS policy 11(a)(ii));
- Habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare (NZCPS policy 11(a)(iv)); and
- Habitats in the coastal environment that are important during the vulnerable life stages of indigenous species (NZCPS policy 11(b)(ii)); or habitats, including areas and routes, important to migratory species (NZCPS policy 11(b)(v)).

For each species listed in **Table 4**, their NZCPS policy 11(a) and (b) status is included.

It is also recognised that marine mammals are considered to be taonga (cultural treasures) to tangata whenua. The detail pertaining to the cultural significance of marine mammal species is therefore a matter for tangata whenua to determine. This assessment is undertaken from a western science point of view.

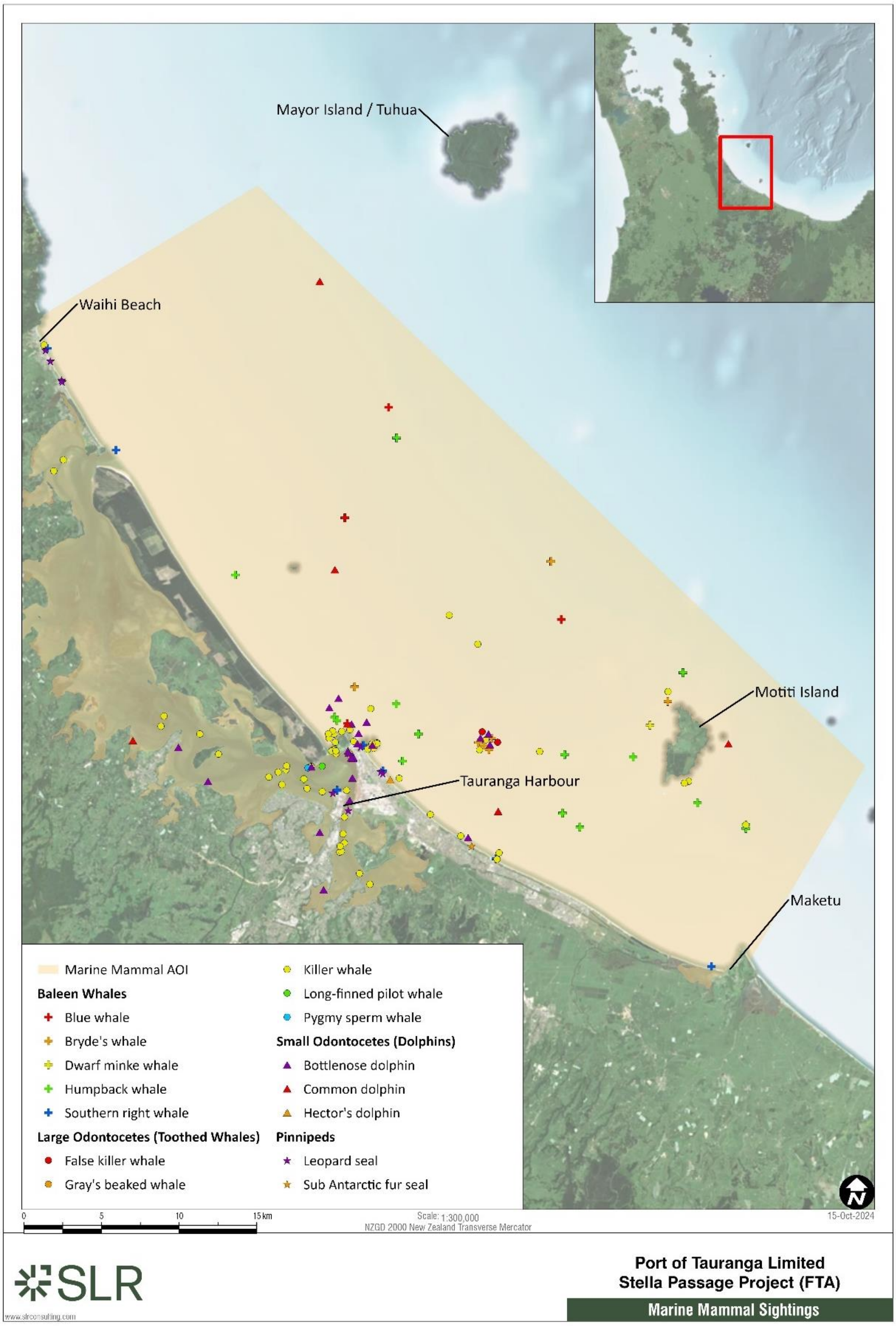

Figure 2: Marine Mammal Sightings Reported by DOC in the AOI

Notes: 1) Each depicted point represents a sighting entry within the DOC database, where each sighting entry can be either a single animal or a group of animals; 2) Where multiple sightings were reported for a single pin-point location these sightings were redistributed slightly around the original coordinates to facilitate visibility on the map; 3) When coordinates were not reported the location description was used for mapping purposes (n = 6); and 4) Despite their presence, no marine mammal sightings outside the AOI have been included on this map.

Figure 3: Marine Mammal Strandings Reported by DOC in the AOI

Table 4: Marine Mammals that are 'Likely' or could 'Possibly' occur in the AOI.

Species • NZTCS (Baker et al., 2019) • IUCN (Redlist, 2024) • NZCPS Policy 11(a) status	Ecological Considerations	Likelihood & Frequency		Seasonal Trends
		Tauranga Harbour	Wider AOI	
Bottlenose dolphin • Nationally endangered • Least concern • Policy 11(a) species	Bottlenose dolphins in the northern North Island occur along at least 500 km of coastline from Doubtless Bay to Tauranga (Constantine, 2002) and probably beyond into parts of the eastern Bay of Plenty (Zaeschmar et al., 2020) and the west coast of the North Island (Tezanos-Pinto et al., 2013). Dolphins move between habitats over this large home range (Tezanos-Pinto et al., 2013) with animals seldom stable within an area for more than a few days (Mourão, 2006). Twenty-five sightings are reported by DOC as occurring inside the AOI, including 14 within Tauranga Harbour/Te Awanui since 1968. Inshore sightings in shallow coastal waters typically occur in winter; and of the sightings inside Tauranga Harbour/Te Awanui, there was a strong bias towards winter and spring. Meissner (2015) also reported higher bottlenose dolphin encounter rates in spring for Bay of Plenty waters. Groups that occur inside the harbour are usually only present for a few days to a week at a time; however, one group was present for up to a month in a quiet part of the harbour near Omokoroa (pers. comm. Karl McCarthy, DOC, Tauranga). An occasional presence in Tauranga Harbour/Te Awanui is therefore likely particularly in winter and spring. Calves could be present.	Likely to be present on occasional basis	Likely to be present on a frequent basis	Year round but more common in winter/spring
Killer whales/orca • Nationally critical • Data deficient • Policy 11(a) species	Small groups of killer whales are typically seen around New Zealand where they travel an average of 100 – 150 km per day (Visser, 2000). Some groups feed predominantly on rays which can bring them into very shallow coastal waters (Visser, 2000). DOC report sixty-one sightings from the AOI since 1968, with 34 of these occurring inside Tauranga Harbour/Te Awanui. Meissner (2015) reported higher killer whale encounter rates in winter and spring; and the DOC sightings data indicates a clear peak in sightings in spring. Killer whales tend not to spend more than a few days inside the harbour during their visits, and it has been suggested that they occur in Tauranga c. two days after visiting Mercury Bay (pers. comm. Karl McCarthy, DOC). An occasional presence in Tauranga	Likely to be present on occasional basis	Likely to be present on a frequent basis	Year round but more common in winter/spring

Species • NZTCS (Baker et al., 2019) • IUCN (Redlist, 2024) • NZCPS Policy 11(a) status	Ecological Considerations	Likelihood & Frequency		Seasonal Trends
		Tauranga Harbour	Wider AOI	
	Harbour/Te Awanui is likely, particularly in winter and Spring. Calves could be present.			
New Zealand fur seals • Not threatened • Least concern • No policy 11 status	Commonly seen in coastal Bay of Plenty, particularly over winter months. Sightings are becoming more common inside Tauranga Harbour/Te Awanui, and occasional presence in Tauranga Harbour/Te Awanui is likely. An emerging breeding colony is establishing on Motunau (Plate) Island (DOC, 2012), but this location is located c 45 km from Tauranga Harbour/Te Awanui entrance.	Likely to be present on occasional basis	Likely to be present on a frequent basis	Year round, but more common in winter
Common dolphins • Not threatened • Least concern • No policy 11 status	Commonly seen in the AOI (Gaborit-Haverkort, 2012; Meissner 2015); but only one sighting since 1968 has been reported by DOC from Tauranga Harbour/Te Awanui and the locational accuracy of this sighting is questionable. On this basis common dolphins are likely to be present in the wider AOI (i.e. outside the harbour) but are unlikely to occur inside the harbour. Calves could be present particularly in summer and autumn. Occur closer inshore in summer compared to other seasons when offshore sightings are more common.	Unlikely	Likely to be present on a frequent basis	Year round, but more common inshore in summer
Humpback whales • Migrant • Endangered • Policy 11(a) species	Humpback whales migrate northwards along coastal New Zealand from May to Aug (Gibbs & Childerhouse, 2000), and southward from Sep to Dec (Dawbin, 1956). During migrations they typically use continental shelf waters (Jefferson et al., 2008) and can approach closely to shore when passing headlands or moving through confined waters (e.g., Gibbs et al., 2017). In central Bay of Plenty waters humpback whales (n=8) are seen mostly in winter and spring in a mean water depth of 32 m (Gaborit-Haverkort, 2012); hence it is possible that humpback whales could be seasonally present in the wider AOI (i.e., outside the harbour). There are several records of humpback whales inside Tauranga Harbour/Te Awanui or near the harbour entrance, including one record of a humpback whale mother/calf pair at the harbour entrance in October 2019 (Sunlive, 2019) and a juvenile humpback at the harbour entrance in 2017 (Bay of Plenty Times, 2017); however, presence of this species within the harbour is highly unusual.	Unlikely	Possibly present on occasional seasonal basis	Winter/spring

Species • NZTCS (Baker et al., 2019) • IUCN (Redlist, 2024) • NZCPS Policy 11(a) status	**Ecological Considerations**	**Likelihood & Frequency**		**Seasonal Trends**
		Tauranga Harbour	**Wider AOI**	
Southern right whales • Recovering • Least concern • Policy 11(a) species	Coastal waters around mainland New Zealand represent a historic calving ground for this species, with recent evidence suggesting a slow recolonisation of this breeding range (Carroll et al., 2014). Southern right whales utilise shallow coastal waters as their winter calving and nursery grounds (Patenaude, 2003). Seven sightings have been reported by DOC from the AOI since 1968, including one inside Tauranga Harbour/Te Awanui. All seven sightings from the AOI occurred in the colder months (July, August, September). Hence, it is possible that southern right whales could have an occasional seasonal presence. This species sometimes occurs in other harbours around New Zealand (Wellington, Otago), so rare occurrences of individual whales entering Tauranga Harbour/Te Awanui should not be dismissed.	Unlikely	Possibly present on sporadic seasonal basis (highly variable between years)	Winter/spring
Leopard seals • Naturally uncommon • Least concern • Policy 11a(iv) status (at limit of natural range).	Hupman et al. (2019) indicate that at least some leopard seals reside around the New Zealand coast for months at a time and that the New Zealand mainland has been described as the limit of the natural range for this species (Hupman et al., 2019). A reasonable number of leopard seal reports occur in the AOI (n=9) including two inside Tauranga Harbour/Te Awanui; hence this species could have a possible occasional presence in the wider AOI (i.e. outside the harbour), and rare occurrences of individuals entering Tauranga Harbour/Te Awanui are possible. However, relative to other locations around the mainland, low densities of leopard seal sightings occur in the Bay of Plenty (Hupman et al., 2019).	Unlikely	Possible occasional presence (variable between years)	Winter/spring
Long-finned pilot whales • Not threatened • Least concern • No policy 11 status	Pilot whale sightings occur in New Zealand waters year-round (Berkenbusch et al., 2013). Long-finned pilot whales commonly strand on New Zealand coasts; with the stranding rate peaking in spring and summer (O'Callaghan et al., 2001). Pilot whales forage at depth (i.e., several hundred metres; Berkenbusch et al., 2013). In central Bay of Plenty waters pilot whales are occasionally encountered in depths greater than 50 m (Gaborit-Haverkort, 2012; n=4). This species could possibly be present in the wider AOI (i.e. outside the harbour).	Unlikely	Possibly present on occasional basis	Year round
Gray's beaked whales	This species has a circumpolar distribution south of 30° and occurs in deep waters beyond the shelf edge (Pitman and Taylor, 2020). Based on the	Unlikely	Possibly present on	Spring/summer

Species • NZTCS (Baker et al., 2019) • IUCN (Redlist, 2024) • NZCPS Policy 11(a) status	**Ecological Considerations**	**Likelihood & Frequency**		**Seasonal Trends**
		Tauranga Harbour	**Wider AOI**	
• Not threatened • Least concern • No policy 11 status	reasonable number of strandings reported for the AOI (n=14), it is possible that they could have an occasional presence in the wider AOI (i.e., outside the harbour).		occasional basis	
False killer whales • Naturally uncommon • Near threatened • No policy 11 status	Mostly found in deep, offshore waters but also occasionally over the continental shelf and shallower areas (Berkenbusch et al., 2013). Forage down to water depths of 500 m (Shirihai & Jarrett, 2006). In central Bay of Plenty waters, false killer whales sometimes occur in large associations with bottlenose dolphins typically in water depths greater than 50 m (Gaborit-Haverkort, 2012; n=3). This species could possibly be present in the wider AOI (i.e. outside the harbour).	Unlikely	Possibly present on occasional basis	Unknown
Bryde's whales • Nationally critical • Least concern • Policy 11(a) species	In New Zealand, Bryde's whales are typically known from the north-eastern coastal region between East Cape and North Cape (Gaskin, 1963); with the Hauraki Gulf and Northland region supporting one of the few known resident populations in the world (Constantine et al., 2012). In central Bay of Plenty waters Bryde's whales (n=13) were seen in a mean water depth of 44 m (Gaborit-Haverkort, 2012); hence it is possible that Bryde's whales could occasionally be present in the wider AOI (i.e. outside the harbour).	Unlikely	Possibly present on occasional basis	Summer
Minke whales • Data deficient • Near threatened (Antarctic minke), Least concern (dwarf minke) • No policy 11 status	The Antarctic minke is very abundant in Antarctic waters in summer, but outside of the summer months their distribution is less well-known (Cooke et al., 2018). Southern Hemisphere Dwarf minke whales also feed in Antarctic waters in summer and have a broad latitudinal distribution in other seasons (Cooke, 2018). Most minke whale sightings around New Zealand occur in spring; aligning with the southern migration towards the Antarctic feeding grounds (Berkenbusch et al., 2013). In central Bay of Plenty waters minke whale presence peaks in spring in mean water depths of 50 m (Gaborit-Haverkort, 2012; n=35). This species could be seasonally present in the wider AOI (i.e. outside the harbour). Calves could be present.	Unlikely	Possibly present on occasional basis	Spring
Blue whales	Two subspecies of blue whale occur in New Zealand waters (Antarctic and pygmy blue whales). Coastal sightings are not uncommon around New Zealand	Unlikely	Possibly present on	Spring

Species • NZTCS (Baker et al., 2019) • IUCN (Redlist, 2024) • NZCPS Policy 11(a) status	**Ecological Considerations**	**Likelihood & Frequency**		**Seasonal Trends**
		Tauranga Harbour	**Wider AOI**	
• Data deficient • Endangered • Policy 11(a) species	for both subspecies (Barlow et al., 2018). In central Bay of Plenty waters blue whales (n=15) are seen mostly in spring in a mean water depth of 60 m (Gaborit-Haverkort, 2012); hence it is possible that blue whales could be seasonally present in the wider AOI (i.e. outside the harbour).		occasional basis	
Sei whales • Data deficient • Endangered • Policy 11(a) species	In central Bay of Plenty waters sei whales (n=7) are seen mostly in winter and spring in a mean water depth of 44 m (Gaborit-Haverkort, 2012); hence it is possible that sei whales could be seasonally present in the wider AOI (i.e. outside the harbour).	Unlikely	Possibly present on occasional basis	Winter/spring

3.2.2 Acoustic Monitoring

Acoustic monitoring for marine mammals in Tauranga Harbour/Te Awanui was undertaken by Styles Group. Methodology and deployment details are provided as **Appendix C**. In summary, three hydrophones (SoundTrap 600 recorders) were deployed at the locations identified in **Figure 4**. Data was collected during the following three periods:

- Deployment 1: 31/08/2022 to 04/11/2022;
- Deployment 2: 04/11/2022 to 08/03/2023; and
- Deployment 3: 09/03/2022 to 06/07/2023.

While the data collection period for each hydrophone varied (as each ran out of battery or filled their memory cards at different times), and monitoring over the winter season was limited, these caveats do not invalidate the data.

Figure 4 Hydrophone Deployment Locations in Tauranga Harbour/Te Awanui

The bullet points below summarise the key findings from the acoustic monitoring.

- Across all deployment locations, dolphins and killer whales were the primary species detected (see **Appendix D** for detection tables). Large whales were not detected inside the harbour, but there were occasional acoustic detections of baleen calls from outside the harbour from both hydrophones at the harbour entrance.
- Of all species, dolphins were most frequently detected, and dolphin detections were recorded from all three hydrophone locations. At the harbour entrance sites (the Outer East and Outer West sites), dolphins were detected on a total of 62 days (24-hour periods from 00:00 - 24:00 hr) of the collective total 221 days that the hydrophones at these sites were collecting data (28%). On 47 of the 62 detection days, detections occurred during daylight hours (07:00 – 19:00 hr); on 12 of the detection days, detections occurred at night (19:00 – 07:00 hr), and on nine detection days, detections occurred across both day and night within a single 24-hour period. The majority of dolphin detections at the harbour entrance were made during the austral spring (n = 27) and autumn (n = 28).
- At the Stella Passage site, dolphins were detected on a total of six days from a 229-day data collection period. Five of the six detections here were of short duration (1 minute or less) indicating that dolphins typically passed quickly through this narrow channel. In four of the six instances, the Stella Passage detections could be paired over sequential days indicating that dolphins entered the inner southeast arm of the harbour one day and departed either the following day or the day after; spending up to 52 hours in the inner harbour.
- At this stage of the analysis, it is not possible to discern the specific dolphin species detected but based on the sightings data presented earlier in this report, it is likely that these detections were bottlenose dolphins, although occasional common dolphin detections cannot be dismissed from the harbour entrance sites.
- Killer whales were only detected from the hydrophones located at the harbour entrance (the Outer East and Outer West sites). No killer whale detections were made from the Stella Passage hydrophone. Of the collective 221 days of monitoring at the harbour entrance, killer whales were detected on a total of 27 days (12%). On 12 of the 27 detection days, detections occurred during daylight hours; on 13 of the detection days, detections occurred at night, and on two of the detection days, detections occurred across both day and night. The majority of killer whale detections at the harbour entrance were made during the austral spring (n = 13) and autumn (n = 12).

3.2.3 Environmental Values of Significance

The following marine mammal species identified in **Table 4** (i.e. marine mammals that are 'Likely' or could 'Possibly' occur in the AOI) are NZCPS Policy 11(a) species.

- Bottlenose dolphin (NZCPS Policy 11(a)(i) species);
- Killer whales (NZCPS Policy 11(a)(i) species);
- Southern right whale (NZCPS Policy 11(a)(i) species);
- Humpback whale (NZCPS Policy 11(a)(ii) species);
- Leopard seal (NZCPS Policy 11(a)(iv) species);
- Bryde's whale (NZCPS Policy 11(a)(ii) species);
- Blue whale (NZCPS Policy 11(a)(ii) species); and

- Sei whale (NZCPS Policy 11(a)(ii) species).

In considering environmental values of significance, marine mammal habitat must also be assessed in terms of importance during vulnerable life stages[3] and migration (NZCPS Policy 11(b)(ii) and NZCPS Policy 11(b)(v). Taking a broader approach to this I believe that the following additional criteria should also be considered when defining important habitat:

a) Areas that support concentrations of animals (following Clark et al., 2010); and/or

b) Areas that are critical to the conservation of a species, particularly those areas that support a high proportion of a population/subpopulation (following the US Endangered Species Act 1973); and/or

c) That nearby alternative habitat of equivalent quality is limited; and/or

d) That a high proportion of sightings include calves or juveniles (following Clark et al., 2010); and/or

e) Areas that are critical for maintaining a healthy population growth rate (following Hoyt, 2011).

On this basis, and in my opinion, important marine mammal habitat would represent areas of concentrated marine mammal presence which habitually support important ecological functions (e.g. feeding, breeding, resting) and where alternative habitat is limited. In keeping with NZCPS Policy 11(b), the regular presence of vulnerable life stages would deem an area to be important, as would habitat important for migratory species.

For the key species that are most likely to occur in the AOI, I note the following findings with regard to important habitat:

- **Bottlenose dolphins**: Whilst bottlenose dolphins clearly occur in the AOI, this population ranges widely with home-ranges that extend over 500 km along the coastline (Constantine, 2002, Tezanos-Pinto et al., 2013, Zaeschmar et al., 2020). Data also suggest that dolphins seldom remain within any one area for more than a few days (Mourão, 2006); hence the AOI does not specifically support concentrations of animals. There is little information available on which to assess how bottlenose dolphins utilise the AOI, but it is assumed that feeding and resting behaviours occur here. In addition, seven of the 25 reported sightings for the AOI (DOC Sighting Database) noted the presence of calves; hence, some breeding behaviours are expected, but these levels are not particularly high. Overall, there is no evidence to suggest that the AOI contains habitat that is specifically important during vulnerable life stages for this species and alternative habitat is plentiful through the broader AOI and beyond. This species is considered to be non-migratory and therefore no effects are predicted in terms of NZCPS Policy 11(b)(v).
- **Killer whales**: This species utilises habitat in the wider AOI on a relatively frequent basis, but based on the scientific literature available, the AOI is not known to support high concentrations of animals relative to other regions. Based on what we know about prey preferences and behaviours in other locations (Visser, 1999), benthic

[3] Defined by DOC in their NZCPS 2010 Guidance Note as ‘when breeding, as juveniles or during migration’ (DOC, 2019)

foraging for rays can be presumed on those occasions when this species enters Tauranga Harbour/Te Awanui. Indeed, several ray species are common inside the harbour (Cadwallader, 2020). Of the 61 reported sightings of killer whales from the AOI, 15 noted the presence of calves (DOC Sighting Database); hence the AOI could support some breeding behaviours. It is noteworthy that killer whales move readily between locations over large distances (Visser, 2007), While some feeding and breeding behaviours are to be expected in the AOI, there is no evidence to suggest that the AOI contains habitat that is specifically important during vulnerable life stages for this species and alternative habitat is plentiful through the broader AOI and beyond. High re-sighting rates of identifiable individuals across their New Zealand range suggest that these whales live permanently or at least semi-permanently around the New Zealand coast (Visser, 2007); hence this species is generally considered as non-migratory.

- **New Zealand fur seal**: While this species is not an NZCPS Policy 11(a) species, New Zealand fur seals will certainly occur in the AOI, foraging typically occurs further offshore and the AOI is part of the non-breeding distribution for this species. Therefore, the AOI is not considered important habitat during the vulnerable life stages of this species. It is noteworthy that an emerging breeding colony is establishing on Motunau (Plate) Island (DOC, 2012) which occurs slightly east of the eastern boundary of the AOI and c. 45 km from the entrance to Tauranga Harbour/Te Awanui; hence while pregnant or lactating females are occasionally expected in the AOI, these individuals probably forage well offshore. On this basis, the AOI does not specifically support concentrations of this species, or habitat that is specifically important during vulnerable life stages. Furthermore, this species is considered to be non-migratory.
- **Common dolphins**: While this species is not an NZCPS Policy 11(a) species, common dolphins will certainly occur in the AOI (especially outside the harbour). Photo-identification evidence confirms that individuals of this species readily move between locations from the Hauraki Gulf to Whakatane (200 km); indicating that common dolphins are highly mobile throughout a large home-range (Neumann et al., 2002). Of the six reported sightings of this species from the AOI in the DOC Sightings Database, none noted the presence of calves. However, between March 1998 and May 2011 Gaborit-Haverkort (2012) undertook 2,364 boat-based marine mammal surveys of the central Bay of Plenty (including the waters of the AOI). Common dolphins were encountered on 1,265 of these trips (54%) and were the most frequently sighted marine mammal species. Most sightings occurred in the area between Motiti Island, Mayor Island and Waihi in water depths from <5 to 130 m; indicating that the AOI is well used by this species for feeding, travelling, resting and socialising, but no sightings occurred in Tauranga Harbour/Te Awanui. Encounter rates were highest during summer and autumn when large groups of dolphins with calves were common. The AOI clearly supports feeding, breeding and resting behaviours; however, sightings across all seasons are common in Bay of Plenty waters beyond the AOI (Gaborit-Haverkort, 2012). On this basis, the AOI is not considered to be of higher importance to this species than other areas across its large home range and alternative habitat is plentiful. This species is non-migratory.

- **Humpback whale**: Coastal sightings of this species are not uncommon along the east coast of the North Island (from North Cape to East Cape) particularly during the southern migration period (Gibbs and Childerhouse, 2000). However, the majority of whales migrate south down the west coast of New Zealand (Dawbin, 1956). In addition, recent satellite tagging studies indicate that of those whales that do travel south down the east coast of New Zealand, many whales do not approach coastal waters but use an open ocean corridor south of the Kermadec Islands (Riekkola et al., 2018). On this basis, the southbound route along the east coast of the North Island is very much a secondary (or even tertiary) migration pathway. Dawbin (1956) found that this species typically utilises open water migratory corridors except in locations where the north/south migration route is partially obstructed by a perpendicular coastline. This explains why sightings are not uncommon in the Bay of Islands, Hauraki Gulf and Bay of Plenty (following Gibbs and Childerhouse, 2000). On this basis, sightings of migrating humpback whales (including mother accompanied by calves, of which only one has so far been reported by the DOC sighting database) are to be expected from time to time in the AOI. Most migrating whales travel in waters greater than 30 m deep (Gaborit-Haverkort (2012) and the Bay of Plenty does not constitute a major migratory corridor for this species.
- **Southern right whale**: Sightings of this species are uncommon across years in the Bay of Plenty, and of the seven reported sightings of this species from the AOI (across 50+ calendar years), only one noted the presence of a calf. However, as the New Zealand mainland represents historic breeding habitat of this species, occasional breeding activity in the AOI cannot be dismissed. However, the Bay of Plenty is not recognised as important habitat for this species on either a historic or contemporary basis (Carroll et al., 2014; Carroll et al., 2014a). During the mainland breeding season, southern right whales move readily between locations across a vast area of potential coastal habitat. On this basis, the project site is not considered to be specifically important during the vulnerable life stages of this species. This species does undertake an annual migration from high latitude feeding areas to temperate breeding areas and is known to spend time consistently close to shore during migrations (Patenaude, 2003); however as noted above, the AOI is not routinely used by this species.

Based on the findings above, while the AOI clearly constitutes marine mammal habitat, and some feeding, breeding, resting and migration behaviours occur here, the AOI is not considered to be of greater ecological significance/importance relative to other areas of the Bay of Plenty or other parts of each species wider home range. In particular there is no evidence to suggest that the AOI itself constitutes important habitat for any marine mammal species either during vulnerable life stages or migration. Nor is the AOI critical to the conservation of any species or the maintenance of healthy population growth rates. Instead, for all marine mammal species that occur here, the AOI forms part of a much larger overall distribution that collectively contributes to population health.

The remaining criteria in NZCPS Policy 11(a) and (b) were also considered. No other species, ecosystems or habitats specified in that policy are relevant to marine mammals in the AOI. In particular, the project site (or surrounds) is not in an area set aside for full or partial protection of indigenous biological diversity under other legislation which protects marine mammals or their habitats (in terms of Policy 11(a)(vi)).

In addition, but still relating to the requirements of NZCPS Policy 11, the project site occurs in the vicinity of designated 'Indigenous Biological Diversity Areas' (**Figure 5**) as defined in the Bay of Plenty Regional Coastal Environment Plan (**RCEP**) as follows:

- Indigenous Biological Diversity Area A (IBDA A) – areas that meet the criteria contained in Policy 11(a) of the NZCPS, which directs the avoidance of adverse effects on certain biological diversity (biodiversity) values.
- Indigenous Biological Diversity Area B (IBDA B) – areas that meet the criteria contained in Policy 11(b) of the NZCPS, which directs the avoidance of significant adverse effects on certain biological diversity (biodiversity) values and that other adverse effects on these values are avoided, remedied or mitigated.

Objective 3 or the RCEP states that "*The integrity, form and functioning and resilience of ecosystems are to be safeguarded in the coastal environment by protecting areas zoned 'Indigenous Biological Diversity Areas A (or '**IBDA A**') and maintaining areas zoned 'Indigenous Biological Diversity Areas B' (or '**IBDA B**')*". Further, the maintenance of indigenous biodiversity 'in general' is to be promoted, and enhancing or restoring indigenous biodiversity is promoted where it is appropriate.

For each IBDA illustrated in **Figure 5**, Schedule 2 of the RCEP makes no mention of marine mammal values, despite the fact that marine mammals clearly utilise these coastal areas from time to time.

Figure 5 Indigenous Biological Diversity Areas in the vicinity of the project site.

3.2.4 Important Marine Mammal Areas

A recent development in marine mammal conservation globally (including New Zealand) has been the identification of Important Marine Mammal Areas (**IMMAs**) based on the recommendations of the International Union for Conservation of Nature's 'Marine Protected Area Task Force'. This task force has identified several areas of coastal New Zealand as IMMAs. While the AOI does not fall within an IMMA, it sits between two adjacent IMMAs: the Hikurangi Trench IMMA and the Tikapa Moana Te Moananui ā Toi Hauraki IMMA (**Figure 6**) (MMPATF, 2023). The key reason behind the designation of the Hikurangi Trench IMMA is Criterion D2: 'Diversity', where the occurrence of 22 cetacean and 3 pinniped species have been reported, while Tikapa Moana Te Moananui ā Toi Hauraki IMMA is designated on account of the following criteria:

- Criterion A: 'Species or population vulnerability', provides habitat for the following threatened species – pygmy blue whales, Bryde's whales and killer whales;
- Criterion B2: 'Aggregations', forms an integral part of the home-range for Bryde's whales;
- Criterion C2: 'Feeding areas', provides routine feeding habitat for pygmy blue whales, Bryde's whales, and false killer whales; and
- Criterion D2: 'Diversity', occurrence of 17 cetacean and 2 pinniped species.

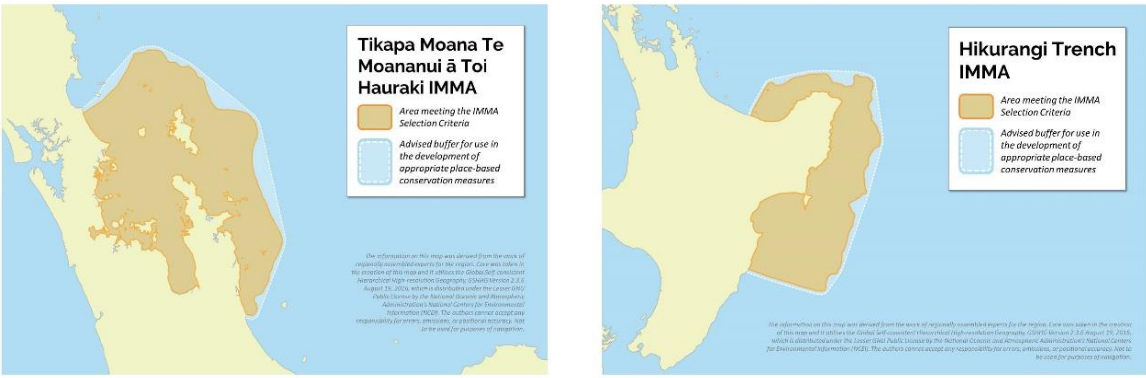

Figure 6 Important Marine Mammal Areas in the vicinity of the AOI

3.3 Summary

Waters of the AOI are used by at least 20 marine mammal species and although some foraging, breeding, resting and migratory behaviours do occur here, this habitat has not been specifically identified as ecologically significant to any marine mammal (relative to other habitat along the east coast of the North Island). In particular, all species that use the AOI have large home ranges, so the AOI would only represent a very small part of their overall distribution. Both sightings data and acoustic monitoring data indicate that only dolphins (mostly bottlenose), killer whales and New Zealand fur seals use waters inside Tauranga Harbour/Te Awanui, albeit on an occasional basis and despite high existing levels of shipping traffic here. No resident populations of marine mammals occur within Tauranga Harbour/Te Awanui.

These findings are supported by the fact that the AOI has not been identified as part of a recognised IMMA.

4.0 Assessment of Environmental Effects

4.1 Methodology

In assessing the effects of the project on marine mammals the following procedures were followed:

1 The actual and potential effects were identified and considered along with any recommended measures to avoid, remedy or mitigate these effects;

2 The likelihood of any residual adverse effects occurring (assuming the adoption of the recommended mitigation measures) was determined in terms of marine mammal occurrence and also considering the area over which each effect could occur. The likelihood categories used for this assessment are as follows: remote, low, moderate, high, and certain; and

3 The magnitude of any residual adverse effects (assuming the adoption of the recommended mitigation measures) in terms of ecological significance was determined according to the definitions presented in **Table 5** (adapted from MacDiarmid et al., 2014).

The results from this assessment process are summarised in **Section 7.0.**

Table 5: Magnitude of Adverse Effects

Magnitude	Criteria
Negligible	The activity may, or may not, have an effect on marine mammal taxa or habitats. Any effect would be undetectable and would be of no concern and of **no ecological significance**;
Minor	The activity may have a detectable effect, but the effect would be of **no ecological significance** to marine mammal taxa (no change to population size or dynamics) or habitat (any changes to habitat would be highly localised, <5% of total habitat area);
Moderate	The activity would have a detectable effect, and the effect would be of **low ecological significance** to marine mammal taxa (small change to population size or dynamics) or habitats (habitat changes are predicted over 5-20% of total habitat area);
Major	The activity would have a detectable effect, and the effect would be of **high ecological significance** to marine mammal taxa (substantial changes to population size or dynamics) or habitat (habitat changes are predicted to affect >20% of total habitat area); and
Severe	The activity would have a detectable effect, and the effect would be of **extreme ecological significance** to marine mammal taxa (local extinctions possible) or habitat (wide-scale habitat change).

As outlined in **Table 5**, the potential for interactions between marine mammals and the port development is clearly linked to spatial overlap between the proposed activities and marine mammal habitat. In this regard, the activities of primary relevance to marine mammals and their habitat are pile driving and dredging. The following potential effects of these activities have been identified:

- Underwater noise;
- Presence of objects in the water column;
- Habitat modification;

- Ship strike;
- Exposure to contaminants;
- Marine debris;
- Artificial lighting; and
- Cumulative effects.

Each of these potential effects is thoroughly described in the relevant subsections below along with recommended mitigation measures and a concluding statement on the predicted likelihood and magnitude.

4.2 Underwater Noise

4.2.1 Overview of Potential Effects

Marine mammals produce sound not only for communication with conspecifics (e.g., Quick & Janik, 2012), but also for foraging, navigation, reproduction, parental care, avoidance of predators, and to gain an overall awareness of their surrounding environment (Thomas et al., 1992; Johnson et al., 2009). Toothed whales and dolphins use echolocation to forage and navigate, whilst all marine mammals use passive listening to gather useful navigational cues (e.g., the sound of waves breaking on coastline etc.). On this basis underwater noise generated by human activity (e.g., shipping, seismic surveys, drilling, dredging, coastal development etc.) has the potential to affect marine mammals. Effects are typically associated with masking, behavioural changes or physical changes as discussed below.

Masking Effects

Masking is the reduced ability of marine fauna to perceive natural acoustic signals used by conspecifics for communication, navigation, predator avoidance, foraging etc. (e.g., Erbe & Farmer, 2000). Marine mammals must be able to perceive and effectively respond to biologically important sounds for several survival functions. Anthropogenic noise can interfere with the perception of these sounds, and this interference is referred to as 'masking'. The likelihood of masking is determined by how much overlap occurs between the frequency of animal vocalisations and the frequency of anthropogenic sounds (Richardson et al., 1995), where marine mammals are broadly separated into the following categories based on hearing capability (NMFS, 2024; Southall et al., 2019):

- Low frequency (**LF**) cetaceans: have an auditory bandwidth between c. 0.007 kHz and 22 kHz. Species from this group that could occur in the AOI include southern right whale, humpback whale, Bryde's whale, minke whale, blue whale and sei whale;
- High-frequency (**HF**) cetaceans: with an auditory bandwidth between c. 0.15 kHz and 160 kHz and the ability to echolocate. Noting that the hearing sensitivity of this group significantly decreases below 1-2 kHz (Southall et al., 2007). Species from this group that could occur in the AOI include bottlenose dolphin, common dolphin, killer whale, false killer whale, pilot whales, and beaked whales;
- Very high frequency (**VHF**) cetaceans: which an auditory bandwidth between c. 0.2 kHz and 180 kHz. No species from this group are expected in the AOI;
- True seals (or phocid seals: **PCW**): with an auditory bandwidth between c. 0.01 kHz and 164 kHz. The only species from this group that is predicted to occur in the AOI is the leopard seal; and

- Sea lions and fur seals (or otariid seals: **OCW**): with an auditory bandwidth between 0.08 kHz and 20 kHz. The only species from this group that is predicted to occur in the AOI is the New Zealand fur seal.

Low frequency noises (e.g., engine noise from large ships) are more likely to lead to masking as these noises travel more readily through water than high frequency noises. These low frequency noises typically impact baleen whales that predominantly use low frequency sounds to communicate (Simmonds et al., 2004; Clark et al., 2009). Even activities that emit relatively low intensity underwater noise can cause masking, but the biological significance of any effect will depend on the significance of the habitat affected and the duration of the effect, where ongoing masking in habitat of high importance will have the greatest ecological significance.

It is also worth considering that some species are known to compensate for the effects of masking by changing their vocalisation behaviours. For example, with increasing ambient noise, right whales and bottlenose dolphins altered the frequency of their vocalisations (Parks et al., 2007; Sobreira et al 2023), bottlenose dolphins increased their calling rate (Buckstaff, 2004) and killer whales and bottlenose dolphins increased call durations (Foote et al., 2004; Sobreira et al 2023).

Behavioural Effects

While severe startle responses are possible in some circumstances when exposure to very high intensity noise occurs (Southall et al., 2019), the main behavioural effects observed in response to underwater noise are the interruption of behavioural patterns (e.g., feeding, breeding, migrating or resting) (e.g., Finneran et al., 2000) and the displacement from habitat (e.g., Thompson et al., 2013). Temporary avoidance is the most reported behavioural response by marine mammals in the vicinity of high intensity acoustic disturbance (Stone & Tasker, 2006); however, some species appear to be attracted to low/medium intensity disturbance (e.g., Wursig et al., 1998; Simmonds et al., 2004; Lalas & McConnell, 2016). Avoidance behaviours may culminate in marine fauna being displaced from habitat and detrimental effects could ensue if long-term displacement from optimal habitat occurs. NMFS (2018) provide interim guidance for the noise threshold required to elicit behavioural effects, being 120 dB_{rms} re 1 µPa for continuous noises such as dredging. However, more recently a dose-response approach has generally been adopted as best practice as this approach is able to better address the inherent uncertainty in assessing the risk of behavioural effects which is typically species and context dependent (Faulker et al., 2018).

New Zealand fur seals could be attracted to development activities. However, otariids (fur seals and sea lions) are not as sensitive to underwater noise as cetaceans and phocids (true seals) as they have small ear flaps and a cartilage valve along the external ear canal that functions to close the ear canal to water (Southall et al., 2007); hence they are expected to tolerate and habituate to underwater anthropogenic noise more readily than other species.

Physical Effects

Potential physical effects to marine mammals from underwater noise include physiological stress responses (e.g., Romano et al., 2004), organ damage (Cox et al., 2006) and changes to hearing ability (i.e. temporary threshold shift: **TTS**, or permanent threshold shift: **PTS**) (DOC, 2013; Lucke et al., 2009; Southall et al., 2019). TTS represents a temporary and reversible change in hearing sensitivity.

The term Auditory Injury (**AUD INJ**) has recently been adopted to describe physical damage to the inner ear which results in destruction of tissue (NMFS, 2024); noting that AUD INJ may or may not result in PTS. NMFS (2024) provides estimates of noise thresholds required to elicit hearing damage in marine mammals. These thresholds have been used in this assessment to predict the onset distances for TTS and Aud INJ (including PTS) during the proposed dredging and pile driving activities. Permanent physical damage to date has only been associated with very high intensity underwater noise such as military sonar (Cox et al., 2006; Ketten, 2014). Most mobile species, if given the opportunity, avoid the range in which physical effects occur.

Whether or not an ecologically significant effect from exposure to underwater noise will occur, and the magnitude of any such effect depends on a suite of factors, including noise characteristics (frequency, volume, intensity, duration etc.), bathymetry (water depth, seabed gradient etc.), and species and life history stage (Simmonds et al., 2004). Detrimental impacts are generally greatest for marine mammals when:

- The frequency of the anthropogenic noise overlaps with the frequency of animal vocalisations resulting in masking (Erbe et al., 2016);
- The volume and intensity of the anthropogenic noise is high, and the duration is long (McGregor et al., 2013);
- The noise occurs in shallow or confined waters that provides habitat to resident animal populations with small home ranges (Forney et al., 2013);
- The marine mammal population is already of conservation concern (Weilgart, 2007); or
- Animals are subject to noise during periods of critical life history (e.g., breeding, feeding, resting, migrating etc.) (Dunlop et al., 2017).

The subsections below discuss the specific noise characteristics of the two primary noise sources associated with the project: dredging and pile driving.

4.2.2 Dredging

In order to assess the potential impacts of the noise generated by the proposed dredging activities on marine mammals it is necessary to understand both the likely characteristics of the anthropogenic noise (i.e. characterisation of the dredge noise, as discussed below) and the distribution of marine mammals in the AOI and the relative importance of this area to them. In general, the marine mammal species that are likely to be present in the immediate vicinity of dredging activities (see **Section 3.2.1**) are coastal species that have large home ranges and that are only expected to have an occasional presence inside the confines of Tauranga Harbour/Te Awanui.

Characterisation of Dredge Noise

Underwater dredging noise is characterised as continuous, broadband sound where the main energy is low frequency; typically occurring below 1kHz (Todd et al., 2015), with peak levels below 0.5 kHz (Robinson et al., 2012). In addition to the standard noise components associated with shipping (e.g. propellor/thruster noise, and hull noise), operational dredge vessels also produce noise from the drag head, the overboard pumps, the suction pipes, and water/sediment discharge (Robinson et al., 2012). Given that dredging activities typically overlap in time and space with high levels of vessel traffic (e.g. in and around commercial ports) it is oftentimes difficult to separate the effects of dredging and the effects of vessel traffic (Anderwald et al., 2013).

In relation to source levels (or loudness), Trailer Suction Hopper Dredge (**TSHD**) operations typically fall within the range 160 to 188 dB re 1µPa at 1 m distance from the source (De Jong et al., 2010; Robinson et al., 2012) and Back Hoe Dredge (**BHD**) operations are substantially quieter (154-179 dB re 1µPa at 1 m; de Vos, 2017). Noise levels of static rippers usually fall between these two more commonly used dredge methodologies (Connell et al., 2023). These source levels (at frequencies below 500 Hz) do not exceed normal engine and propeller cavitation noise or hull noise that would be expected from ships (176 to 188 dB re 1µPa at 1 m: McKenna et al., 2012; Todd et al., 2015; Robinson et al., 2012) and the noise outputs from dredging vessels are substantially quieter than other marine industrial activities such as pile driving and seismic surveys (Robinson et al. 2012). After measuring sounds from several TSHDs during a 2,000 ha port extension in the Netherlands (where sand was the primary material being relocated), De Jong et al. (2010) concluded that dredging itself was no louder than transit of the dredge vessel between the dredging and spoil sites. Further to this, Hoffman (2012) reported that tug noise is typically louder than dredge noise, and tugs operate frequently in (and on approach to) the Port of Tauranga.

At frequencies above 1 kHz, elevated broadband noise has been noted for some TSHDs during the extraction of coarse aggregates such as gravel, but typically not for finer aggregates such as sand (Robinson et al., 2012). The sediment characteristics of the area subject to dredging (both capital and maintenance) is primarily comprised of sand (coarse, medium and fine) and silt (medium, fine and very fine) (de Lange, 2024). On a broader spatial scale, Leonard et al. (2020) states that benthic sediment in Tauranga Harbour/Te Awanui is dominated by sand, although de Lange (2022, 2024) noted that fine sediment accumulates at the harbour margins and in previously dredged areas. The most recent quantitative analysis of the area that will be subject to dredging indicates that the sediment is comprised mostly of sand (70%), then fines (30%), silt (26%) and clay (6%) (de Lange, 2024); hence elevations in high frequency noise (>1 kHz) are not expected during dredging activities in Stella Passage.

As outlined in **Section 2.1**, the proposed dredging will most likely utilise a TSHD. Previously, dredging in the project area has been undertaken by the *Albatros*. The source level for the *Albatros* was measured to be 178 dB_{rms} re 1 µPa m while actively dredging unconsolidated sediment (Pine, 2025). On the basis that TSHD activity will represent the noisiest component[4] of the proposed dredging, empirical noise measurements using the *Albatros* as a proxy TSHD were used for the purpose of underwater noise modelling for this project (Pine, 2025). The results of this modelling are discussed below.

Underwater Acoustic Modelling

Modelling has recently been undertaken by Styles Group (Pine, 2025) to predict the impact of underwater noise from dredging activity in Tauranga Harbour/Te Awanui on marine mammals. The modelling was tailored to specifically address the species that are identified in **Section 3.2.1** as having a likely or possible presence in and around the harbour. The model results are presented in **Table 6**, **Table 7**, **Table 8**, **Figure 7**, and **Figure 8** and are used in this assessment to interpret the ecological consequences for marine mammals in terms of:

- Physical effects (will the proposed dredging elicit TTS or AUD INJ (including PTS) in marine mammals);
- Behaviour (will the proposed dredging elicit significant behavioural responses);
- Masking (how will the proposed dredging affect the listening space);
- Audibility (how far will dredging noise be audible for marine mammals); and
- Cumulative soundscape effects (how dredging alters the existing soundscape of the harbour).

The key findings from the modelling are summarised in the points below, noting that in all instances the zones of predicted effect are not symmetrical around the active dredge, but the results below are based on the maximum predicted onset zone to account for the worst case scenario:

[4] Noting that TSHDs are considered the loudest of all dredge types (i.e. louder than BHDs, static rippers and other dredge equipment), so the source level of a proxy TSHD has been used to reflect the worst possible scenario for the project.

Physical Effects:

- With regard to potential physical changes resulting in permanent or temporary hearing loss, TTS is not expected beyond 1 m of the active dredge for those species that could be present in the AOI, and no risk of AUD INJ (including PTS) was identified (Pine, 2025).

Behavioural Effects:

- **Figure 7** illustrates the probability of marine mammals exhibiting a behavioural response from dredging activities in Tauranga Harbour/Te Awanui. Zones of predicted effect for dolphins and killer whales are shown in panels 'A' (low level responses) and 'B' (moderate level responses). Zones of predicted effect for baleen whales are shown in panel 'C'. This figure is not specific to works associated with the Stella Passage Development (it models maintenance dredging activities along the length of the shipping channel); hence is indicative only. Despite this, **Figure 7** is still valuable in showing how dredge noise in an enclosed waterway is expected to affect marine mammal behaviour. For the purpose of this application, only the predictions in the immediate vicinity of Stella Passage (at the very bottom of each map panel presented) are of relevance;
- As indicated by **Figure 7,** any marine mammal present in Stella Passage during active dredging would be expected to exhibit a low- or moderate-level behavioural change;
- The onset distances for low level behavioural responses (i.e., minor changes in respiration rates, swimming speed or direction of travel) in killer whales, bottlenose dolphins and common dolphins are presented in **Table 6**. For these species there is a 50% risk of low-level responses at a distance of 528 m, noting that the closer they approach the dredge the greater the risk of a response. The outer limit of response is c 1.7 km; meaning that beyond this distance no behavioural responses are expected;
- Predictions relating to moderate behavioural responses (i.e. moderate to extensive changes in swimming speeds/direction and/or diving behaviours, moderate or prolonged cessation of vocalisations, and/or avoidance) in killer whales, bottlenose dolphins and common dolphins are also presented in **Table 6**. This level of response is expected from most animals that come within 74 m of the active dredge, but beyond c. 1 km no moderate level responses are expected;
- The onset distance for low-level behavioural response in baleen whales is greater than the other species assessed (in line with the increased sensitivity of these species to disturbance). As presented in **Table 6**, the modelling predicts a risk gradient from 75% at c. 1.5 km to 0% at 3.5 km. Meaning that behavioural responses for these species will be limited to those individuals within 3.5 km of the active dredge; and
- For seals, the risk of low-level behavioural response is restricted to within c. 2 km of the active dredge and moderate changes could occur out to about 500 m.

Masking Effects:

- Masking effects are gauged by way of calculating 'listening space reduction' ('**LSR**'). An animals natural listening space is the surrounding area over which animals can typically detect biologically important sounds. When anthropogenic noise is present; however, listening space reduces because the man-made noise interferes with sounds that are important for marine mammals (e.g. sounds used to detect prey or predators, or sounds used to communicate with conspecifics);

- LSR results are presented in **Table 7** and show that for dolphins and killer whales a 50% LSR is expected at 1.5 km from the active dredge but that for animals c 5.5 km from the active dredge no LSR will occur;
- For baleen whales, a 50% LSR is expected at c. 1.5 km from the active dredge but that masking effects become no longer relevant at c. 5 km (**Table 7**); and
- For seals (both PCW and OCW), the 50% LSR distances are predicted to extend out to 1.68 km and 0% LSR extending to c. 5.3 km (similar to that predicted for baleen whales).

  Audibility:

- The active dredge will be audible above the existing soundscape for all marine mammal species to c. 8 km away from the active dredge (**Table 8**).

  Cumulative Soundscape Effects:

- An assessment of soundscape change associated with dredging in Tauranga Harbour/Te Awanui was conducted using Automatic Identification System (**AIS**) data from a previous maintenance dredging campaign to produce daily cumulative noise maps which were overlaid with AIS shipping data to make predictions about how dredging alters the existing soundscape of the harbour and surrounds. Noting that for the purpose of this report only the effects reported for Stella Passage are relevant.
- The predicted soundscape change arising from dredging is negligible in habitats outside the shipping channel. Furthermore, and accounting for the different functional hearing groups of marine mammals, the cumulative noise effects of dredging are predicted to generate very small differences over the existing soundscape.
- While dredging elevates the background noise level by a small degree, these increases are spatially restricted to the dredging area itself and are not far reaching into surrounding waters.
- When considering the entire shipping channel, dredging noise has the greatest cumulative impact on the existing soundscape in the harbour entrance and Stella Passage as, in these locations, the noise is confined by the surrounding geography.
- **Figure 8** presents the average 24 hr cumulative sound exposure modelled for all marine traffic (using AIS data from May 2022 – June 2023). This illustrates the existing soundscape in the absence of dredging which provides context against which the predicted dredge noise can be assessed. **Figure 8** reflects the fact that the Port of Tauranga is a very busy waterway for commercial ships, noting that most recreational craft are excluded from this analysis as they do not normally carry AIS systems; hence in reality, this existing soundscape is even noisier than depicted here.

Table 6: Predicted zones of behavioural effects (Pine, 2025).

Species	Behavioural Response	Risk Isopleth (m)			
		75%	50%	25%	0%
HF (e.g. killer whales & dolphins)	Low	374	528	715	1,666
	Moderate	74	109	241	985
LF (e.g. baleen whales)	Low	1,546	1,987	2,168	3,497
PCW & OCW (e.g. all seal species)	Low	1,948			
	Moderate	530			

Table 7: Predicted zones of listening space reduction (Pine, 2025).

Species	Distance from the TSHD (m)			
	75% LSR	50% LSR	25% LSR	0% LSR
HF (e.g. killer whales & dolphins)	160	1,500	2,888	5,500
LF (e.g. baleen whales)	170	1,438	2,827	5,107
OCW (e.g. fur seals)	702	1,682	2,786	5,312
PCW (e.g. leopard seals)	919	1,687	2,791	5,307

Table 8: Predicted zones of audibility (Pine, 2025).

Species	Audibility radius (m)
HF (e.g. killer whales & dolphins)	8,336
LF (e.g. baleen whales)	8,343
OCW (e.g. fur seals)	8,348
PCW (e.g. leopard seals)	8,375

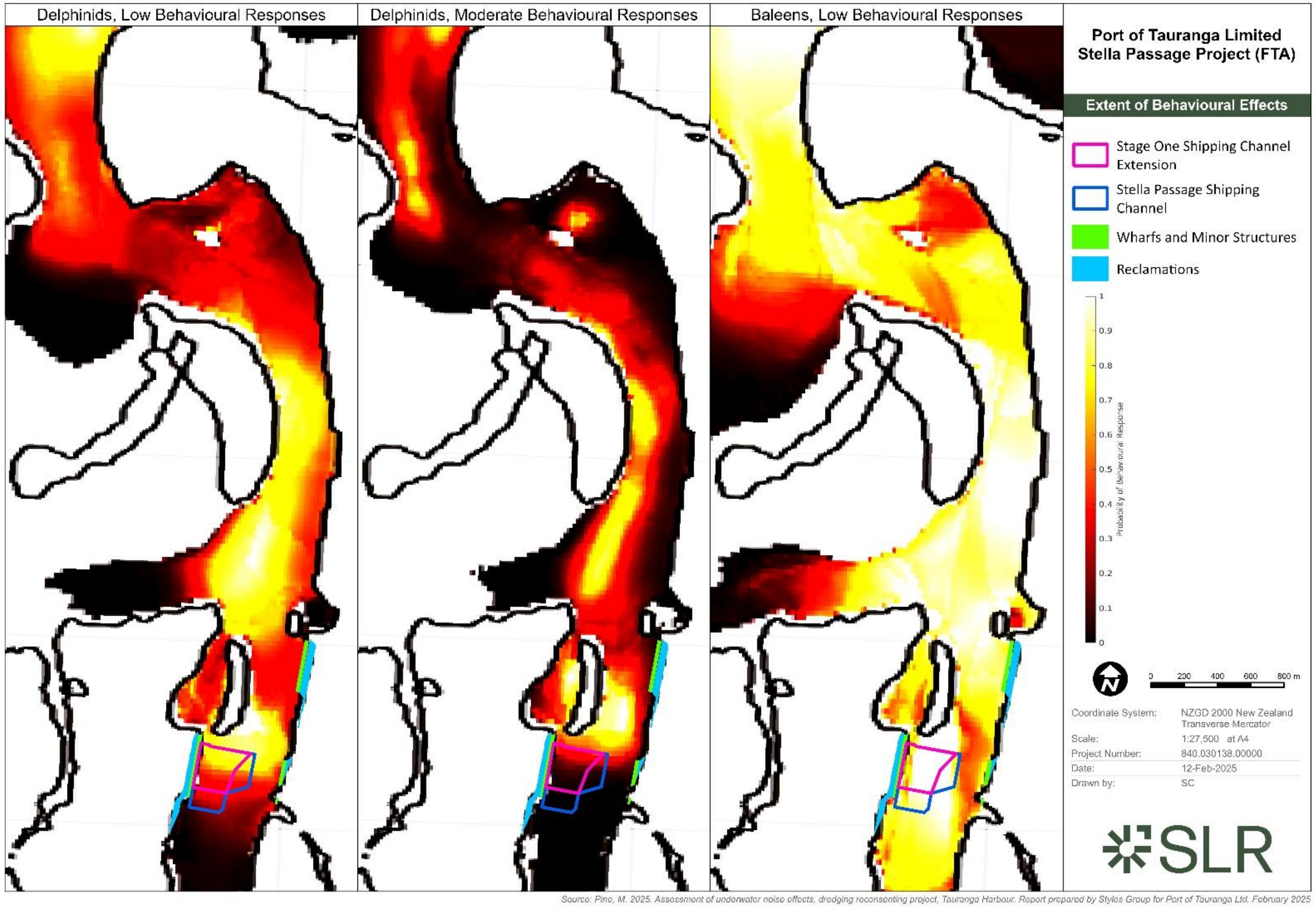

Figure 7 Probability of low (A) and moderate (B) level behavioural effects for dolphins and killer whales, and low level behavioural effects for baleen whales (C) during active dredging in Tauranga Harbour/Te Awanui.

Source: (adapted from Pine, 2025). *NOTE: only the indicative predictions in the vicinity of Stella Passage (at the very bottom of each map panel) are of relevance to this FTA application.*

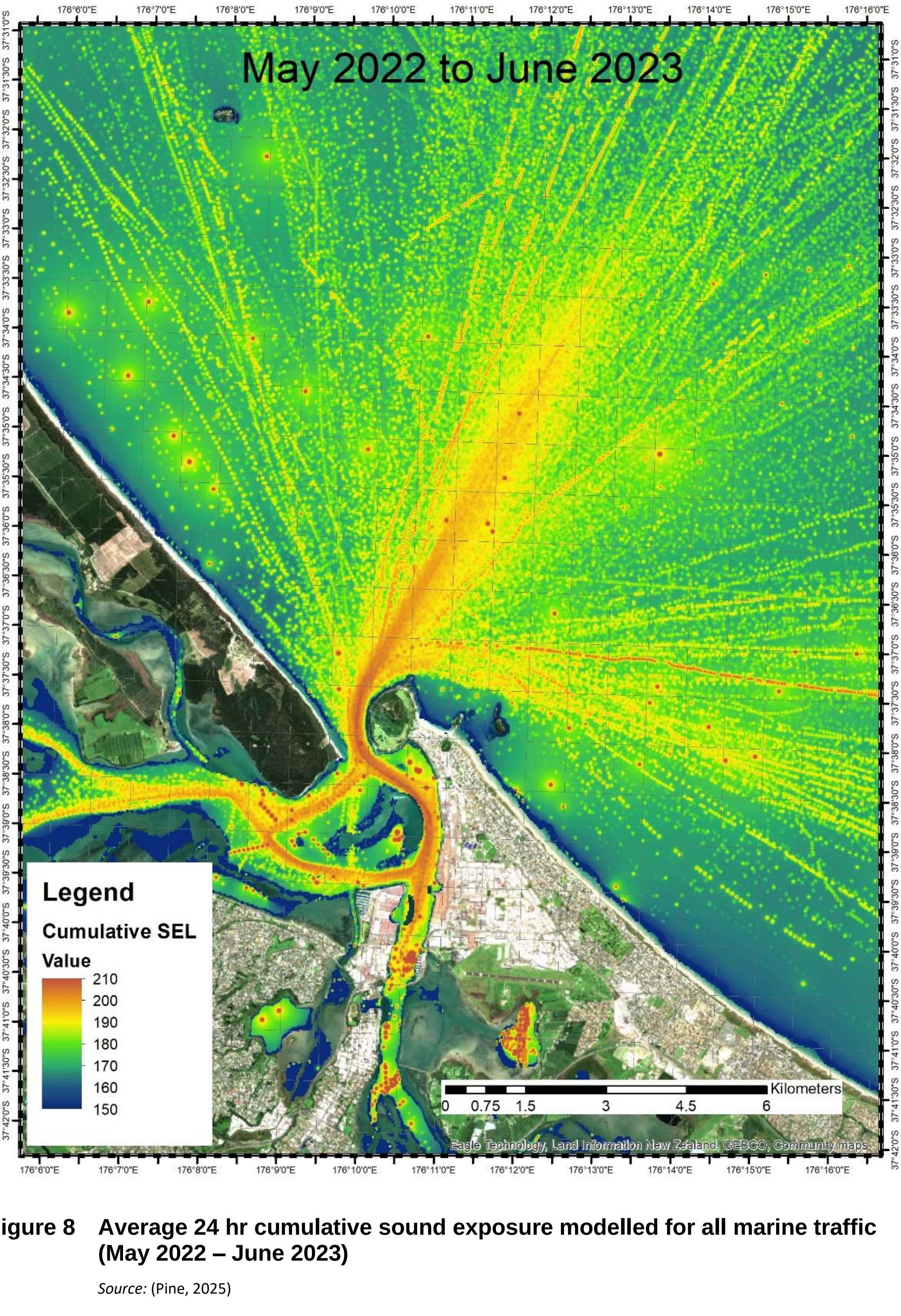

Figure 8 Average 24 hr cumulative sound exposure modelled for all marine traffic (May 2022 – June 2023)

Source: (Pine, 2025)

Literature Review

Although very few studies have directly quantified the effects of dredging noise on marine mammals, the paragraphs below summarise what is available from the international literature and help to put the modelling results presented above into context. Of high importance, is that while hearing damage (i.e. physical effects) from dredging noise is theoretically possible, to date auditory injuries have not been reported from dredging activities alone (Thomsen et al., 2013).

Behavioural Effects

Temporary avoidance by harbour porpoises within 600 m of a TSHD extracting sand was noted by Diederichs et al. (2010) and declines in the regular occurrence of foraging bottlenose dolphins in Aberdeen Harbour, Scotland have been linked to increased dredge intensity (Pirotta et al., 2013). In the latter study, noise (that results in masking of communication between conspecifics), in combination with suspended sediment, are thought to reduce foraging efficacy which results in dolphin groups moving to alternative foraging patches when dredging intensity is high (Pirotta et al., 2013).

More recently, Bossley et al. (2022) quantified the effect of dredging (TSHD and BHD) on bottlenose dolphins and New Zealand fur seals around South Australia's main port in the lower reaches of Adelaide's Port River. The findings of this study are of particular relevance to the Port of Tauranga project due to 1) the similarity in marine mammal species present, 2) the parallel in dredge methodology used, and 3) the fact that both dredge sites are located in highly industrialised environments. In this study, surveys collecting data on the presence/absence of marine mammals occurred over 876 days for dolphins (between 1992 and 2020) and 416 days for New Zealand fur seals (between 2010 and 2020). Generalised linear models were used to analyse the relationship between dolphin and seal numbers and the following variables: dredging operations, season, rainfall, and sea surface temperature (**SST**). Despite fluctuations in numbers of both species, this study concluded that dredging operations were not responsible for these fluctuations (i.e. dredging did not affect marine mammal presence); rather, SST and season were the most important predictors of presence for both species. While this study did not investigate short term behavioural changes of individual animals near an active dredge, it did confirm no long-term avoidance of the area.

In a similar study, Marley et al. (2017) conducted theodolite tracking of dolphins at two study sites (Perth Waters and Fremantle Inner Harbour) within an urbanised estuary in Perth, Western Australia to quantify bottlenose dolphin responses to vessel traffic and dredging activities. Like Tauranga Harbour/Te Awanui, these Perth study sites are subject to commercial shipping and high recreational vessel use. The Western Australia study sites are however used on a more frequent basis by a resident population of bottlenose dolphins (Moiler, 2008; Chabanne et al., 2012). Key findings of this study were that dolphin sighting rates were highest at the deepwater study site (5-13 m) that experienced the highest vessel density (i.e., Fremantle Inner Harbour which experienced up to 34 vessels per hour) and which had previously been identified as a foraging hotspot (Moiler, 2008). At this site, environmental factors (i.e., tidal height and water salinity and temperature) had a greater influence on rates of dolphin occupancy than density of vessel traffic. The authors hypothesise that the value of this foraging site outweighs the cost in terms of high vessel traffic.

Marley et al. (2017) also noted that no dolphins were sighted on the 12 days during which the BHD was operational, but dredging activity was restricted to the shallow study site (Perth Waters) that was primarily used as a transit site and was least frequented by dolphins. Low sample sizes hampered the analysis of any statistical relationship between dredging activity and dolphin occupancy. It is unclear therefore whether BHD use might result in avoidance by marine mammals but given the noise levels associated with BHD operations are lower than those for TSHD, it seems unlikely that BHD operations would cause sustained avoidance responses.

Investigations to date suggest that underwater dredging noise has little impact on pinnipeds, with several studies describing no adverse reaction or no sign of disturbance (Bossley et al. 2022; EPA, 2007; Gilmartin, 2003, as cited in Todd et al., 2015).

<u>Masking</u>

Overlap between marine mammal vocalisations and dredge noise is predicted to be greater for baleen whales than dolphins or killer whales, on the basis that the frequency range of baleen whale vocalisations is lower. Hence, of the cetaceans that could be present around the project area, baleen whales would be most susceptible to masking effects from the proposed dredging activities. However, as described in **Section 3.2.1**, baleen whales are not resident to the AOI, and although they have an occasional seasonal presence outside the harbour, their presence inside the harbour is rare. While high frequency cetaceans (e.g. bottlenose dolphins and killer whales) do also use some lower frequency (below 30 kHz) sounds for communication and echolocation, their hearing range, and the frequency range over which they produce sounds, is much greater and therefore masking effects are less pronounced in these species.

Knowledge of underwater vocalisations used by pinnipeds is relatively scarce, but data confirms that they do not echolocate to forage, but often vocalise as part of underwater social interactions, including mating (Schusterman & Van Parijs, 2003). It is noteworthy that even though the LSR results (**Table 7**) suggest that the zone of masking for fur seals extends to 5.3 km from the active dredge, the proposed dredging activities in Stella Passage will occur over 45 km from the nearest breeding site, so ecologically significant masking effects for this species are not predicted.

<u>General Discussion</u>

The model results suggest that the effects on marine mammals of underwater noise from the proposed dredging component of the project will be spatially restricted to a few kilometres around the active dredge: where 1) behavioural effects are limited to 1.7 km for dolphins and killer whales and 3.5 km for baleen whales; 2) masking effects are limited to within 5.5 km for all species; and 3) dredging noise is no longer audible to marine mammals above background noise at c. 8 km. These findings are not dissimilar to those reported by other studies that assess the effects of dredging on marine mammals.

All physical and behavioural effects of underwater noise from dredging in Stella Passage are restricted to within the harbour. Any effects from the proposed dredging are therefore unlikely to elevate risks to marine mammals above those already present from existing dredging and/or commercial shipping. In particular, animals will only be exposed to physical and behavioural effects temporarily when they approach within 3.5 km of the active dredge.

While shipping noise has been associated with a number of detrimental effects on marine mammals, e.g. masking (Erbe, 2002), physiological stress (Wright et al., 2007), changes in behaviour (Nowacek et al., 2007), and changes in vocalisations (Parks et al., 2007); hearing damage or other related physical injuries are unlikely. This sentiment is echoed by Todd et al. (2015) and Thomsen et at. (2013) who both conclude that the risk of damage to marine mammal auditory systems from dredging noise is very low, and that effects are most likely to relate to masking or temporary behavioural responses. The model results support these conclusions.

While there is clear evidence that anthropogenic noise can act as a stressor to marine mammals, corresponding evidence for effects on survival or fitness are, to date, limited (Duarte et al., 2021). However, recent evidence suggests that vessel noise can reduce the ability of male killer whales to capture prey and can lead to female killer whales reducing their efforts of prey pursuit (Tennessen et al., 2024). Therefore, while vessel noise could theoretically result in reduced survival or fitness of individuals if it was persistent and widespread across an individual's home range, marine mammals that visit Tauranga Harbour/Te Awanui from time to time are expected to have ample foraging opportunities elsewhere to offset any temporary reduction in foraging efficacy that vessel noise within the harbour could impart. In particular, dredging noise will not be persistent throughout any marine mammals home range.

The Port of Tauranga is one of New Zealand's busiest ports, yet marine mammals (particularly dolphins, killer whales and fur seals) still utilise the area on occasion despite the elevated levels of vessel activity and associated underwater noise. This suggests that at least some species are tolerant or have already habituated to relatively high levels of underwater noise and vessel activity. Habituation of bottlenose dolphins to high levels of shipping activity has recently also been reported by Mills et al. (2023) where dolphins frequently foraged in the presence of multiple vessels in the Corpus Christi Shipping Channel, Texas (the largest port in the USA that typically sees >20 vessels pass through per hour). Likewise, no behavioural changes were detected for bottlenose dolphins in response to the presence of large and medium sized vessels in the Galveston Shipping Channel, Texas, but behavioural effects were apparent when small boats and commercial trawlers were present (Piwetz, 2019).

4.2.2.1 Recommended Mitigations - Dredging

To minimise any adverse effects on marine mammals from dredge noise the following mitigations are recommended:

- Dredge equipment will be regularly maintained, including lubrication and repair of winches, generators, propulsion components and other potential noise sources (following Thomsen et al. 2013); and
- Compliance with the Marine Mammal Protection Regulations 1992 (**MMPR**) which stipulate the requirements for operating vessels around marine mammals.

4.2.2.2 Assessment Results - Dredging

The potential underwater noise effects of both Stage 1 (6.1 ha) and Stage 2 (4.45 ha) dredging have been considered in this assessment. As there is little material difference in the extent of the proposed dredging between the two stages, it follows that the assessment findings below apply to both Stages 1 and 2. While the overall duration of Stage 1 dredging will be slightly longer, the day-to-day effects that marine mammals could be exposed to are equally relevant across the stages. Furthermore, all recommended mitigations (**Section 4.2.2.1**) will apply to both stages.

While marine mammals have a frequent presence in and around the AOI, their presence within Tauranga Harbour/Te Awanui is occasional. All species with a possible presence here have home ranges that are vast compared to the project area, so individuals would only be subject to dredging noise effects occasionally. Further to this, the AOI (including the project area) has not been identified as being specifically important habitat for any marine mammal species (see **Section 3.3**). On this basis the following observations are made:

- Dredging noise is not a novel acoustic input in the AOI;
- Underwater dredging noise is highly unlikely to cause TTS for any marine mammal species and no risk of AUD INJ (including PTS) has been identified;
- Any behavioural effect from dredge noise would be temporary and spatially restricted to within the confines of Tauranga Harbour/Te Awanui;
- Following on from this, and based on the findings of **Section 3.2** that there are no resident populations of marine mammals within Tauranga Harbour/Te Awanui but

dolphins, killer whales and New Zealand fur seals use waters inside the harbour on an occasional basis, dredging noise is not anticipated to have ecologically significant consequences to individuals or populations; and

- Scientific evidence suggests that dredge noise constitutes no greater threat to marine mammals than commercial vessels that also use the area.

With the adoption of the recommended mitigation measures (which POTL is proposing), the likelihood of adverse effects on marine mammals from dredge noise will be low and the magnitude of predicted effects will be negligible. While dredging noise will alter the existing soundscape and could result in localised behavioural effects and masking, these effects will be spatially confined to within Tauranga Harbour/Te Awanui (where only killer whales, bottlenose dolphins and New Zealand fur seals are expected to have an occasional presence) and will be largely indiscernible from those of existing vessel traffic in and around the port.

4.2.3 Pile Driving

Impact pile driving generates very high levels of impulsive underwater noise (Richardson et al., 1995). Measurements of pile driving noise in the marine and coastal environment reveal that while project specific details (pile size, hammer size and seabed properties) influence the noise characteristics, the generated noise is typically broadband with most energy concentrated below 500 Hz, but with substantial energy up to 10 kHz (Madsen et al., 2006). During pile driving, pulsed sounds are produced every 1 to 2 seconds with source levels up to 250 dB re 1 $\mu Pa_{(peak\text{-}peak)}$ at 1 m (Bailey et al., 2010) representing one of the most intense anthropogenic sounds to be routinely used in the marine environment.

Marine mammals exposed to pile driving noise are expected to exhibit behavioural effects (e.g., avoidance) even at extended distances (i.e., tens of kilometres) from the construction site (Madsen et al., 2006) and given the broadband nature of pile driving noise, some masking of marine mammal vocalisations is probable if marine mammals are present (David, 2006). PTS is also possible at close range (Madsen et al., 2006), and, beyond this zone, repetitive impulsive sounds can have a cumulative impact on the hearing abilities of marine mammals over time, with TTS being another possible outcome (Kastelein et al., 2016). An analogy of TTS in humans is the change in hearing sensitivity that people experience for a brief period after attending a loud rock concert; where sounds can seem muffled, and a ringing sound occurs in the ears. Hearing typically returns to normal after a few hours.

Specific examples of these potential effects are discussed further below. It is noteworthy that many of the available examples involve wind farm construction, where pile-driving for windfarms requires much larger piles (up to 4 m diameter, compared to the proposed 785 – 914 mm in Stella Passage), therefore heavier pile drivers are typically required during windfarm construction, leading to a much higher sound source level (Fricke and Rolfes 2015).

Perhaps the most relevant example is that described by Leunissen (2017) who measured pile driving noise and its effects on Hector's dolphins in Lyttelton Harbour during 15 months of pile driving that mostly occurred in 2014 (during repairs to the port infrastructure following the Canterbury earthquakes). During this project three different impact hammers were used to drive 80 m long capped tubular steel piles with diameters ranging from 610-710 mm. Pile driving noise was detectable over an area of 16.3 km^2, with a maximum sound exposure level of 194 dB re 1 $\mu Pa^2 s$ @ 1m with most of the energy within the 100-1000 Hz frequency range. These sound exposure levels were comparatively lower than other pile driving noise measurements on account of the smaller sized pile drivers (9-14 tonne drop hammers with maximum energy of 106 kJ and 206 kJ respectively) and the soft substrate into which the piles were driven. This study also reported that a breakwater structure about 500 m from piling activity was found to shield significant levels of noise from surrounding waters through absorption and reflection.

Effects of pile driving on Hector's dolphins were noticeable via a clear avoidance reaction within 1.3 km of piling activity, where acoustic detection of dolphins was significantly lower on days when piling operations were undertaken (Leunissen, 2017). Detection rates recovered within 50-83 hours of piling activity ceasing. Despite this clear trend of displacement, Leunissen (2017) noted that individual dolphins were frequently detected within 370 m of active construction for durations of up to 10 minutes. TTS in these individuals cannot be dismissed as TTS onset during this study was calculated to be between 26 m for a single hammer blow, to 376 m for an exposure period of one hour. The noise levels measured in this study were 'very unlikely' to cause PTS. During construction activities a 'soft start' was used at the start of a piling sequence to give dolphins a chance to leave the immediate vicinity, and a shutdown occurred if dolphins were observed within 300 m of the construction site.

Bailey et al. (2010) investigated marine mammal effects from wind farm construction off the coast of Scotland where large (1.8 m diameter) hollow steel piles were driven to form the pedestal for wind turbines. Each pile took c. two hours to drive with c. 6,000 hammer blows each. Sound was measured during construction and likely marine mammal effects were noted as follows: 1) zones of AUD INJ and TTS were restricted to within 100 m of construction; 2) strong avoidance behaviours were expected within 20 km and 14 km of the site for cetaceans and pinnipeds respectively; and 3) behavioural disturbance was expected out to 50 km. It wasn't until 80 km from the site that pile driving noise was no longer distinguishable from background noise, i.e., the noise may still have been audible to some marine mammals even at this distance. It is noteworthy that the piles used in this project were much larger than those proposed for the Stella Passage development.

The acoustic behaviour of harbour porpoises was monitored during the construction of an offshore wind farm in the North Sea that involved the hydraulic hammering of 91 large monopiles (3.9 m) (Brandt et al., 2011). Within 2.5 km from the construction site, porpoise calls reduced significantly during the construction period and remained low for up to 72 hours after pile driving. Effects of call reduction were detectable out to c. 18 km, although the post-exposure recovery period decreased with increasing distance from the site. Interestingly porpoise calls temporarily increased at the monitoring station 22 km from construction, providing evidence that porpoises did not simply stop calling, but moved away from the noise source. Harbour porpoises are thought to be highly sensitive to noise and for this reason this species is often used to predict worst case effects for other cetacean species (Southall et al., 2007).

In controlled playback experiments captive harbour porpoises were exposed to pile driving noise (equivalent to the noise that would be received c. 800 m from a wind farm driving large piles at 2,760 blows per hour) for up to six hours (Kastelein et al., 2016). Exposed individuals experienced a relatively minor TTS of 4-5 dB; meaning that hearing sensitivity decreased such that sounds needed to be 4-5 dB louder than normal to be heard. Recovery time for the experimental animals was less than one hour. The authors of this study noted that the magnitude of TTS is influenced by total exposure duration, the inter-pulse interval between hammer blows, the sound pressure level (i.e., amplitude/volume) received by the animal (which in this study equated to a mean sound pressure level broadband ~ 144 dB re 1µPa) and the sound frequency received by the animal. Noting also, that if multiple piles are being driven simultaneously the inter-pulse intervals are likely to be shorter resulting in a larger magnitude TTS.

Benhemma-Le Gall et al. (2021) have recently reported on broad-scale responses of harbour porpoises to pile driving and vessel activities during the construction of two Scottish offshore windfarms. This study used passive acoustic monitoring to assess spatio-temporal variation in echolocation clicks (indicative of foraging activity) of harbour porpoises. Declines in porpoise occurrence were detected (8-17%) in the areas impacted by pile driving or other construction activities. Porpoises were displaced up to 12 km from pile driving sites and up to 4 km from construction vessels.

Far-field effects on coastal bottlenose dolphins from pile driving were investigated using a 10-year dataset of dolphin acoustic presence and a 'before-after-control-impact' study design in the Moray Firth, on the northeast Scotland coast (Fernandez-Betelu et al., 2021). The results of this study suggest that impulsive noise did not displace dolphins from the coastline inshore of the construction sites (40-70 km offshore). These results are similar to other studies which found that displacement from impulsive noise typically occurs at closer ranges. For instance, harbour porpoises and baleen whale displacement from impulsive noise has been reported up to 20 km away (as referenced by Fernandez-Betelu et al., 2021), but as bottlenose dolphin hearing is comparatively less sensitive, the zone of displacement for this species is expected to be smaller (Fernandez-Betelu et al., 2021).

Masking has been described as possibly the most pervasive impact of anthropogenic noise (Erbe et al., 2016) and while Southall et al. (2007) noted that masking from anthropogenic noise probably has the most widespread effect on marine mammal populations, these authors also stated that more data on the masking effects of both natural and anthropogenic noise and on the detection of biologically meaningful signals are required before noise exposure criteria can be successfully applied to masking. While significant progress has been made towards data collection on the effects of masking for some species of dolphin, pinnipeds and sea otters, specific masking criteria for marine mammals are still unavailable (Southall et al., 2019).

Alternative methods to quantify the effects of masking on marine mammals have been developed; namely estimates of communication space reduction (e.g. Clark et al., 2009) and LSR (Pine et al., 2019). These methods are certainly evolving quickly and, in lieu of exposure criteria, are beneficial in assessing the potential effects of masking. The latter technique in particular, can not only quantify impacts on intra-specific communication, but also extends to the detection of acoustic signals from prey species, predators, and other potential threats (Pine et al., 2019). However, Pine et al. (2019) caution that in order to apply these techniques effectively, the underlying assumptions and conditions must be well understood.

LSR calculations were undertaken by Styles Group (2022) for piling associated with a port development project at Northport, Whangarei. For this project impact piling was proposed to expand the existing wharf facilities. An assessment of potential masking effects from impact piling concluded that no masking would occur beyond c. 3 km from the construction site for any marine mammal, and that (depending on species) the zone within which a 50% LSR was expected to occur would be between 1 – 1.4 km.

Earlier studies predicted masking effects over larger distances. For example, David (2006) investigated the masking potential of pile driving noise on bottlenose dolphins and concluded that a six tonne hammer (90 KJ) had the potential to mask normal communication whistles (9 kHz) within 10-15 km and quieter whistles at distances up to 40 km, and that higher frequency echolocation clicks (50 kHz) would be masked up to 6 km away. David (2006) also noted that lactating female bottlenose dolphins and young calves were likely to be particularly vulnerable to communication masking given the risk of separation should this occur.

It is noteworthy that some species are known to compensate for the effects of masking by changing the frequency of vocalisations (e.g. right whales; Parks et al., 2007 and bottlenose dolphins; Sobreira et al 2023), increasing calling rate (bottlenose dolphins; Buckstaff, 2004) and changing call durations (e.g. killer whales; Foote et al., 2004 and bottlenose dolphins; Sobreira et al 2023).

Fewer studies exist regarding the effects of pile driving on seals, and it is understood that no studies have specifically investigated the effects on otariids (fur seals and sea lions). In lieu of such literature, the findings of a study on phocid harbour seals is discussed below, noting that the magnitude of effects on otariids are likely to be smaller given the differences in auditory anatomy (see **Section 3.5.1**).

Satellite telemetry was used to monitor harbour seal movements and relate these to construction noise from a wind farm development off the southeast coast of England (Russell et al., 2016). The maximum sound pressure level (**SPL**) was 235 dB re 1 µPa(p-p) @ 1 m, and the maximum sound exposure level (**SEL**) at 1 m from the source was 211 dB re 1 µPa2 s-1. Seal abundance decreased significantly within 25 km of the construction site (a 19-83% decrease compared to non-piling periods) indicating a substantial displacement effect. However, displacement effects disappeared within two hours of cessation of piling noise stopped. Russell et al. (2016) suggest that avoidance of the construction site was a successful strategy by which individual seals could reduce their exposure to noise, thereby reducing the risks of auditory damage. However, the importance of breaks in piling to allow seals to forage and travel unhindered was highlighted.

As AUD INJ (including PTS) and TTS occur as physical changes to the auditory system of an affected individual, it is particularly important to carefully consider these impacts when assessing the effects of pile driving activities on marine mammals. To address this (and the potential for behavioural effects) in relation to the project, sound transmission loss modelling has been undertaken by Vallarta & Eickmeier (2025) (**Appendix E**). This modelling used site and project specific inputs to predict how pile driving sounds will behave in Tauranga Harbour/Te Awanui and how far noise will propagate from the construction site. For project specific inputs, the worst case was assumed, i.e., the model considers the 14 tonne hammer was used consistently at full power. Modelled sound levels were related to noise exposure criteria for marine mammals (NMFS, 2024 for AUD INJ and TTS; NOAA, 2021 for behavioural responses) to assess possible effects on marine mammals at various distances as described by Vallarta & Eickmeier (2025) and summarised in **Table 9** and Table 10 below. As the simultaneous operation of two piling units is unlikely during the project, the results presented below are for a single piling location. The effects onset distances for two piling units operating at once are presented and discussed in **Section 6.0.**

Table 9: Zones of immediate impact for Auditory Injury & TTS from a single pulse

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	AUD INJ onset		TTS onset	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
LF cetaceans (e.g. baleen whales)	222	10	216	20
HF cetaceans (e.g. killer whales and dolphins)	230	-	224	-
VHF cetaceans*	202	100	196	170
PCW (e.g. leopard seals)	223	-	217	20
OCW (e.g. fur seals)	230	-	224	-

*Note: a dash indicates the threshold is not applicable; * indicates species not expected in the AOI.*

The results presented in **Table 9** indicate that for a single hammer strike to cause physical effects (TTS or AUD INJ) to any individual marine mammal that has been identified as having a potential presence in Tauranga Harbour/Te Awanui (noting that no VHF cetaceans are expected either in the harbour or in the wider AOI), that individual would need to be very close to the noise source, i.e., closer than 20 m.

While these results are useful for understanding the basic characteristics and intensity of piling noise, a more realistic scenario would be that an animal is exposed to multiple hammer strikes (pulses) over time, or cumulative impact. The cumulative impact results are presented for between 10 and 8,000 hammer strikes over a 24 hour period in **Table 10** below.

Table 10: Zones of cumulative impact for AUD INJ and TTS from multiple piling pulses

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels					
	AUD INJ onset			TTS onset		
	Criteria - Weighted SEL24hr dB re 1 μPa2·s	No. of pulses	Maximum threshold distance, m	Criteria - Weighted SEL24hr dB re 1 μPa2·s	No of pulses	Maximum threshold distance, m
LF cetaceans (e.g. baleen whales)	183	10	120	168	10	640
		100	330		100	1,430
		200	520		200	1,850
		1,000	940		1,000	2,390
		2,000	1,190		2,000	2,450
		5,000	1,680		5,000	2,460
		8,000	1,930		8,000	2,550
HF cetaceans (e.g. killer whales and dolphins)	193	10	20	178	10	50
		100	40		100	150
		200	50		200	210
		1,000	110		1,000	510
		2,000	130		2,000	670
		5,000	180		5,000	940
		8,000	240		8,000	1,170
VHF cetaceans*	159	10	90	144	10	300
		100	190		100	910
		200	250		200	1,260
		1,000	540		1,000	2,350
		2,000	720		2,000	2,440
		5,000	1,140		5,000	2,620
		8,000	1,310		8,000	2,620
PCW (e.g. leopard seals)	183	10	60	168	10	270
		100	170		100	810
		200	240		200	1,130
		1,000	450		1,000	2,160
		2,000	640		2,000	2,380
		5,000	940		5,000	2,450
		8,000	1,170		8,000	2,450
OCW (e.g. fur seals)	185	10	30	170	10	110
		100	70		100	270
		200	100		200	380
		1,000	150		1,000	870
		2,000	240		2,000	1,170
		5,000	320		5,000	1,680
		8,000	430		8,000	2,200

*Note: an * indicates species not expected in the AOI.*

The results presented in **Table 10** give the predicted onset distances for AUD INJ and TTS for cumulative exposure to piling noise within a 24 hour period for the different marine mammal functional hearing groups theoretically exposed to between 10 and 8,000 hammer strikes (pulses). Here the onset distances for both AUD INJ and TTS increase with increasing number of hammer strikes.

Given the predicted occurrence of both bottlenose dolphins and killer whales inside the harbour on an occasional basis and their threatened conservation threat status, the results for the high frequency cetaceans (the group to which these species belong) are of primary interest. For these species the model predicts that AUD INJ would only occur if individuals were within 20-240 m of pile driving activities and were subject to between 10 and 8,000 hammer strikes (respectively) within a 24 hour period. For high frequency cetaceans the maximum TTS onset distance is 1,170 m; hence, TTS could be expected out to this distance if individuals were to remain in this zone and be exposed to 8,000 hammer strikes within 24 hours. These results also apply to common dolphin, false killer whale, pilot whales, and beaked whales, as they are also considered to be high frequency cetaceans; however, these species are only expected to occur outside the harbour, hence are highly unlikely to be present within the zones of impact for AUD INJ or TTS from pile driving.

The other species predicted to have an occasional presence inside Tauranga Harbour/Te Awanui during development activities is the New Zealand fur seal which is characterised as an otariid pinniped (OW). For this species, the zone of AUD INJ is limited to within 430 m (for 8,000 hammer strikes within 24 hours) and the maximum TTS onset distance for fur seals is 2,200 m if an individual seal was exposed to 8,000 hammer strikes within this zone over 24 hours.

All other species occur in Tauranga Harbour/Te Awanui only as rare visitors (including baleen whales/LF cetaceans and leopard seals/PW) or are not expected at all (VHF cetaceans). In terms of those species which occur as rare visitors, the following findings are of relevance:

- Baleen whales belong to the LF group, and for this group the model predicts relatively large impacts compared with dolphins (HF cetaceans). For baleen whales AUD INJ is predicted to occur out to 1.9 km and TTS is predicted to occur out to 2.5 km for exposure to 8,000 hammer strikes within 24 hours. However, even exposure to the noise from 200 hammer strikes could cause AUD INJ out to 520 m. The sound exposure level (**SEL**) contours that underpin these zones of impact are illustrated in **Figure 9**. While this appears to be of concern, it is noteworthy that these zones are restricted to inside the harbour and the likelihood of a baleen whale occurring here is extremely low (see **Section 3.2.1**); with the likelihood of large whales being present in the harbour and going undetected being virtually nil. Sound propagation from piling does not extend into open waters beyond the harbour entrance due to the very high attenuation along the inner harbour area beyond the channel.
- For leopard seals (PW), exposure to the noise from 8,000 hammer blows within 24 hours could cause AUD INJ out to 1.17 km from the construction site and TTS out to 2.45 km. Again, this zone is restricted to within Tauranga Harbour/Te Awanui and the likelihood of a leopard seal occurring inside the harbour is low.

It is noteworthy that the model assumes that animals remain inside the impact zones for the entire 24 hour period. On this basis, these predictions very much represent the worst case scenario as it is extremely unrealistic that marine mammals would occur around piling activities for this length of time or for a high number of hammer strikes. The more realistic scenario is that underwater piling noise will be audible to marine mammals' tens of kilometres from the construction site and individuals will exhibit avoidance responses to avoid injurious levels of piling noise by choosing not to enter the harbour while piling is underway.

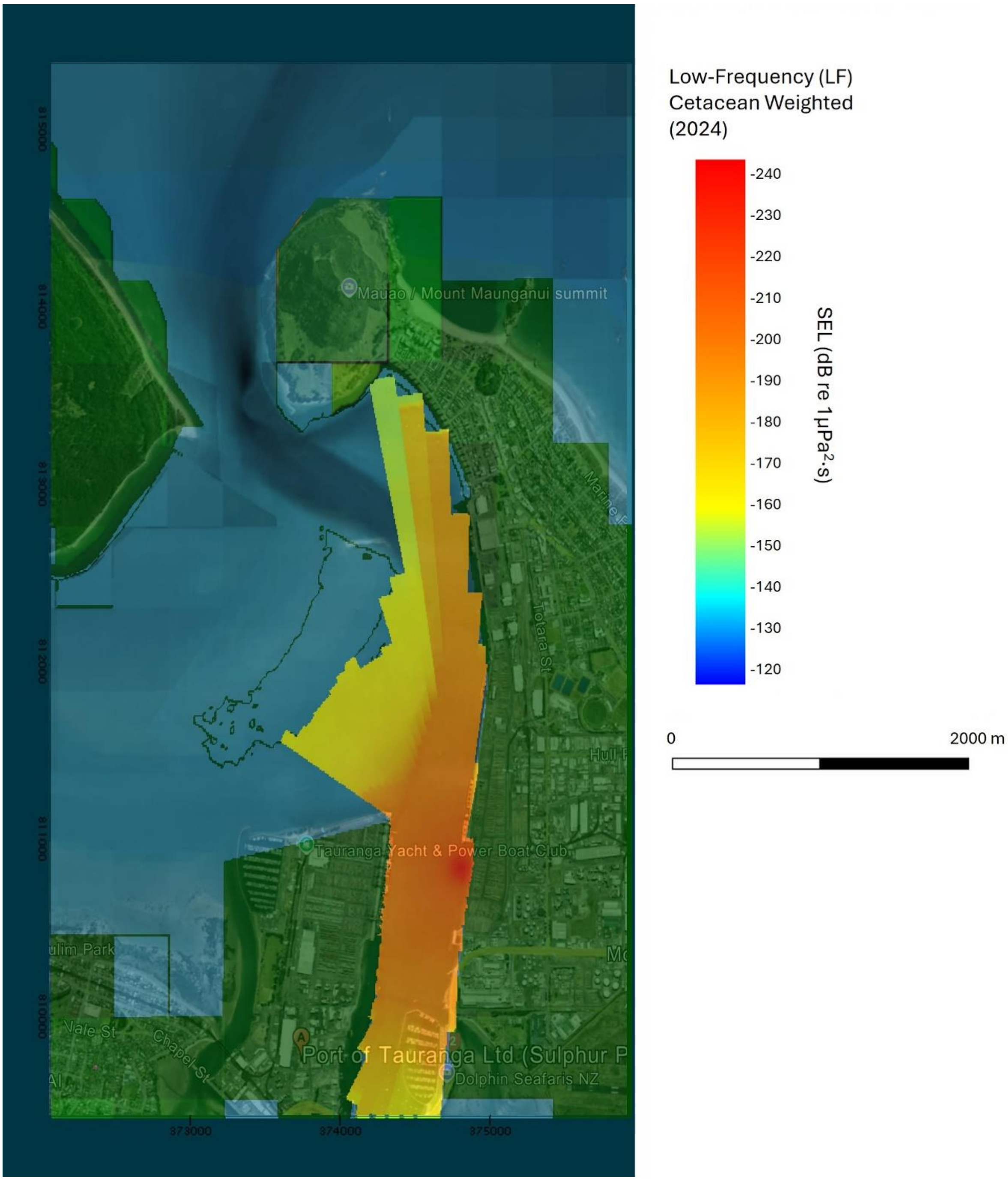

Figure 9 Modelled maximum SELs (for 8,000 pulses) that underpin predicted zones of AUD INJ and TTS for baleen whales during pile driving

Table 11: Zones of impact for behavioural changes from a single impact piling pulse

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels	
	Behavioural disturbance	
	Criteria - SPL RMS, dB re 1µPa	Maximum threshold distance, m
All hearing groups	160	1,700

Table 11 presents the model findings for behavioural effects on marine mammals from piling noise and the following key points are noted:

- Avoidance reactions from marine mammals to underwater piling noise are expected during the project (following Leunissen & Dawson, 2018; Bailey et al., 2010 and Brandt et al., 2011) and on this basis, cetaceans are unlikely to enter the harbour while piling activities are underway. The model predicts that strong behavioural responses (e.g. severe startle responses) will be largely limited to within Tauranga Harbour/Te Awanui; hence while effects on marine mammal behaviour outside the harbour are possible, these effects will be of low ecological significance and effects on the migratory behaviour of whales are unlikely. It is noteworthy that avoidance behaviours are essentially protective; in that they reduce an individuals' exposure to high levels of noise, hence reduce the risk of AUD INJ or TTS; and
- Given the predicted avoidance effect, cetaceans are unlikely to enter the harbour while piling activities are underway. However, there is a risk that pile driving could commence while animals are already in the harbour, effectively blocking their escape route. Specific mitigation measures to address this possibility are included in **Section 4.2.3.1** below.

The project specific acoustic modelling (undertaken by Vallarta & Eickmeier, 2025) did not specifically address the zone of masking (or LSR) for the proposed pile driving. However, and despite some variations in project specific details (e.g. differences in bathymetry, sound speed, sediment type, pile size/type, hammer weight/power etc.), the masking predictions for Northport (Styles Group, 2022) provide an indication of the general scale of masking zones from impact piling in a harbour setting; suggesting that masking effects do not extend beyond 3 km from the construction site. Hence, it seems probable that masking associated with the Stella Passage project will mostly be restricted to within Tauranga Harbour/Te Awanui. In the absence of LSR calculations for Stella Passage, a conservative approach should however be taken, and on this basis, it is assumed that some masking effects could extend beyond the harbour entrance. This assumption aligns with the general acceptance that the scale of masking effects can extend well beyond the noise source and towards the limits of audibility (Erbe et al., 2018; Gomez et al., 2016).

As previously noted, marine mammals are expected to avoid Tauranga Harbour/Te Awanui while piling is underway. However, the two cetacean species most likely to enter the harbour (hence potentially come into close contact with underwater pile driving noise) are killer whales and bottlenose dolphins. Echolocation frequencies for these two species are 22 to 80 kHz and 23 to 102 kHz respectively (see Southall 2019) indicating that these species have greatest hearing sensitivity in these high spectrum ranges. However, bottlenose dolphins and killer whales have shown some hearing sensitivities to signals as low as 100 Hz and 500 Hz respectively (Hall and Johnson, 1972; Popov and Klishin, 1998; Szymanski et al., 1999). While pile driving noise is broadband, high frequency components rapidly attenuate with distance (Bailey et al., 2010) indicating that the zone in which the masking of echolocation signals will occur would be relatively small, but that masking of other vocalisations could occur over a wider area (following David, 2006).

Also of relevance to potential behavioural effects is the possibility that pile driving noise could prohibit any cetaceans that may be present in the inner harbour (i.e. up-harbour from Stella Passage) from exiting to the open sea, and that this could theoretically increase the risk of whale and dolphin strandings. Of particular concern are animals that pass through Stella Passage during the night, and which could then become entrapped in the inner harbour if piling occurred the following day. Given the findings of **Section 3.2.1** and **Section 3.2.2** the species most at risk of entrapment would be bottlenose dolphins and killer whales; however, 1) the DOC Sighting Database includes a total of only eight reports of killer whales in the inner harbour, and only one report of bottlenose dolphins; and 2) the acoustic monitoring results also found that animals seldom pass through Stella Passage into the inner harbour. The extremely low sightings rates of these species in the inner harbour suggest that the likelihood of entrapment is very low. Despite this, several mitigation measures (see **Section 4.2.3.1**) have been specifically developed to address the risk of cetacean entrapment in the inner harbour.

In addition to impact piling, which is the focus of the discussion above, a small component of vibro-piling will occur at the outset of the project in association with reclamation (as described in **Section 2.1**). While vibro-piling generates continuous noise, the sound pressure levels generated are substantially lower than those of impact piling (Clement, 2017); hence, the effects will be of lower magnitude to marine mammals.

4.2.3.1 Recommended Mitigations – Pile Driving

In response to the model findings and considering the scientific literature discussed above, the following suite of mitigation measures are recommended in keeping with national and international best practice.

- The use of dedicated trained marine mammal observers (**MMOs**) to undertake visual monitoring for the presence of marine mammals both before and during all pile driving operations;
- Pre-start monitoring – the presence of marine mammals should be visually monitored by a MMO for at least 30 minutes before piling commences using a soft start procedure;
- Soft start – if marine mammals have not been observed inside the shutdown zone during the pre-start observations, soft start may commence with piling impact energy and/or frequency gradually increased over a 10-minute time period. A soft start will also be used after breaks of more than 30 minutes in piling activity;
- Normal piling – if marine mammals have not been observed inside the shutdown or observation zones during the soft start, piling at full impact energy may commence. Visual observations will continue throughout piling activities;
- Stand-by – if marine mammals are detected within the observation zone during the soft start or normal operational piling, the operator of the piling rig will be placed on stand-by to shut down the piling rig, while visual monitoring of the animal continues. Pile driving can still continue while marine mammals are beyond the shutdown zone; and
- Shutdown – if a marine mammal is sighted within or are about to enter a designated shutdown zone, piling activity should be stopped immediately. If the animal is observed to move outside the zone again, or 30 minutes have elapsed with no further sightings, piling activities will recommence with the soft start procedure. If a marine mammal is detected in the shutdown zone during a period of poor visibility, operations will stop immediately until visibility improves.

- The following recommendations are made with regard to the size of shutdown zones and observation zones. Noting that these recommendations are based on sound propagation modelling for 8,000 hammer blows per day and account for differences in hearing sensitivity between species:
  - The recommended shutdown zone for high frequency cetaceans (bottlenose dolphins, killer whales, common dolphin, false killer whale, pilot whales, and beaked whales) and fur seals is a 500 m in-water radius around the construction site;
  - An extended shutdown zone is recommended for baleen whales and leopard seals as defined by the extent of the harbour (illustrated in **Appendix F**), i.e. pile driving operations will cease or will not commence if any baleen whales or leopard seals are detected within waters inside the harbour or are known to be present in harbour waters (regardless of proximity to the construction site); and
  - The recommended marine mammal observation zone (**MMOZ**) for all marine mammal species is a 500 m radius around the construction site with an extension down the shipping channel towards the harbour entrance where possible. Noting that in good visibility, observations will be possible over a distance of approximately 3 km.
- In addition to pre-start monitoring of the MMOZ, 30 minutes of 'inner harbour observations' (to detect cetaceans up-harbour of Stella Passage) should be conducted prior to commencing piling operations each day. This mitigation measure seeks to reduce the likelihood of cetaceans becoming 'trapped' in the inner harbour during active piling;
- If any cetacean sighting is made or reported from the inner harbour whilst piling is underway, piling will immediately cease for the remainder of the day or until the animal/s are seen to depart through Stella Passage and are clear of the relevant shutdown zone. The presence of fur seals in the inner harbour will not trigger any management actions as this is a non-threatened species to which the risk of stranding does not apply;
- Prior to piling operations beginning on the morning after any inner harbour cetacean sightings were made, an additional boat search should be made of the inner harbour (as far as Maungatapu Bridge) to check for the presence of cetaceans;
- The development of a communication network that will serve as an "Alert System for marine mammals in Tauranga Harbour'. This system should actively seek information regarding marine mammal detections inside Tauranga Harbour/Te Awanui from other marine users. This recommendation is made specifically to support the extended shutdown zone for baleen whales and leopard seals. This network should include all MMOs, vessel pilots, the Harbour Master, and DOC to facilitate the immediate reporting of marine mammal sightings within Tauranga Harbour/Te Awanui. Given the rarity of sightings of baleen whales and leopard seals in the harbour, pre-start observations beyond the MMOZ and inner harbour (as described above) for these species are neither recommended nor considered necessary;
- Full records of all marine mammal sightings and mitigation actions should be made from all construction sites and assets during the project;
- To ensure underwater noise impacts are minimised, pile driving equipment (i.e. hammer type, hammer size and driving force) and power regime (i.e. hammer energy) should be carefully selected and daily piling duration (for vibro-piling) and/or strike rate (for impact piling) should be minimised as far as practicable while still

achieving construction goals. By minimising the daily piling duration/strike rate, lower cumulative SELs are achieved, hence the extent of any impact is also minimised;

- Cushion blocks and bubble curtain technology should be used to reduce underwater noise propagation during impact piling associated with the installation of steel piles. In particular, bubble curtains will serve to reduce the distance over which TTS could occur and assist with protecting high frequency cetaceans beyond the 500 m shutdown zone;
- The results of the acoustic propagation modelling should be validated by *in situ* measurements soon after the commencement of pile driving activities and further noise attenuation measures will be adopted if necessary to ensure the size of the shutdown zones are appropriate to protect marine mammals from AUD INJ;
- The preparation of a Marine Mammal Management Plan (**MMMP**) to describe in detail all measures that are to be adopted to avoid the effects on marine mammals from pile driving operations. The draft MMMP is included as **Appendix F**. As a precaution, vibro-piling operations should adopt the same mitigations as those developed for impact piling[5], with the exception of bubble curtain technology and model validation. The draft MMMP has been developed on this basis.

While restrictions on timing and duration are sometimes used to reduce impacts of pile driving noise on marine mammals, this strategy is not recommended for the project as marine mammals are not resident specifically to Tauranga Harbour/Te Awanui and there are no obvious temporal trends in harbour use. In addition, underwater noise modelling does not predict strong behavioural responses outside of the harbour, therefore effects on marine mammals present outside the harbour (including migrating whales) are expected to be minimal.

4.2.3.2 Assessment Results – Pile Driving

The potential underwater noise effects of pile driving for both Stage 1 (total of 420 piles) and Stage 2 (total of 752 piles) have been considered in this assessment. While the number of piles to be installed during Stage 2 is greater, on a daily basis the intensity of piling activity will not change (i.e. maximum 8,000 hammer strikes per day) between these two stages. The only variable between stages will be the duration (number of days) required to complete the work. Hence, at any one time (i.e. on any one piling day) there is no appreciable difference in the likelihood or magnitude of effects that marine mammals may be subject to.

It is however noteworthy that during active piling, and for both project stages, marine mammals are expected to avoid Tauranga Harbour/Te Awanui. The longer duration associated with Stage 2 means that the period of potential displacement from the harbour will be greater for this stage than for Stage 1 but given that marine mammal presence in the harbour is not continuous and neither is piling activity, opportunities for animals to enter the harbour will still occur during the construction period (i.e. at night and during non-piling days). All recommended mitigations (**Section 4.2.3.1**) are relevant to both stages and the assessment results outlined below are equally relevant to the proposed Stage 1 and Stage 2 piling activities.

Assuming the mitigation recommendations as outlined above are adopted in accordance with the detail outlined in the draft MMMP, the likelihood of adverse effects on marine mammals from pile driving noise from the Stella Passage Development will be <u>moderate</u> and the magnitude of predicted effects will be <u>minor</u> as:

[5] On the basis that sustained vibro-piling can result in reasonably high cumulative sound exposure levels, that, depending on duration, can approach those generated during impact piling.

- Marine mammals are expected to exhibit avoidance responses at distances greater than the predicted AUD INJ and TTS onset distances, thereby avoiding injurious levels of piling noise;
- Even if marine mammals do come into the predicted zones of cumulative impact for AUD INJ and TTS, their presence here is likely to be transient (i.e. much shorter than the 24-hour period used by the model (or indeed, the 12 hour daily operational period); hence exposure to high numbers of hammer strikes in close proximity is unlikely);
- The actual zones of impact for AUD INJ and TTS will be smaller than those predicted as the model predictions assume the worst case scenario (e.g. 100% power during all operations and that all piles will be driven with the 14 tonne hammer; where this doesn't accurately reflect reality as most of the driving will be at 50% power and the 10 tonne hammer will be used for all but the back three rows) and cushion blocks and bubble curtains will further reduce the source noise below that which was modelled;
- Predicted noise levels are unlikely to cause permanent hearing effects for any marine mammal. The use of shutdown zones will provide complete protection from mortality or AUD INJ for all species that are 'likely' to occur or could 'possibly' occur in Tauranga Harbour/Te Awanui and the wider AOI; hence no population level effects are anticipated;
- While noise levels are predicted to cause TTS out to c. 2.5 km from the source for baleen whales and leopard seals, avoidance of the harbour by these species is predicted during piling, and the recommended shutdown zones will provide full protection to these species;
- While the recommended shutdown zones do not provide full protection against TTS for HF cetaceans and fur seals (e.g. HF cetaceans could experience TTS if exposed to 1,000+ strikes out to c. 1.2 km, and fur seals could experience TTS if exposed to 200+ strikes out to c. 2.2 km), these risks have been assessed as being acceptable on the basis that 1) the actual zones of impact will almost certainly be substantially smaller than those predicted; 2) the likelihood of marine mammal presence in Stella Passage is low; 3) seals are able to avoid loud underwater noise by swimming with their heads above water (Mikkelsen et al., 2017); and 4) TTS is a temporary effect for exposed individuals; hence, no population level (i.e. taxa) effects would occur from the infrequent occurrence of TTS. Furthermore, and of critical importance, in-situ acoustic monitoring of actual underwater impact piling noise during the installation of steel piles is a requirement of the MMMP at project commencement. The purpose of this monitoring is to ensure that the size of the shutdown zones is appropriate. The MMMP includes a provision for adjusting the shutdown zones as necessary in accordance with the results of this monitoring;
- Strong behavioural effects are only predicted to occur within the harbour and 1) the shutdown requirements will provide protection from severe behavioural effects in the immediate vicinity of the construction site for dolphins, killer whales and fur seals; 2) the harbour-wide shutdowns required for baleen whales and leopard seals will provide excellent protection against behavioural effects for these species; and 3) avoidance of the area (which constitutes a behavioural response) has a protective function in that it prevents animals from exposure to auditory injury; and
- While general avoidance effects and masking are expected over a larger area (including outside the harbour where marine mammal presence is more consistent), individual animals will only experience these effects intermittently; hence no ecologically significant consequences are expected, and furthermore, only a very

small proportion of any individual marine mammals' home-range (<5% of total habitat area) will be affected.

4.3 Presence of Structures in the Water Column

Marine mammals are typically highly aware of their surroundings and possess exceptional abilities to detect and avoid obstacles in the water column. Sound plays an important role in navigation for marine mammals and can be used in several ways. Many species are believed to avoid coastlines and reefs by using the acoustic cue of breaking waves, while others can also emit sounds and interpret the reflected signal (echolocating) as a way of mapping their local underwater environment (DOSITS, 2021). Despite these abilities, obstacles in the marine environment represent a potential risk of displacement, collision, entanglement or entrapment to marine mammals. The level of risk varies according to the factors listed in **Table 12** (following Wilson et al. 2007).

During the project, piles will be driven into the seabed and will extend through the water column to support the new wharf extensions, the permanent physical presence of piles will result in marine mammals being displaced from the small portion of the water column that they occupy. However, any displacement effects are predicted to be insignificant as 1) very few marine mammal species routinely use the waters of Stella Passage, 2) the area of potential displacement is miniscule compared to the home ranges of marine mammals; and 3) alternative coastal habitat is plentiful (even within the harbour).

Physical structures in the marine environment can also increase the potential risk of collision, entanglement or entrapment for marine mammals; however, entanglements of New Zealand marine mammals are typically associated with unattended fishing gear (Laverick et al., 2017) and collisions are typically associated with ships as discussed in **Section 4.5**. According to the DOC Incident Database, entrapment in coastal structures is very rare in New Zealand. In 2020, a juvenile minke whale became stuck and died under a jetty at Hobsonville, Auckland (Stuff, 2020). In this news report, the General Manager of Project Jonah was quoted as saying "I've never heard of a whale becoming stuck like this before it is very unusual". More recently, a juvenile pygmy blue whale became trapped under a wharf on Kawau Island and was subsequently freed. DOC was quoted as describing the situation as 'highly unusual' (Stuff, 2024). Given that large whales very rarely enter Tauranga Harbour/Te Awanui, and the only record of a large whale and calf inside the harbour was made by the harbour entrance (i.e. no records of calves in the port zone or inner harbour), the possibility of entrapment in wharf structures associated with project activities is very small.

The pile spacing for the proposed wharf extensions at Sulphur Point and Mount Maunganui are in keeping with the existing wharves with an inter-pile distance of 5.6 - 6 m from centre to centre (900 mm pile diameter). To date no entrapments have occurred in Port of Tauranga structures (pers. comm. R. Johnstone, Port of Tauranga). Pinnipeds will be virtually unimpeded as they are small and highly manoeuvrable and could easily move amongst the wharf piles.

Table 12: Risk factors for marine mammal collision or entanglement

Risk Factor	Considerations
Species	Of the large whales, right whales have limited ability to control their buoyancy which increases their susceptibility to collision. Seals and dolphins are typically highly manoeuvrable and capable of rapid turns to avoid obstacles.
Size	Generally, it is assumed that the larger the animal the less able it is to manoeuvre through spatially restricted areas. Also, most large marine mammals are accustomed to deeper offshore environments where exposure to obstacles is relatively infrequent.

Risk Factor	Considerations
Sensory Perception	Dolphins and toothed whales navigate by echolocation. The mechanism for navigation in baleen whales is not well understood; however, the use of low frequency sounds is a possibility and navigation abilities are highly refined.
Age	Young animals may not recognise an obstacle as a threat, whilst old animals may have compromised abilities to detect the threat or escape from it once perceived.
Health	As with old animals, diseased animals may have compromised abilities to detect and/or escape from threats.
Behaviour	Marine mammals can be curious, and seals and dolphins in particular often approach unfamiliar objects.
Population Density	Probability dictates that the greater the density of animals in an area, the greater the chance of collision.
Oceanic Conditions	Turbidity may affect the ability of some marine mammals to visually detect obstacles, and high current flow rates can increase collision rates. Anthropogenic sounds may also affect echo-locating abilities.
Nature of Obstacle	Solid, stationary obstacles are more easily detected by echolocating marine mammals as they have higher acoustic reflectivity. Proximity and relative orientation to other objects can affect escape options.

4.3.1 Recommended Mitigation

No specific mitigations are recommended in relation to the physical presence of structures in the water column.

4.3.2 Assessment Results

In terms of the presence of structures in the water column, the potential effects of both Stage 1 and Stage 2 have been considered in this assessment. As outlined above, no ecologically significant effects are predicted from the placement of piles; hence even though Stage 2 (total of 752 piles) represents the installation of a greater number of piles than Stage 1 (total of 420 piles), both stages carry the same risk profile, and the findings below are equally relevant to Stage 1 and Stage 2.

As discussed above while objects (i.e. wharf piles) will be introduced to the coastal environment as part of the project:

- Displacement effects on marine mammals are predicted to be insignificant as very few individuals pass through Stella Passage and the area affected by new piles will be miniscule compared to marine mammal home ranges; and
- The occurrence of cetaceans becoming trapped under wharf structures is highly unusual and is therefore not predicted. Further to this, pinnipeds are small and highly manoeuvrable and for these species there is virtually no risk of entrapment in solid structures.

On this basis, the likelihood of adverse effects on marine mammals from the presence of structures in the water column will be <u>low</u> and the magnitude of predicted effects will be <u>minor</u> as no fatalities are anticipated and changes to habitat (from pile placement) are highly localised.

4.4 Habitat Modification

Several components of the project will disturb the seabed: namely, dredging, and to a lesser extent, reclamation and pile driving.

Plumes of turbidity, caused by suspended sediment from seabed disturbance

Seabed disturbance can result in habitat modification directly through the generation of plumes of turbidity (caused by an increase in total suspended sediment; **TSS**) that marine mammals can encounter.

Increased turbidity is of particular note for dredging; when the seabed is disturbed by the drag head of the dredge or by the bucket being lifted through the water column it is almost inevitable that the surrounding water column will be subject to a degree of increased turbidity. Overflow of sediment laden dredge water can also contribute to turbidity during dredging, but in general, plumes of turbidity from dredging activities are generally confined to within a few hundred metres of the point of discharge and are short lived (Hitchcock and Bell, 2004). Hydrodynamic plume modelling for dredging activity in Stella Passage was undertaken by Montaño (2024) and predicts that highest suspended sediment concentrations (SSC) will occur in the bottom layer of the water column (on account of the drag head operating at the seabed). For the most part, highest SSC values are spatially restricted to within a 200 - 600 m radius of the dredging location. While surface plumes from will occur, they will be smaller and are predicted to have lower SSC values. The model results predict that disturbed sediment will settle rapidly.

If encountered by marine mammals, areas of increased turbidity can result in patches of habitat (both temporal and spatial) that are characterised by reduced visibility. However, there is little evidence to suggest that marine mammals are adversely affected by suspended sediment as they are tolerant of turbidity and typically don’t rely heavily on vision for foraging and navigation (Todd et al., 2015). Indeed there are many examples of marine mammals generating sediment plumes themselves during normal foraging behaviours; for example mud ring feeding in bottlenose dolphins (see Kiszka et al., 2022); and killer whales hunting for rays in shallow waters (see DOC, 2014). This in itself is indicative of tolerance for turbid conditions.

While data is limited on how fish (potential prey species of marine mammals) respond to increased turbidity, data suggests that when exposed to sub-lethal concentrations of suspended sediment, fish will swim away from a sediment plume and this avoidance will be triggered at TSS concentrations of 100 mg/L (NIWA, 2014). While predictions regarding TSS levels for the proposed dredging activities in Stella Passage are not available, exceedance of this threshold in Stella Passage during active dredging is considered to be unlikely as TSS levels exceeding 100 mg/L have only been predicted when dredge spoil is released at the offshore disposal sites (Montaño, 2025). Even so, if exceedances of this threshold did occur in Stella Passage; relative to marine mammal home ranges and potential foraging habitats, the area of exceedance would be small and of no ecological significance.

Trophic interactions

In addition, the seabed is important habitat for those marine mammal species that rely directly on benthic organisms as a primary source of food. For these species, disturbance to the seabed has the potential to affect the quality and availability of benthic prey which ultimately can affect the health of individuals and resilience of the populations that they belong to.

Of the marine mammal species that are likely to be present in the AOI, bottlenose dolphins, killer whales, New Zealand fur seals, common dolphins, long-finned pilot whales, and leopard seals are known to exploit benthic prey (see **Table 13**); however, none of these species rely solely on benthic prey; instead benthic prey contributes to a broader overall diet that includes both benthic and pelagic species. Benthic prey species that marine mammals target on the seabed are most likely to be large mobile epifauna (for example larger species of crabs and bivalves) that will be relatively tolerant of low levels of disturbance (Lohrer et al. 2004), or demersal fish that would most likely move out of heavily disturbed areas.

Changes to prey availability of marine mammals might occur either through a) fish or mobile epifauna avoiding areas of increased turbidity caused by project activities; or b) the reduction of productive benthic foraging habitat through sediment deposition from plumes of turbidity or the removal of sediment during dredging or reclamation.

Several studies of relevance to the impacts of seabed disturbance on the potential prey species of marine mammals in and around Tauranga Harbour/Te Awanui are summarised by de Luca (2024). For instance, Leonard et al. (2020) described marine species assemblages in Tauranga Harbour/Te Awanui and concluded that species diversity and abundance was relatively stable over time despite the periodic occurrence of dredging, and de Luca (2024) states that port operations (including dredging) have had little influence on fish abundance, noting that the port area supports significant fish populations. Furthermore, Battershill (2022) concluded that recolonisation and recovery of soft sediment benthic habitat in Tauranga Harbour/Te Awanui will occur relatively quickly (within 1-3 years) following disturbance such as dredging activity. Modelling also confirms that during dredging in Stella Passage, the highest values of deposition to the seabed will be mostly constrained within 200 m of the dredge site, and beyond this, sediment deposition thickness will be below 1 cm (Montaño, 2024). On this basis, potential effects associated with prey quality and availability are not expected to be of ecological significance for marine mammals that are highly mobile and can readily avoid areas affected by direct disturbance or suspended sediment in favour of nearby alternative habitat.

Table 13: Foraging ecology of marine mammals that could occur in the AOI

Species	Foraging Ecology	Benthic Prey?
Bottlenose dolphin	Varied diet of fish and squid (Blanco et al., 2001; Gowans et al., 2008, Constantine & Baker, 1997). Foraging dives in both shallow and deep habitats (to depths of over 500 m) (Wells & Scott, 2009). Diet includes both benthic and pelagic prey.	**Yes**
Killer whales	Killer whales around the North Island are generalist foragers that opportunistically take advantage of prey (Visser, 2007) Benthic foraging for rays is common around New Zealand's coast (Visser, 1999). Diet includes both benthic and pelagic prey.	**Yes**
New Zealand fur seal	Forage on a range of species, with relative importance of each prey item varying by season. Arrow squid are important prey in summer and autumn, lanternfish are taken year-round, barracouta and jack mackerel are major contributors to the summer diet, while red cod, ahuru, and octopus are important in winter (Harcourt et al., 2002). Diet includes both benthic and pelagic prey.	**Yes**
Common dolphins	Diverse diet of fish and cephalopod species. Primary prey species in New Zealand are pelagic, including arrow squid, jack mackerel and anchovy, but the overall diet does include some benthic prey (Meynier et al., 2008). Diet changes with body size, sex and season (Peters et al., 2020). Diet includes both benthic and pelagic prey.	**Yes**
Southern right whale	Utilise offshore summer feeding grounds in Antarctic waters to feed on krill by lunge feeding in mid- or surface waters. Do not typically feed during coastal winter presence in New Zealand (Carroll et al., 2011). Diet does not include benthic prey.	No
Leopard seal	Diet includes birds, mammals, benthic and pelagic fish and invertebrates (Halls-Apsland and Rogers, 2004). Includes both benthic and pelagic prey.	**Yes**
Long-finned	Information is limited for this species in New Zealand, but stomach content analysis of five stranded individuals suggests a cephalopod diet of both	**Yes**

Species	Foraging Ecology	Benthic Prey?
pilot whales	pelagic squid and benthic octopus (Beatson et al., 2007). Diet includes both benthic and pelagic prey.	
Gray's beaked whale	Diet appears to vary with location but includes meso-pelagic fish and squid (Pitman et al., 2020). Diet does not include benthic prey.	No
False killer whale	Feed on a variety of oceanic squid and fish, with diet occasionally supplemented with marine mammals (Baird, 2009). Diet does not include benthic prey.	No
Humpback whale	Feed on krill and small pelagic schooling fish by lunge feeding in mid- or surface waters (Murase et al., 2002). Diet does not include benthic prey.	No
Bryde's whale	Feed on schooling fish (e.g., anchovies, herring, pilchards and mackerel) (Omura, 1962), krill & plankton (Constantine et al., 2012). Diet does not include benthic prey.	No
Minke whale	Feed on krill and a variety of other small schooling fish by lunge feeding in mid- or surface waters (Cooke et al., 2018). Diet does not include benthic prey.	No
Blue whales	Feed on krill and other zooplankton by lunge feeding in mid- or surface waters (Acevedo-Gutierrez et al., 2002). Diet does not include benthic prey.	No
Sei whale	Feed on zooplankton, pelagic schooling fish and squid (Cooke, 2018a). Diet does not include benthic prey.	No

Narrowing of Stella Passage

The proposed Sulphur Point wharf extension will effectively narrow the southern end of Stella Passage to c. 260 m. This represents a decrease of approximately 20% from the present passage width at this southernmost point. While it seems logical that narrow or confined waterways could potentially displace marine mammals and dissuade them from accessing adjoining habitat, this effect is not well recognised. Instead, displacement is typically associated with disturbance (such as underwater noise, see **Section 4.2**) as opposed to spatial confinement.

It is not uncommon for bottlenose dolphins and orca to utilise narrow waterways in other parts of New Zealand and internationally, for example:

- Killer whales have been documented swimming between the lanes of mussel farm buoys in shellfish farms (Visser, 2020); where the available space between header lines is typically 20 m;
- Killer whales are frequently reported feeding in harbours around northern New Zealand (Visser, 1999) where it is not uncommon for groups to be observed in shallow (< 12 m) confined waters e.g. Marsden Cove Marina (Newshub, 2020), Bayswater Marina (Yeoman, 2016), Whangamata Estuary (Bay of Plenty Times, 2016);
- Diaz-Lopez & Methion (2017) clearly demonstrated that bottlenose dolphins use mussel farms on the northwest coast of Spain as regular habitat. This again demonstrates how well these animals can navigate through confined waterways; and
- In addition to this, bottlenose dolphins are frequently seen in New Zealand harbours (e.g. Gulf Harbour: Stuff, 2018; Otago Harbour: Brough et al., 2015), they are also commonly seen in the Marlborough Sounds (Merriman et al., 2009), Paterson Inlet (Brough et al., 2015) and Fiordland (Currey et al., 2008); all of which have sections of spatially confined habitat.

Stella Passage is already narrow, heavily modified, and busy with shipping traffic, yet despite this, bottlenose dolphins, killer whales and New Zealand fur seals still utilise it to access the inner harbour on occasion. It is anticipated that these species will continue to do so even if the passage width is narrowed at the southern end. These species are already exhibiting a degree of habituation to narrow waterways and coastal development through their current occasional presence in this, and other, built-up environments. It is also noteworthy that when cetaceans do use the inner reaches of Tauranga Harbour/Te Awanui, they travel underneath the Harbour Bridge, navigating their way between the bridge support piles which have an approximate spacing of less than 40 metres. These inter-pile spaces are significantly narrower than the proposed new dimensions of Stella Passage. On this basis, it seems unlikely that the risk of displacement or entrapment of these species will change as a result of the proposed changes to the width of Stella Passage.

4.4.1 Recommended Mitigations

No specific mitigations are recommended in relation to potential habitat modification effects.

4.4.2 Assessment Results

The potential habitat modification effects for both Stage 1 and Stage 2 have been considered in this assessment. Both Stage 1 and Stage 2 will contribute to the proposed narrowing of Stella Passage; as both stages include piling and reclamations as part of the southern wharf extensions. On this basis, the findings below are relevant to Stage 1 and Stage 2.

The discussion above identifies that direct exposure of marine mammals to plumes of turbidity/suspended sediment are predicted to have no material effects on any individuals foraging success. And while small scale changes to prey availability could occur in response to sea bed disturbance or sediment plumes, these changes are unlikely to be of ecological significance to marine mammals. Furthermore, any potential effects associated with the narrowing of Stella Passage will be no greater than those associated with the existing channel layout. Therefore, adverse effects on the future transit of marine mammals through Stella Passage are not predicted.

The likelihood of adverse effects on marine mammals from habitat modification during the project activities will be <u>remote</u> and the magnitude of predicted effects will be <u>negligible</u> as:

- No marine mammals rely solely on the project area, but they do occur in Tauranga Harbour/Te Awanui on an occasional basis;
- While marine mammals are highly mobile and have ample opportunity to avoid areas of turbidity, they are well adapted to forage and navigate at depth where natural light is limited or in turbid coastal waters where visibility is restricted;
- Instead of vision, toothed whales and dolphins use echolocation to navigate and detect prey and baleen whales and pinnipeds feel for prey with their sensitive whiskers (Peyensen et al. 2012; Denhardt et al. 1998);
- Seabed disturbance (in particular dredging) is not novel to Tauranga Harbour/Te Awanui, yet despite this, marine mammals continue to utilise the harbour;
- While sediment plumes will certainly occur as a result of proposed dredging activities, elevated suspended sediment levels will be restricted both spatially and temporally (see Montaño, 2024), and because of this the footprint of affected benthic habitats will be small compared to the potential marine mammal foraging habitat in the AOI;
- While some marine mammals do have a benthic component to their diets, none are solely reliant on benthic prey (consuming a mixture of benthic and pelagic prey species);

- The dredging component of the project (which will cause the greatest extent of seabed disturbance) is only anticipated to have a 12-month duration after which maintenance dredging of this area will be required periodically;
- Any marine mammal species that do forage within the AOI can access nearby alternative foraging habitat of similar quality, noting that all the marine mammal species expected in the AOI have a home-range that is vast in comparison to the project site; and
- There are numerous examples of marine mammals successfully navigating narrow passages of water, including within Tauranga Harbour/Te Awanui itself.

Given that reclamation, pile driving and dredging will occur during both Stage 1 and Stage 2 of the proposed project, both stages will contribute to sea bed disturbance. However, the exact turbidity/TSS effects that a marine mammal may be exposed to on a daily basis will depend on the specific activities that are being undertaken.

4.5 Ship Strike

There are two potential pathways of effect for ship strike during the project, 1) the movement of the dredge vessel/s and 2) increased shipping rates into the Port of Tauranga that could materialise following the completion of the development works.

The term 'ship strike' refers to the collision of a marine mammal with a vessel, and as ship strike events can result in death or life-threatening injuries to whales and dolphins, they are of global conservation concern (IWC, 2014). A number of factors influence the likelihood of collisions, these are:

- Vessel size – larger vessels (> 80 m) are more frequently involved in collisions with marine mammals than smaller vessels (Laist et al., 2001; Jensen & Silber, 2003). Large vessels usually have deeper drafts, hence a larger strike area (Schoemann et al., 2020);
- Vessel speed – most lethal marine mammal collisions involve vessels travelling at faster speeds (> 12 knots; Laist et al., 2001; Vanderlaan & Taggart, 2007) because higher speeds increase the risk of blunt force trauma (Wang et al., 2007);
- Species – large whales are the most common victims of collisions (e.g., fin whales, right whales, humpback whales, minke whales and sperm whales) (Laist et al., 2001; Jensen & Silber, 2003; Van Waerebeek et al., 2007). However, a recent global review of ship strike incidents by Schoemann et al. (2020) found a total of 61 marine mammal species are affected by vessel collisions and incidents involving smaller species often go unreported; and
- Behaviour - species that remain at or near the sea surface for extended periods are particularly vulnerable to collisions (Laist et al., 2001; Constantine et al. 2012); as are species that are attracted to vessels (Bejder et al. 1999; Wursig et al., 1998).

All marine mammal species potentially present in the AOI are potentially at risk of collision with operational vessels. However, data indicates that large whales are at greater risk than smaller marine mammal species (Laist et al., 2001; Jensen & Silber, 2003); where the size and agility of dolphins and seals means that these groups are more successful at avoiding potential collisions (Schoemann et al., 2020).

Jensen and Silber (2003) reported that fin whales, humpback whales, minke whales, southern right whales and sperm whales were the most likely to be involved in ship-strike incidents. Of these species, humpback whales, minke whales and southern right whales could potentially be present in the AOI (see **Section 3.2.1**).

One of the primary factors affecting the severity of each ship-strike incident is vessel speed (Jensen & Silber, 2003) where the likelihood of mortality increases with increasing speed. The mean vessel speed that results in mortality following a ship strike is 18.6 knots (Jensen & Silber, 2003) and Laist et al. (2001) found that most lethal ship-strike incidents involved vessels travelling at 14 knots or faster. Vanderlaan and Taggart (2007) reported that the probability of a lethal injury drops below 0.5 at speeds of 11.8 knots or less. The slow operational speed of dredge vessels no doubt contributes to this type of vessel being under-represented in ship strike data globally; of the 134 collisions reported globally between 1975 and 2002 only one was attributed to a dredge vessel (Jensen & Silber, 2004).

Information provided by the Port of Tauranga indicates that a typical THSD of the size intended for use during the proposed dredging activities will be dredging at a speed of 2 knots. Even though disposal of dredge spoil is not a consideration of this application, from a marine mammal perspective, it seems prudent to consider the potential for ship strike from the dredge in transit. The loaded dredge travelling to the disposal site would have a maximum speed of about 14 knots (outside the harbour), but potentially slightly faster with a full tidal flow behind them. The empty dredge returning to the harbour could be half to 1 knot faster. Based on this information, the THSD will be travelling at speeds up to 15 knots during transit to and from the disposal sites outside the harbour. Within the harbour, no speed restrictions apply, however the dredge will either be slowing down for its approach to the dredge area or building speed away from the dredge area.

Todd et al. (2015) conducted a review of the impacts of dredging on marine mammals and noted that ship strike risk is highest while dredges are in transit to and from disposal sites as speed is greater during this part of the dredging cycle. However, Tillin et al. (2011; cited by Todd et al., 2015) found that the addition of dredging vessels in areas of high shipping traffic are unlikely to increase the overall collision risk present in an area. The DOC Incident Database lists only one ship strike incident for the AOI, that being a sei whale that arrived in Port Tauranga draped over the bulbous bow of a large ship (not associated with dredging activity). While this incident was discovered on the ships arrival into the Port of Tauranga, it is unknown whether the collision occurred inside or outside the AOI, as it is possible that the whale had been lodged on the ships bow for some time. No postmortem was conducted on this whale. Furthermore, baleen whales typically migrate through Bay of Plenty waters in deeper offshore waters than those affected by the dredging activities, and the presence of migrating baleen whales is seasonally restricted (primarily winter and spring).

Despite the existing high rates of vessel traffic entering and departing the Port of Tauranga, the incidence of ship strike is remarkably low even for vessels that are much larger and faster than dredges. While the proposed dredging activities may indirectly facilitate increased levels of large ships visiting the Port of Tauranga, which could increase the ship strike risk to large whales in the AOI, the existing low levels of ship strike in the area reflects the fact that the Bay of Plenty does not support any resident concentrations of large whales and that the density of migratory whales through the region is relatively low and their presence is temporary.

4.5.1 Recommended Mitigations

The MMPR stipulate the requirements for operating vessels around marine mammals including:

- Avoid sudden or repeated changes in speed and direction near marine mammals;
- There should be no more than three vessels within 300 m of any marine mammal;
- Vessels should travel no faster than idle or ‘no wake’ speed within 300 m of any marine mammal;

- Do not circle whales and dolphins, and do not obstruct their path or cut through any group; and
- Keep at least 50 m from whales (or 200 m from any large whale mother and calf/calves).

Compliance with these regulations during the proposed dredging activities will serve to reduce the likelihood of marine mammal ship strike, as will the slow operational speed of the dredge vessels that will be used as part of the project.

4.5.2 Assessment Results

The potential ship strike risk for both Stage 1 and Stage 2 has been considered in this assessment. In essence both stages will contribute to the potential for ship strike; as both include dredging (i.e. the potential direct effects from collision between marine mammals and dredge vessels). On this basis, the findings below are relevant to both Stage 1 and Stage 2. As a legal requirement, POTL must comply with the MMPR. POTL is aware of this obligation and will ensure that all project vessels operate in accordance with the MMPR to manage the risk of ship strike during the proposed activities associated with the project. On this basis, the likelihood of ship strike will be low, and the magnitude of potential effects will be minor as no ship strike fatalities are anticipated based on the existing low levels of ship strike in the region.

Of particular relevance to this application is that the risk of ship strike is primarily associated with transit to and from the disposal sites which is when the dredge is underway at greater speed. During the active extraction phase of dredging, the likelihood of ship strike would be remote, and the magnitude of potential effects would be negligible.

4.6 Exposure to Contaminants

The resuspension of contaminated sediment during activities that disturb the seabed has the potential to affect marine mammals. Of the project activities, dredging has the greatest potential to disturb the seabed; hence is the activity of greatest relevance and is the focus of the discussion below.

Contaminants in the marine environment that are widespread and at high levels can pose health risks to many marine fauna (e.g., Williams et al., 2020). In relation to dredging activities, marine mammals can either come into direct contact with contaminants by swimming through a sediment plume or can be exposed indirectly through the consumption of contaminated prey. Being at the top of the food chain, marine mammals are particularly susceptible to bioaccumulating contaminants from their prey species (Moeller, 2003) and contaminants in marine mammals typically accumulate in blubber (Weisbrod et al., 2000).

The chemical contaminants of primary concern to marine mammals are persistent organic pollutants (i.e., organochlorines and organotins such as PCBs, DDT, TBT etc.), hydrocarbons (namely PAHs), and heavy metals (such as mercury, cadmium and lead) (De Guise et al., 2003); where the following serious health implications have been linked to contaminant exposure: immunosuppression, reproductive and developmental effects and endocrine disruption (Vos et al., 2003). Generally speaking, the source of these pollutants into the marine environment is extremely varied; however, stormwater run-off is often a ubiquitous source of contaminants (Barbosa et al., 2012). Pollutant concentrations in marine mammal tissue are variable depending on contaminant bioavailability, marine mammal habitat preferences, distribution, trophic level, and foraging ecology (Mendez-Fernandez et al., 2017; Pinzone et al., 2015; Delgado-Suarez et al., 2023); where individual variation within species (or even populations) is common and linked to age, sex and individual foraging strategies (Remili et al., 2021; Schwacke et al., 2002).

Recent analysis by Williams et al. (2023) of stranded marine mammals in Great Britain suggest that despite environmental levels of persistent organic pollutants having decreased in the marine environment following the introduction of stronger international regulations around their use (e.g. Stockholm Convention, 2001), some marine mammals continue to harbour tissue concentrations that present a toxicological risk to individual health. The findings of this study noted that of the 11 species analysed, pollutant concentrations were highest in apex predators such as orca and bottlenose dolphins. The authors also noted that marine mammal populations that utilise habitat around industrialised areas are generally the most heavily contaminated. However, in general terms, contaminant concentrations detected in New Zealand marine mammals are considerably lower than concentrations in northern hemisphere species (Jones, 1998); however, relatively few published studies are available on this topic.

With regards to metals and hydrocarbons, some prey species of marine mammals are more susceptible to bioaccumulation; with metals typically bioaccumulating in molluscs and crustaceans (Zeng et al. 2013) and hydrocarbons bioaccumulating in bivalves (Hoffman et al., 2003). Benthic foraging marine mammals could therefore be subject to some secondary contamination through the consumption of contaminated invertebrate prey, but it is noteworthy that marine mammals can metabolise and excrete hydrocarbon contaminants over time (see Ruberg et al., 2021), but this is not the case with metals which are well recognised to bioaccumulate and biomagnify (see Delgado-Suarez et al., 2023).

In areas of historical contamination, dredging has the potential to resuspend sediments and expose marine mammals to legacy pollutants (Todd et al., 2015). However, Todd et al. (2015) noted that exposure potential from such scenarios will be spatially restricted in accordance with plume size.

The likelihood of marine mammals being exposed to contaminants during the project is largely dependent on the quality of the sediment to be dredged. Sediments from Stella Passage (and other areas of Tauranga Harbour/Te Awanui) have been tested for contaminants and the following findings are of relevance:

- Sediment chemistry analysis was conducted by Boffa Miskell in 2023 for heavy metals, PAHs, PCB and TBT. The results indicate low concentrations of all contaminants, with PAHs, PCBs, and TBT below laboratory detection limits (de Luca, 2024);
- The chemistry of pipi (shellfish) flesh was also analysed by Boffa Miskel in 2023 and is a useful proxy for bioaccumulation potential. While no PAHs or PCBs were detected, heavy metals were present at concentrations above laboratory detection limits, but only arsenic (total) was present at concentrations above the ANZ (2018) default guideline values (‘**DGV**’) of the Australia and New Zealand Food Standards Code (however, the guideline value refers to inorganic arsenic which is approximately 10% or less of total arsenic). Concentrations of cadmium, lead, and mercury were below the DGV;
- Prior to the analysis by Boffa Miskell in 2023, Leonard et al. (2020 reported as part of the SPRC process that for Tauranga Harbour/Te Awanui, sediment heavy metal contamination and levels of all metals tested (As, Cd, Ch, Cu, Pb, Ni, Zn) were below the DGVs recommended by the Australia and New Zealand Guidelines for Fresh and Marine Water Quality; and
- Modelling predicts that suspended sediment plumes associated with dredging in Stella Passage will be spatially and temporarily restricted (Montaño, 2024), and this coupled with the limitations that stipulate when, where and for how long overflow will be permitted, will minimise contaminant resuspension.

Although marine mammals could occasionally be present around the dredging site in Stella Passage, all species potentially present have home ranges that are vast compared to any area that may be subject to reduced water quality. Hence, the overall degree of direct exposure for any individual marine mammal is likely to be low. Also, as discussed in **Section 4.4**, no marine mammal species is entirely reliant on the AOI for foraging habitat, and plenty of nearby alternative foraging habitat exists. On this basis, bioaccumulation is unlikely to occur as any contaminated areas that are subject to resuspension would represent a very small proportion of total foraging habitat for marine mammals. Further to this, the impact of exposure will be greatest in areas where high contaminant burdens overlap with areas defined as important marine mammal habitat (Williams et al., 2023). Neither of these are factors of relevance to this application.

4.6.1 Recommended Mitigations

No specific mitigations are recommended in relation to potential effects from contaminant exposure.

4.6.2 Assessment Results

In terms of potential exposure to contaminants, the potential effects of both Stage 1 and Stage 2 have been considered in this assessment. As both stages involve activities that will disturb the seabed (e.g. dredging), both stages contribute to the potential for marine mammal exposure to contaminants; hence, the findings below are relevant to both Stages 1 and 2.

The likelihood of adverse effects on marine mammals from chemical contaminants (via direct and indirect exposure) during the project activities will be remote and the magnitude of predicted effects will be negligible as:

- Sediments to be dredged do not contain concerning levels of heavy metals and the dredge techniques proposed will minimise contaminant resuspension in the event that other pollutants are present;
- Unlike fish, marine mammals do not assimilate oxygen through gills, but instead return to the surface to breathe; therefore, the uptake of contaminants in the water column is restricted to trophic pathways (e.g. food chain) or through direct contact with skin and mucous membranes;
- Marine mammals are highly mobile and have ample opportunity to avoid areas of poor water quality characterised by increased TSS, therefore the likelihood of marine mammals spending extended periods in contact with contaminants is low; and
- Bioaccumulation associated with the consumption of contaminated prey is unlikely given the limited extent of total foraging habitat that could be affected by any contaminants that may be present and that marine mammals can metabolise hydrocarbon contaminants.

4.7 Marine Debris

Potential impacts of marine debris on marine mammals include ingestion or entanglement of manmade objects that have been lost to the marine environment. Any maritime vessel, including dredge vessels are potential sources of debris. Coastal construction sites also represent a potential source of marine debris. Debris can enter the marine environment either as a result of careless operations (e.g. plastic litter blowing overboard) or equipment failure (e.g. dredge or construction equipment breaking and being lost to sea). Entanglement in debris (especially loose thin lines or nets) can lead to injury or drowning, and an extreme consequence of marine debris ingestion is blockage of the digestive tract leading to death by starvation, however, sublethal effects include malnutrition, disease and exposure to toxins (summarised by Baulch & Perry, 2014).

A positive side-effect of previous dredging campaigns within Tauranga Harbour/Te Awanui has been the removal of a substantial amount of marine debris from the seabed (e.g., old tyres, shopping trolleys, rope, road cones etc). Any debris collected during dredging is bought ashore and safely disposed of on land (R. Johnstone, POTL, pers. comm.). Further to this, all port staff and contractors already operate in accordance with the Resource Management Act (1991) and Resource Management (Marine Pollution) Regulations 1998, both of which require the adoption of practices that ensure waste is appropriately managed.

4.7.1 Recommended Mitigations

To minimise any adverse effects on marine mammals from marine debris the following strategies are recommended:

- Continued compliance with Resource Management (Marine Pollution) Regulations 1998 and any other relevant legislative requirements;
- A commitment to retrieve any waste or equipment lost to sea from construction sites or dredge vessels if safe to do so; and
- A commitment to collect and retrieve obvious objects of marine debris during the course of dredging and to safely dispose of these onshore.

4.7.2 Assessment Results

The potential effects of marine debris have been considered for both Stage 1 and Stage 2 in this assessment. As both stages involve activities that could contribute to the generation of marine debris, the mitigations outlined in **Section 4.7.1** and the assessment results below are relevant to both stages.

POTL has confirmed that it will adopt the recommendations outlined above during the project activities. On this basis, the likelihood of marine debris effects on marine mammals is remote, and the magnitude of potential effects will be negligible.

5.0 Artificial lighting

Pile driving and reclamation works will only occur during daylight hours, so no artificial lighting will be required for these components of the project. In comparison, dredging will occur 24 hours a day, seven days a week. The proposed capital works could take up to 12 months to complete. During the hours of darkness, dredge vessels will comply with standard navigation and safety lighting requirements.

Effects of artificial lighting on marine mammals at sea are not well studied but are likely to be limited to attraction and associated risks (MPI, 2013). While submerged underwater lighting will not be used during the proposed dredging activities the operational lights located on the vessel deck could generate some spill-over to sea which could potentially attract prey species of marine mammals (e.g. plankton and fish).

It is not possible to predict with any certainty how the balance between potential attraction (from artificial lights) and potential avoidance (from underwater noise) will manifest for each marine mammal species that could be present in the vicinity of the dredge vessel/s as this will largely be driven by individual variability; whereby some individuals will be more inquisitive or more sensitive than others. At a species level, fur seals and dolphins are the most probable candidates for attraction. However, the project area has not been identified as important habitat for any marine mammal species and the slow speed of the dredge, and the agility of these species reduces any potential ship strike risk that could culminate from any potential attraction effect.

5.1.1 Recommended Mitigations

No specific mitigations are recommended in relation to potential effects from artificial lighting.

5.1.2 Assessment Results

The potential effects of artificial lighting have been considered for both Stage 1 and Stage 2 in this assessment. As both stages involve dredging which will rely on the use of artificial lighting at night, the assessment results outlined below are therefore relevant to both stages.

On the basis of the information presented above, the likelihood of artificial lighting effects on marine mammals is <u>remote</u> and the predicted magnitude is <u>negligible</u>.

6.0 Cumulative Effects

Cumulative effects occur when the effects of an activity are added to or interact with other effects in space and time. Assessing the cumulative effect of different anthropogenic activities on wildlife populations is globally recognised as a complicated field for which quantitative tools are not widely available (Hague et al., 2022). In the absence of such tools, a quantitative assessment of cumulative effects for marine mammals is not possible, but, from a qualitative perspective, the following comments are of relevance.

<u>Underwater Noise</u>

The potential for cumulative underwater noise effects that could result when multiple acoustic sources combine is of particular concern given the introduction of both dredging and piling noise into an already noisy port environment. In terms of this potential for cumulative effects, the following points are made:

- It is probable that dredging activities and pile driving activities will overlap temporally. While this suggests that cumulative underwater noise effects are possible when these various activities occur concurrently, the potential for such effects is reduced substantially by the use of bubble curtains around each piling site to minimise the propagation of underwater piling noise. Further to this, shutdown zones around each piling site will be implemented and piling activities must cease when marine mammals enter these zones (in which significant impacts could occur if piling continued in an unmitigated manner);
- In the event that pile driving and dredging activities overlap it is noteworthy that underwater noise is not simply additive, but rather the loudest noise will serve to mask the quieter noise (Clement, 2022). In these circumstances the control measures proposed to manage the effects of underwater noise from piling activities will serve to adequately protect any marine mammals that may be present from cumulative underwater noise;
- While unlikely, during Stage 2 (**Table 2**), it is possible that piling activities could occur concurrently on both the Sulphur Point wharf extension and the Mount Maunganui wharf extension. Therefore, the potential for cumulative effects from multiple piling units operating simultaneously on opposite sides of Stella Passage has also been considered;
- Addition of equivalent noise sources is logarithmic. This means, that two identical noise sources at the same location summed together will add 3 dB to the overall level. However, when considering two different locations, the closer the sources are located to one another, the closer to 3 dB the addition will be. **Figure 10** compares (**A**) the two modelled locations operating as simultaneous sources and (**B**) the single noise source. On comparison, the noise level in the channel between the two locations is higher when both sources are active, but further north, the noise levels are not dissimilar. With regard to multiple piling locations, the species most likely to

occur inside the harbour are dolphins, killer whales and fur seals. However, as fur seals are able to avoid loud underwater noise by swimming with their heads above water (Mikkelsen et al., 2017), the potential effects on dolphins and killer whales are of primary concern.

- Site specific modelling for simultaneous operations (i.e. when the timing of the hammer strikes is synchronised across two piling units) was undertaken by Vallarta & Eickmeier (2025) (Appendix E) and concluded that although peak noise levels in Stella Passage are slightly higher when both sources are active, no AUD INJ and TTS are expected to exceed 500 m (the proposed shut-down zone) for either HF cetaceans (i.e. dolphins and killer whales) or OCW (fur seals) when a single simultaneous strike occurs from two piling units either side of the channel; and
- However, assuming the worst-case project scenario, if individual animals are exposed to multiple pulses simultaneously from two piling units (up to 8,000 per source) the cumulative zone of AUD INJ for HF cetaceans is 250 m. This remains well below the proposed 500 m shut down zone for pile driving during this project.
- While the cumulative zone of AUD INJ for OCW (exposure to multiple pulses from two simultaneous piling locations) is predicted out to 990 m, fur seals are expected to behaviourally limit their exposure through exiting the water or raising their heads above the sea surface. In addition, the likelihood of simultaneous piling occurring is low, with the use of bubble curtains and cushion blocks reducing the actual source level from that which was modelled. Despite this and to ensure that all risk of permanent hearing injury is eliminated during pile driving activities, a 1,000 m shutdown zone will be implemented when two piling rigs are operating simultaneously.
- When two piling units are operating concurrently but are striking at different times (i.e. are not simultaneous), the standard shutdown zones as described in **Section 4.2.3.1** are sufficient to fully protect against permanent hearing injury providing there is no exceedance of the maximum limit of 8,000 hammer blows per day (Dr J. Vallarta, pers. comm.).

In addition to the cumulative potential of the project components themselves, the background noise levels of the AOI are already elevated on account of existing commercial shipping (**Figure 8**) and recreational boating activities. On this basis alone, masking of some marine mammal vocalisations undoubtedly already occur in the region. While the project is underway (both Stage 1 and Stage 2), underwater project noise will also interact with existing shipping noise. While the proposed activities will add to this soundscape (and therefore will contribute to the potential for masking of biological sounds that are important to marine mammals), any such effects would be temporary (whereby project noise will cease at project completion). More importantly, no marine mammals are confined to the zone within which project noise will be audible (i.e. all species expected in the AOI have home-ranges that expand well beyond the zone of audibility); hence are easily able to avoid areas in which their communication or echolocation range is heavily compromised by anthropogenic noise impacts.

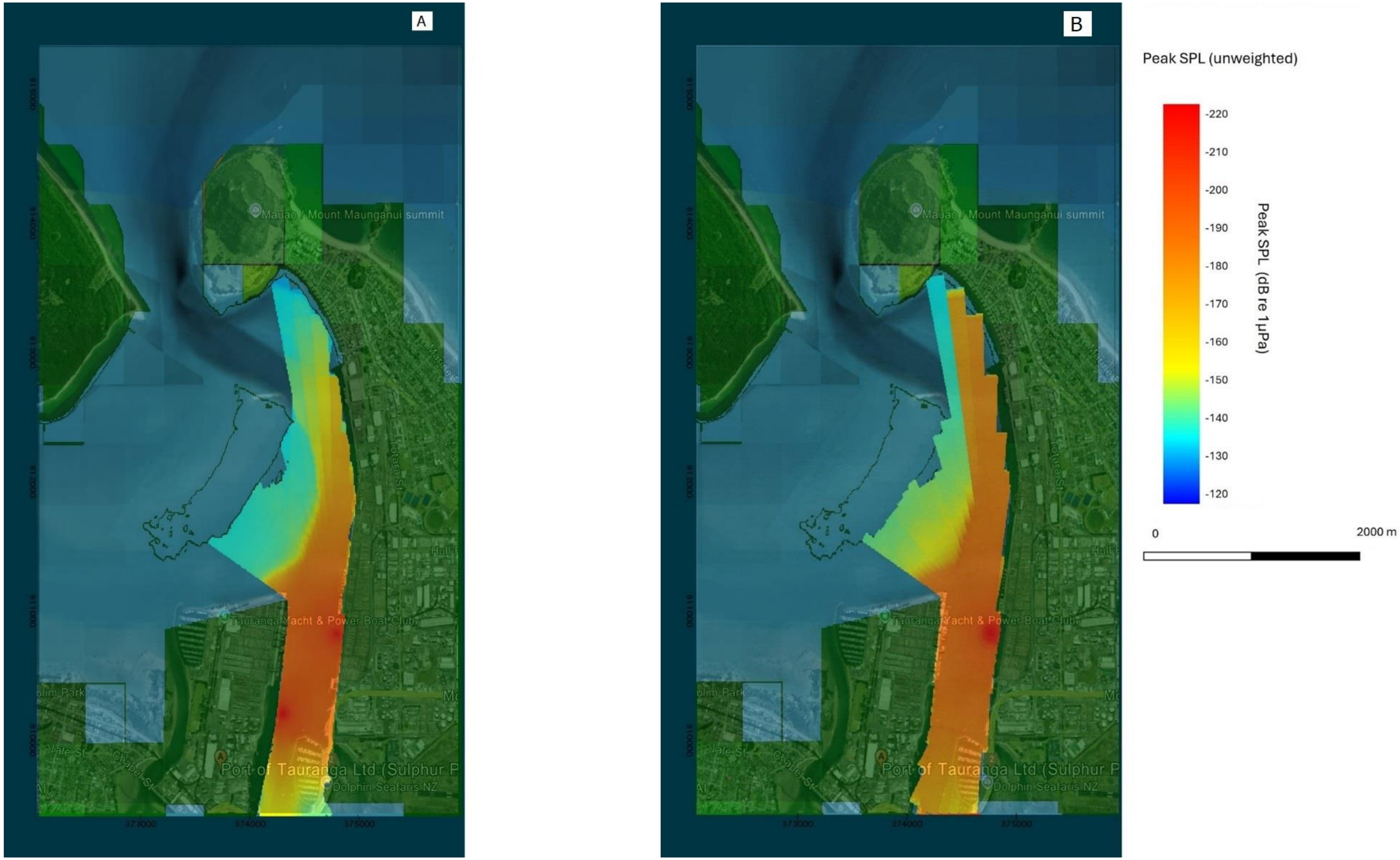

Figure 10 Modelled sound exposure levels with two piling units operating simultaneously (A) compared with one piling unit (B).

Other threats to marine mammals

When considering cumulative effects, it is also important to acknowledge other threats (i.e. those that are not related to underwater noise) that marine mammals may be exposed to. Waters of the AOI, and indeed much of the northeast coast of the North Island, are subject to multiple potential threats to marine mammals or their habitat including bycatch in fishing gear, disturbance from vessel traffic, and habitat degradation. In this regard cumulative effects will be of most relevance to threatened species. The threatened species that are most likely to be present in the AOI are killer whales and bottlenose dolphins, and the potential for cumulative effects on these species is discussed below:

- Killer whales: other threats to killer whales and their habitat in New Zealand include habitat degradation, noise pollution, chemical pollution, and interactions with fisheries (Visser, 2007). New Zealand killer whales have extensive home-ranges (circumnavigating the entire North Island as a minimum) and cover large distances on a daily basis (an average of 100 – 150 km per day; Visser, 2000). This life history trait has both advantages (ability to readily move to avoid disturbance) and disadvantages (exposure to a wide range of threats over a wide range of habitats). While the home-range of New Zealand killer whales is vast, the project site is small in contrast and there is no specific evidence to suggest that this habitat (namely Tauranga Harbour/Te Awanui within which all potentially significant project effects are restricted) is of high relative importance for this species.
- Bottlenose dolphins: because of their coastal nature, bottlenose dolphins are susceptible to disturbance. Dolphins that are present in the AOI are considered as part of the Northland population which occurs along at least 500 km of coastline from Doubtless Bay to Tauranga (Constantine, 2002) and probably beyond into parts of the eastern Bay of Plenty (Zaeschmar et al., 2020) and the west coast of the North Island (Tezanos-Pinto et al., 2013). Dolphins inhabiting this stretch of coastline show varying degrees of site fidelity and high levels of movement (Constantine, 2002; Tezanos-Pinto et al., 2009), with animals seldom stable within an area for more than a few days (Mourão, 2006). This population is in decline (Tezanos-Pinto et al., 2009) and DOC considers that the main threat is associated with the eco-tourism industry in the Bay of Islands which is linked to displacement, high mortality, low birth rates (DOC, 2021) and changes to foraging, breeding, and resting behaviours (Peters & Stockin, 2016). The Te Pēwhairangi (Bay of Islands) Marine Mammal Sanctuary was established in 2021 to address this problem. While effects of underwater noise from project activities could affect individual bottlenose dolphins that use the AOI from time to time, there is no specific evidence to suggest that this habitat (namely Tauranga Harbour/Te Awanui within which all potentially significant project effects are restricted) is of high relative importance for this species and evidence suggests that dolphins move readily across their large distributional range (see Mourão, 2006).

6.1.1 Recommended Mitigations

To address the potential of two piling units operating simultaneously, and the associated increased onset distances for AUD INJ, a 1,000 m shutdown zone is recommended for HF cetaceans and fur seals whenever two piling rigs are operating simultaneously (i.e. when the timing of the hammer strikes is synchronised).

6.1.2 Assessment Results

In terms of potential cumulative effects, both Stage 1 and Stage 2 have been considered in this assessment. As both stages involve activities that could contribute to the overall soundscape in the AOI, the risk of ship strike and the generation of marine debris; the assessment results below are relevant to both stages. It is however noteworthy that concurrent piling is only possible during Stage 2 and the proposed mitigations (as outlined in

Section 4.2.3.1) are appropriate to address the effects of any concurrent piling that may occur.

On the basis of the information presented above and given that POTL has confirmed that it will adopt the recommendation outlined in **Section 6.1.1** and the recommendations specified in **Section 4.2.3.1**, **Section 4.5.1** and **Section 4.7.1** of this report to manage underwater noise, ship strike and marine debris respectively, I consider that the likelihood of cumulative effects is moderate and will be of minor magnitude.

7.0 Summary of Findings

This assessment has identified and described the potential effects of the project activities on marine mammals. Where considered necessary, recommendations have been made to avoid, remedy or mitigate adverse effects. Based on the adoption of these recommendations the likelihood of each effect occurring, and the predicted magnitude was determined. Assessment results are summarised in **Table 14**.

Table 14: Summary of Assessment of Effects Results for Marine Mammals

Potential Effect	Summary of Recommended Mitigations	Likelihood of Effect	Magnitude of Effect
Underwater noise from dredging	Regularly maintained dredge equipment. Compliance with the MMPR.	Low	Negligible
Underwater noise from pile driving	MMO on-watch before and during piling. Implementation of soft start procedures. Implementation of shutdown zones. Carefully select pile driving equipment. Minimise daily piling duration/strike rate. Use cushion blocks and bubble curtains. Alert System for marine mammal sightings in Tauranga Harbour/Te Awanui. Conduct inner harbour observations. Keep records of sightings and mitigations. Validate model predictions. Compliance with MMMP.	Moderate	Minor
Presence of structures in the water column	None	Low	Minor
Habitat modification	None	Remote	Negligible
Ship strike – during active extraction	Compliance with MMPR	Remote	Negligible
Ship strike – during transit to disposal site	Compliance with MMPR	Low	Minor
Exposure to contaminants	None	Remote	Negligible
Marine debris	Comply with Resource Management (Marine Pollution) Regulations 1998 and any other relevant legislative requirements.	Remote	Negligible

Potential Effect	Summary of Recommended Mitigations	Likelihood of Effect	Magnitude of Effect
	Retrieve any waste or equipment lost to sea if safe to do so. Retrieve marine debris whilst dredging.		
Artificial lighting	None	Remote	Negligible
Cumulative effects	Implementation of larger shutdown zone during simultaneous pile driving.	Moderate	Minor

8.0 Response to Feedback

In preparing their FTA application for submission, POTL have sought feedback on their proposed approach from numerous parties. Feedback of relevance to this marine mammal assessment report was received from the following parties and is discussed in the subsections below:

- Local iwi/hapū groups;
- Bay of Plenty Regional Council; and
- DOC.

As part of the FTA application, POTL will proffer two sets of conditions: the ‘Structures Conditions’, and the ‘Dredging Conditions’ which are integral to the management of potential effects on marine mammals. Where relevant, the responses outlined below reference these proffered consent conditions as they form a crucial part of managing effects on marine mammals to an acceptable level. Note, that the final condition numbering is yet to be confirmed.

8.1 Cultural Effects Identified by Iwi/Hapū

Throughout the course of their application preparation POTL have engaged with local iwi/hapū groups, several of which have provided Cultural Impact (or values) Assessments. These assessments supplement the findings of this report which has been prepared from a western science point of view.

Table 15 provides a summary of the cultural effects and associated management recommendations of relevance to marine mammals that were identified in these assessments and provides a response to each.

Table 15: Marine Mammal Effects Identified in Cultural Impact Assessments

Potential Effect	Iwi/Hapu Recommendation	Response
Effects of underwater construction noise on marine mammals	Monitor compliance with MMMP	The effects of construction noise (dredging and pile driving) have been comprehensively addressed in **Section 4.2** of this report. Assessment findings are based on the implementation of a suite of mitigation measures to 1) minimise underwater noise effects, and 2) ensure any residual effects are managed to acceptable levels. On this basis the proposed mitigations set out in the MMMP sufficiently address this issue, namely: - Compliance with the MMMP as required by Consent Condition 12.1 of the Structures Conditions. In addition, specific management requirements of the MMMP that are critical to the management of underwater noise effects on

Potential Effect	Iwi/Hapu Recommendation	Response
		marine mammals have been offered as conditions of consent. See Consent Conditions 12.2 to 12.17 of the Structures Conditions. - The Structures Conditions also provide for the appointment of a marine mammal observation auditor, the function of which will be to conduct periodic reviews of pile driving operations to ensure that Marine Mammal Observers are acting in full compliance with the MMMP. See Consent Condition 3.3(h). - Dredging noise is addressed through Consent Condition 6.3 of the Dredging Conditions. Furthermore, the magnitude of predicted dredge noise effects on marine mammals is negligible (see **Section 4.2.2.2**).
Risk of ship strike to marine mammals	Monitor compliance with MMMP	The effects of ship strike have been comprehensively addressed in **Section 4.5** of this report. Assessment findings are based on compliance with the MMPRs which is a legal requirement. On this basis the proposed mitigations sufficiently address this issue, namely: Compliance with the MMPRs as required by Consent Condition 12.16 of the Structures Conditions and Consent Condition 6.5 of the Dredging Conditions. Compliance will be monitored by the relevant authority.
Lack of consideration to long-term effects on marine mammals following the completion of works. Ongoing infrastructure and vessel-traffic have historically resulted in the decline of tohorā/aihe in the area	POTL should undertake further assessment of environmental effects, considering the cumulative, catchment-wide impacts of the Port's operation at Te Tāhuna o Rangataua.	Cumulative effects of the project have been comprehensively addressed in **Section 6.0** of this report. In addition, the potential for on-going effects associated with the project are limited to the permanent placement of additional wharf piles (see **Section 4.3**), the narrowing of Stella Passage (see **Section 4.4**), and the indirect facilitation of increased levels of large ships visiting the Port of Tauranga, which could increase the ship strike risk to large whales (see **Section 4.5**). - Regarding the placement of additional wharf piles, the assessment findings concluded that the likelihood of associated adverse effects on marine mammals will be low, and the magnitude of predicted effects will be minor as no fatalities are anticipated and habitat changes are highly localised and in locations outside of utilised habitat. - Regarding the narrowing of Stella Passage, the assessment findings concluded that the likelihood of associated adverse effects on marine mammals will be remote, and the magnitude of predicted effects will be negligible given that marine mammals do not regularly use this area and when they do, it is primarily as they pass through to other areas of the harbour. - Regarding the potential for ongoing increased ship strike risk, **Section 4.5** addresses this by noting that despite the existing high rates of vessel traffic in the region, the incidence of ship strike is remarkably low reflecting that resident concentrations of large whales are absent and that the density of migratory whales that pass through is relatively low and their presence is temporary. In addition, POTL has modelled the hypothetical future increase in shipping to conclude that the proposed project activities could equate to a maximum of 24 additional vessels using the port per month

Potential Effect	Iwi/Hapu Recommendation	Response
		(Julian, 2024). Currently the upper bound of ship visits per month is 162 (Julian, 2024), so the additional 24 vessels would represent only a 15% increase on existing shipping levels. Furthermore, the assertion that ‘ongoing infrastructure and vessel-traffic have historically resulted in the decline of tohorā (whales) /aihe (dolphins) in the area’ is unfounded, as in the most part declines for these species are historically linked with commercial whaling or fisheries related mortality.

8.2 Bay of Plenty Regional Council

Bay of Plenty Regional Council (the council) was provided with the opportunity to review the final draft of this report and the draft proffered consent conditions. The council engaged Dr Simon Childerhouse, a marine mammal scientist from Blue Planet Marine to undertake this technical review. **Table 16** provides a summary of the action points that Dr Childerhouse recommended and provides a response to each.

Table 16: Suggested Actions Recommended by Dr Childerhouse

Marine Mammal Assessment of Environmental Effects
Suggested Action 1 (paragraph 37 of BPM letter): Review basis for 500 m shutdown zone noting that implementing the zone at 500 m will still allow for TTS and/PTS for some species during some activities and during times when two piling rigs may be operating. Consider different shutdown zone for when two piling rigs are operating simultaneously.
Response: Dr Childerhouse has correctly noted that the 500 m shutdown zone for dolphins, killer whales and fur seals doesn’t provide full protection in the following circumstances: • For High-Frequency (HF) cetaceans (i.e. dolphins and killer whales) which could experience Temporary Threshold Shift (TTS) if exposed to 1,000+ strikes from a single piling rig out to c. 1.2 km. • For Otariid Carnivores in Water (OCW) (i.e. fur seals) which could experience TTS if exposed to 200+ strikes from a single piling rig out to c. 2.2 km • For fur seals which could experience auditory injury if exposed to 8,000 strikes from two piling rigs operating simultaneously out to c. 1 km. These potential risks are considered to be acceptable for the following reasons: • The actual zones of impact will almost certainly be substantially smaller than those predicted. This is because 1) the model predictions assume the worst-case scenario — that the hammer will operate at 100% power during all operations and that all piles will be driven with the 14 tonne hammer — in reality, most driving will be at 50% hammer power, and the 10 tonne hammer will be used for all but the back three rows; and 2) the modelling did not account for the use of cushion blocks or bubble curtains which will be mandatory for all impact piling operations. • The likelihood of dolphin and killer whale presence in Stella Passage is low (< 3% of days for dolphins and even lower for killer whales). • Seals can avoid loud underwater noise effects by exiting the water or swimming with their heads above water (which they regularly do). • The likelihood of two piling rigs operating concurrently is low. • When only one piling rig is operational (which will be the modus operandi), the 500 m shutdown zone for dolphins, killer whales and fur seals provides full protection against all

permanent hearing effects in these species. While temporary effects remain possible outside the shutdown zone, infrequent temporary changes in hearing sensitivity for these species are unlikely to lead to ecologically significant consequences.

- In-situ acoustic monitoring of actual underwater impact piling noise during the installation of steel piles is a requirement of the Marine Mammal Management Plan (MMMP) at project commencement. This requirement is included as Condition 12.14 in the 'Structures Conditions'. The purpose of this monitoring is to ensure that the size of the shutdown zones is appropriate. The MMMP includes a provision for adjusting the shutdown zones as necessary in accordance with the results of this monitoring.

Result 1:

Edits have been made to the Marine Mammal AEE to ensure that 1) the risk of hearing effects beyond the 500 m shutdown zone is clearly stated for dolphins, killer whales and fur seals; and 2) the reasons outlined above are provided to address the issue of risk acceptability.

Clarification has been given in the Marine Mammal AEE regarding the important role of in-situ acoustic monitoring at the commencement of impact pile driving.

Further correspondence:

Dr Childerhouse raised ongoing concerns about this issue, concluding that: "Overall, I am concerned that by sticking with a single shutdown zone of only 500 m, it is allowing for the potential of both temporary and permanent hearing injuries for marine mammals. Given how rarely it appears marine mammals are found within the project area, there is likely to be little impact on piling operations by setting a large and comprehensive shutdown zone. Another option might be to set a different shutdown zone size for the different species groups and for single vs. double piling rig operations. I believe that the proposed SLR Result to my original concern is inadequate to address the real risk of hearing injury from the project.

Result 2:

An extended shutdown zone of 1,000 m will be adopted when two piling rigs are operating simultaneously. This approach ensures complete protection against auditory injury (including PTS). Edits have been made to the Marine Mammal AEE, the MMMP and the Structures Conditions to reflect this requirement.

Suggested Action 2 (paragraph 38 of BPM letter):

There is no mitigation proposed for potential behavioural effects although the AEE notes that there are likely to be low and/or moderate level behavioural effects for some species.

Response:

Behavioural responses represent temporary individual effects, and the likelihood of marine mammal presence inside the harbour is low; hence marine mammals will not consistently be subject to behavioural effects associated with the proposed activities. For these reasons, there is no risk that behavioural effects caused by the proposed activities could result in population level consequences for any marine mammal species.

Furthermore, for pile driving, 1) the shutdown requirements will provide protection from severe behavioural effects in the immediate vicinity of the construction site for dolphins, killer whales and fur seals; 2) the harbour-wide shutdowns required for baleen whales and leopard seals will provide excellent protection against behavioural effects for these species; and 3) avoidance of the area (which constitutes a behavioural response) has a protective function in that it prevents animals from exposure to auditory injury.

Furthermore, most piling projects in New Zealand and overseas do not specifically mitigate against behavioural effects.

Result:

Edits have been made to the Marine Mammal AEE to ensure that the role of shutdown zones in mitigating against behavioural effects is described.

Further correspondence:

Dr Childerhouse confirmed that the result outlined above is noted and accepted.

Dredging Conditions
Suggested Action 3 (paragraph 39 of BPM letter): Review details provided in the MMMP and AEE for mitigation and other actions proposed for dredging operations which do not appear to be reflected in the draft conditions, including a reference to implementing the controls identified in the MMMP
Response: Dr Childerhouse is correct in identifying that the MMMP includes some dredge requirements, but not others, and the confusion that this creates is acknowledged. **Result**: To rectify this and given that effects associated with active dredging have been assessed as being negligible, all requirements specific to dredging have been removed from the MMMP and are instead presented as consent conditions. In accordance with this the following components have been added to the Dredging Conditions (as Conditions 9, 10 and 11) – Recording & Reporting Requirements: • A marine mammal sightings form must be completed by the dredge master for each marine mammal sighting made during dredging operations. In addition to this, when specifically requested (i.e. during piling operations), marine mammal sightings will be reported immediately to the Port of Tauranga Ltd Customer Service Centre; and • Any physical interaction between the dredge vessel/s and marine mammals must be reported immediately to the Port of Tauranga Ltd, Bay of Plenty Regional Council and the Department of Conservation. Waste Management: • If any waste or equipment enters the water from the dredge vessel it must be promptly retrieved (if safe to do so); • Obvious objects of marine debris recovered during the process of dredging must be collected and retrieved for safe disposal onshore; and • All dredge vessels will have covered waste bins and debris retrieval nets. Training: • Dredge masters will receive training on a) the recording and reporting requirements relating to marine mammals; b) waste management requirements; and c) compliance with the Marine Mammal Protection Regulations 1992. Furthermore, content of the Marine Mammal AEE has been checked to ensure that it is clearly stated that mitigations for dredging are addressed directly through consent conditions and that mitigations for pile driving are collated into the MMMP and supported by consent conditions (see Suggested Action 7 below). **Further correspondence:** Dr Childerhouse confirmed that the result outlined above is noted and accepted.
Structures Conditions
Suggested Action 4 (paragraph 40 of BPM letter): Details of the provision and role of a marine mammal observation auditor should be clarified.
Response: The Marine Mammal Observation Auditor (MMOA) is a requirement of the ‘Stella Passage Development Advisory Group’ (SPDAG) as discussed in Structures Conditions 1.1(d)(v), and 3.3(h). While it would be beneficial for the role to be further defined in Condition 1.1, it is important to also leave some scope for the SPDAG to define this role too. To clarify, no marine mammal observer, and therefore no MMOA, is required in relation to the dredging conditions. **Result**: Condition 3.3 (h) has been revised to define the basic functions of the MMOA role as follows:

"… to conduct periodic reviews of pile driving operations to ensure that Marine Mammal Observers are acting in full compliance with the certified Marine Mammal Management Plan. Specific auditor duties will be defined by the SPDAG prior to the auditor's appointment (Condition 1.1(d)(v))". **Further correspondence:** Dr Childerhouse confirmed that the result outlined above is noted and accepted, provided an additional minor edit was made to the condition. The Structures Conditions have been updated accordingly.
Suggested Action 5 (paragraph 41 of BPM letter): It would be useful to add a condition that requires the applicant to confirm that the final design statement is consistent with, or less than, the details provided and assessed in the AEE.
Response: The design statement referred to by Dr Childerhouse here occurs in Condition 6 of the Structures Conditions. Condition 6 is an engineering focused condition. However, Condition 5 is a more generic condition that requires that works are to be completed in accordance with the application. Therefore, compliance with Condition 5 appropriately addresses this suggested action point. **Result**: No edits required; however, see addition at Condition 6.1(d) for consideration. **Further correspondence:** Dr Childerhouse confirmed that the result outlined above is noted and accepted.
Suggested Action 6 (paragraph 42 of BPM letter): It would be useful to specify in conditions that ground truthing of the underwater noise must take place and that this may lead to changes in the shutdown zone based on the actual measured noise levels from the activity.
Response: The requirement for acoustic monitoring is included in the Structures Conditions. However, the draft condition fails to identify the important role of this acoustic monitoring in confirming that the shutdown zones are of an appropriate size to sufficiently protect marine mammals from auditory injury. **Result**: Condition 12.14 has been amended to include the statement that "The purpose of these measurements is to a) confirm that the shutdown zones are of an appropriate size to protect marine mammals from auditory injury or b) provide robust justification that the shutdown zones should be amended to sufficiently protect marine mammals." **Further correspondence:** Dr Childerhouse confirmed that the result outlined above is noted and accepted.
Suggested Action 7 (paragraph 43 of BPM letter): Ensure that all controls described in the MMMP and Reclamation and Construction Management Plan are reflected specifically in conditions. In my experience, critical issues that are not specified in conditions can often be neglected or forgotten during the delivery of the project.
Response: I agree that critical issues must be captured by consent conditions. **Result:** I have reviewed the draft conditions and (in addition to those conditional matters already addressed above), the following edits/additions to the Structures Conditions have been made: <u>Edits made to draft conditions:</u> • Condition 12.8 - will be amended to plural to address both primary and extended Marine Mammal Observation Zones. • Condition 12.9 – will be amended to require that MMOs are not only trained but also dedicated when undertaking the role of MMO.

- Condition 12.9(b and c) – will be amended to reference 'relevant shutdown zones' in recognition that there are more than one.
- Condition 12.9(d) – will be amended to align with Section 3.11 of the MMMP in terms of when recommencement of piling after a shutdown can occur.

New conditions added:

- Training will be provided to all relevant staff in accordance with the requirements of the MMMP (see Condition 12.10).
- During impact pile driving operations, strike rate shall not exceed 8,000 strikes per day (see Condition 7.14).
- The use of cushion blocks is mandatory for all impact pile driving of steel piles (see Condition 7.15).
- The use of bubble curtains is mandatory for all impact pile driving of steel piles (see Condition 7.16).

Further correspondence:

Dr Childerhouse confirmed that the result outlined above is noted and accepted.

Suggested Action 8 (paragraph 44 of BPM letter):

Vibro-piling should be specified in the conditions as having the same mitigation requirements as impact-piling where appropriate.

Response:

The Marine Mammal AEE states "vibro-piling operations should adopt the same mitigations as those developed for impact piling, with the exception of bubble curtain technology and model validation." In addition, the MMMP states that pile driving controls are relevant to both impact- and vibro-piling. Dr Childerhouse is correct in recognising that this is not clearly articulated in the draft Structures Conditions.

Result:

An advisory note has been added to the Marine Mammal Management Section of the Structures Conditions noting that unless specified, 'piling activities' relate to both impact- and vibro- piling.

Further correspondence:

Dr Childerhouse confirmed that the result outlined above is noted and accepted.

Suggested Action 9 (paragraph 45 of BPM letter):

Turtles and sharks are specified as being included as species for which that shutdown zone applies. This should be specified in conditions.

Response:

While turtles and sharks are not my field of expertise and were not mentioned in either the Marine Mammal AEE or the draft MMMP, I note that white pointer sharks and green turtles were specified in the draft conditions as species that Marine Mammal Observers will be vigilant for and when detected, these species will trigger delayed starts and shutdowns.

Result:

Turtles and sharks are now addressed separately to the marine mammal management conditions (see placeholder at Condition 7.17).

Further correspondence:

Dr Childerhouse confirmed that the result outlined above is noted and accepted.

Suggested Action 10 (paragraph 46 of BPM letter):

Consider adding additional detail to shutdowns for leopard and fur seals specifically that when they are hauled out of the water, the shutdown rules do not apply.

Response:

Dr Childerhouse raises an excellent point in that there is zero risk of underwater noise injury for seals ashore.

Result:

The MMMP, and Condition 12.6(d and e) have been updated to address this issue. The MMMP has been edited to clarify that the shutdown requirements for fur seals and leopard seals only apply to the waters of each respective Shutdown Zone, and that seals ashore (and adjacent to a relevant Shutdown Zone) will be monitored and that a shutdown must be implemented as required when a seal enters the water. **Further correspondence:** Dr Childerhouse confirmed that the result outlined above is noted and accepted.
Other Matters
Additional Matter: In his paragraph 32, Dr Childerhouse commented on the proposed use of a 'suitable resolution camera system' and how this would need to be evaluated as suitable.
Response: I agree that a process for evaluating any camera system will be necessary before it can be relied upon to support Marine Mammal Observers in undertaking the requisite Inner harbour Observations. **Result**: Criteria have been developed and incorporated into the MMMP against which any proposed camera system must be evaluated prior to it being deemed acceptable. See also Condition 12.11. **Further correspondence:** Dr Childerhouse confirmed that the result outlined above is noted and accepted.

8.3 Department of Conservation

While DOC have not seen the final draft of this report, they have provided some initial commentary, based on the draft project-wide Assessment of Environmental Effects report that has been collated by POTL and summarises the key findings of the subject matter reports (including this marine mammal assessment). **Table 17** provides a summary of the feedback received and provides a response to each issue raised.

Table 17: Feedback Received from Department of Conservation

DOC comment	Response
DOC was not provided with a copy of the Marine Mammals Management Plan (and or Appendices 3/F) as part of pre-lodgement consultation.	POTL will provide a copy of these documents ahead of formal lodgement.
Based on the information provided the assessment of effects on marine mammals appears well considered and recognises the most likely concern being effects of noise from pile driving. There is the added potential for entrapment of animals from behavioural responses to noise in the harbour area beyond Stella Passage.	The potential for entrapment in the inner harbour is discussed in **Section 4.2.3** of this report. The MMMP and the Structures Conditions require 30 minutes of 'inner harbour observations' to detect cetaceans up-harbour of Stella Passage prior to commencing piling operations each day. The procedures to be followed if cetaceans are detected in the inner harbour are also described.
Without access to the Marine Mammal Management Plan, it is unclear that these issues have been fully considered, and appropriate mitigation committed to	POTL will provide a copy of relevant documentation ahead of formal lodgement confirming that underwater noise effects are addressed through the MMMP and the Structures Conditions.
The marine mammals plan provided to support the application needs to be adequate and sufficiently address the management of actual	POTL will provide a copy of relevant documentation ahead of formal lodgement confirming that all actual and potential adverse effects on marine mammals are addressed

DOC comment	Response
and potential adverse effects on marine mammals.	through the MMMP and the Structures Conditions. Furthermore, this report, the MMMP and the draft conditions have been reviewed and accepted through engagement with BOPRC.
There are a range of species that are recorded within the AOI but are not listed, including a number of different beaked whale species.	A comprehensive description of the marine mammal species reported from the AOI is presented in **Section 3.2.1** of this report and individual species data is provided also in **Appendix A**.
If it is identified that the applicant requires an authority under the mammal protection regulations – this would need to be applied for outside of the fast-track process.	POTL acknowledge this but as there is no intention to 'take' as defined under the Marine Mammal Protection Act 1978, it is considered that no permit is required.
Effects would be more significant if an animal moved into the area of operation – however as noted in the AEE mitigations such as marine mammal observers and shut down procedures should minimise effects.	The full suite of mitigation measures is summarised in **Table 14** and are discussed in full throughout this report. All mitigations are detailed in the MMMP of the proffered consent conditions.

9.0 Conclusion

This report describes the marine mammal populations that occur in and around the AOI and assesses the potential effects of the project activities on marine mammals. Data from the DOC Sightings Database, the DOC Incident Database, published and unpublished literature and project specific acoustic monitoring was assessed to determine the species that use the waters of the AOI (with a specific focus on Tauranga Harbour/Te Awanui) to assess the likelihood of each species being present here.

While at least 20 marine mammal species have been reported from the AOI, both sightings data and acoustic monitoring data indicate that only dolphins (mostly bottlenose), killer whales and New Zealand fur seals use waters inside Tauranga Harbour/Te Awanui, albeit on an occasional basis and despite high existing levels of shipping traffic.

Within the wider AOI (i.e., outside of the harbour) the following additional species could be present: common dolphins, humpback whales, southern right whales, blue whales, minke whales, sei whales, Bryde's whales, false killer whale, Gray's beaked whale, long-finned pilot whale and leopard seals.

Analysis of all available data indicates that the AOI does not include important marine mammal habitat and has not been specifically identified as ecologically significant to any marine mammal (relative to other habitat along the east coast of the North Island). No resident populations of marine mammals occur within Tauranga Harbour/Te Awanui, and all species that use the AOI have large home ranges, so the AOI only represents a very small part of their overall distribution.

New Zealand and overseas data and publications were reviewed to determine both the potential effects that the project activities could have on marine mammals, and the possible management measures to avoid, remedy or mitigate such effects. The following potential effects were identified: underwater noise, the presence of objects in the water column, habitat modification, ship strike, exposure to contaminants, marine debris, artificial lighting and cumulative effects.

Underwater noise from pile driving has been identified as the potential impact with the greatest likelihood to affect marine mammals. Unmitigated piling noise could have significant ecological effects on marine mammals that may be present in Tauranga Harbour/Te Awanui during wharf construction. To address this, underwater acoustic modelling based on conservative noise inputs was used to predict the spatial extent over which underwater noise effects could occur. These modelling results were subsequently used to develop mitigation zones that can be implemented by MMOs and piling operators to ensure marine mammals are fully protected from AUD INJ.

This assessment found that there will be no population level effects on marine mammals as a result of the project activities and no effects will exceed the thresholds set by the NZCPS and the RCEP.

With the adoption of the recommended mitigation measures, the likelihood of adverse effects occurring from the project activities will be (at worst) moderate to remote and the magnitude of any adverse effects that do occur will be (at worst) minor or negligible.

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Appendix A Marine Mammals and their Likelihood of Occurrence in the AOI

Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Common Name	Scientific Name	NZ Conservation Status (Baker et al., 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Incident database (No. of stranding events inshore of AOI)	DOC Sightings database (No. reports inside Tauranga Harbour/No. of reports in Marine Mammal AOI)	Modelled habitat suitability of AOI (Stephenson et al., 2020/MacKenzie et al., 2022)	Acoustic detections in Tauranga Harbour	Likelihood of Presence in the AOI
Andrew's beaked whale	*Mesoplodon bowdoini*	Data deficient	S?O	Data deficient	0	0	Low / Low	0	Unlikely
Blue whales	*Antarctic blue whales Balaenoptera musculus intermedia* *Pygmy blue whales* *Balaenoptera musculus brevicauda*	Data deficient Data deficient	TO S?O	Critically endangered Endangered	0	0/5	Low / Low - Moderate	0	Possible in waters outside Tauranga Harbour
Antarctic fur seal	*Arctocephalus gazella*	Vagrant	SO	Least Concern	0	0	NA / Nil	0	Unlikely
Minke whales	*Antarctic minke whale Balaenoptera bonaerensis* *Dwarf minke whale Balaenoptera acutorostrata*	Data deficient Data deficient	DP, SO DP, SO	Near Threatened Least concern	4	0/1	Low / Moderate	0	Possible in waters outside Tauranga Harbour
Arnoux's beaked whale	*Berardius arnuxii*	Data deficient	S?O	Least concern	0	0	Low / Low - Moderate	0	Unlikely
Blainville's/Dense beaked whale	*Mesoplodon densirostris*	Data deficient	S?O	Least concern	0	0	Low / Low	0	Unlikely
Bottlenose dolphin	*Tursiops truncatus*	Nationally endangered	De, PF, SO, Sp	Least concern	7	14/25	Low – Moderate / Low - Moderate	Yes	Likely in waters both inside and outside Tauranga Harbour
Bryde's whale	*Balaenoptera edeni*	Nationally critical	CD, DP, SO	Least concern	0	0/7	Low – Moderate / Moderate	0	Possible in waters outside Tauranga Harbour
Common dolphin	*Delphinus delphis*	Not threatened	DP,SO	Least concern	23	1/6**	Low – High / Low - Moderate	Possibly	Likely in waters outside Tauranga Harbour
Crab eater seal	*Lobodon carcinophaga*	Vagrant	SO	Least concern	0	0	NA / Low	0	Unlikely
Cuvier's beaked whale	*Ziphius cavirostris*	Data deficient	SO	Least concern	3	0	Low / Low - Moderate	0	Unlikely
Dusky dolphin	*Lagenorhynchus obscurus*	Not threatened	S?O	Least concern	0	0	Low / Low	0	Unlikely
Dwarf sperm whale	*Kogia sima*	Data deficient	S?O	Least concern	0	0	NA / Moderate - High	0	Unlikely
False killer whale	*Pseudorca crassidens*	Naturally uncommon	DP, T?O	Near Threatened	0	0/2	Low / Low	0	Possible in waters outside Tauranga Harbour
Fin whale	*Balaenoptera physalus*	Data deficient	TO	Vulnerable	0	0	Low / Moderate - High	0	Unlikely
Fraser's dolphin	*Lagenodelphis hosei*	Data deficient	SO	Least concern	0	0	NA / Low	0	Unlikely
Ginkgo-toothed whale	*Mesoplodon ginkgodens*	Data deficient	S?O	Data deficient	0	0	NA / Moderate	0	Unlikely

Common Name	Scientific Name	NZ Conservation Status (Baker et al., 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Incident database (No. of stranding events inshore of AOI)	DOC Sightings database (No. reports inside Tauranga Harbour/No. of reports in Marine Mammal AOI)	Modelled habitat suitability of AOI (Stephenson et al., 2020/MacKenzie et al., 2022)	Acoustic detections in Tauranga Harbour	Likelihood of Presence in the AOI
Gray's beaked whale	*Mesoplodon grayi*	Not threatened	S?O	Least concern	14	1/1	Low / Low - Moderate	0	Possible in waters outside Tauranga Harbour
Hector's beaked whale	*Mesoplodon hectori*	Data deficient	S?O	Data deficient	0	0	NA / Moderate	0	Unlikely
Hector's dolphin	*Cephalorhynchus hectori hectori*	Nationally vulnerable	CD, DP, PF	Endangered	0	0/1	Low / Nil - Low	0	Unlikely
Hourglass dolphin	*Lagenorhynchus cruciger*	Data deficient	SO	Least concern	0	0	Low / Nil - Low	0	Unlikely
Humpback whale	*Megaptera novaeangliae*	Migrant	SO	Least concern	0	2/16	Low – Moderate / Moderate	0	Possible in waters outside Tauranga Harbour
Killer whale	*Orcinus orca*	Nationally critical	DP, S?O, Sp	Data deficient	6	34/61	Low – Moderate / Moderate	Yes	Likely in waters both inside and outside Tauranga Harbour
Leopard seal	*Hydrurga leptonyx*	Naturally uncommon	De, SO	Least concern	0	2/9	NA / Low - High	0	Possible in waters outside Tauranga Harbour
Lesser/pygmy beaked whale	*Mesoplodon peruvianus*	Data deficient	S?O	Least concern	0	0	NA / Nil - Low	0	Unlikely
Long-finned pilot whale	*Globicephala melas*	Not threatened	DP, S?O	Least concern	4	1/5***	Low / Low - Moderate	0	Possible in waters outside Tauranga Harbour
Māui's dolphin	*Cephalorhynchus hectori maui*	Nationally critical	CD	Not assessed	0	0	Low – Moderate / Nil - Low	0	Unlikely
Melon-headed whale	*Peponocephala electra*	Vagrant	SO	Least concern	0	0	NA / Moderate	0	Unlikely
New Zealand sea lion	*Phocarctos hookeri*	Nationally vulnerable	CD, RR	Endangered	0	0	NA / Low	0	Unlikely
New Zealand fur seal	*Arctocephalus forsteri*	Not threatened	Inc, SO	Least Concern	1	Common, generally unreported	NA / High	possibly	Likely in waters both inside and outside Tauranga Harbour
Pantropical spotted dolphin	*Stenella attenuata*	Vagrant	SO	Least concern	0	0	NA / Low	0	Unlikely
Pygmy killer whale	*Feresa attenuata*	Vagrant	DP, S?O	Least concern	0	0	NA / Moderate	0	Unlikely
Pygmy right whale	*Caperea marginata*	Data deficient	S?O	Least concern	0	0	NA / High	0	Unlikely
Pygmy sperm whale	*Kogia breviceps*	Data deficient	DP, S?O	Least concern	3	1/1	Low / Low	0	Unlikely
Risso's dolphin	*Grampus griseus*	Data deficient	SO	Least concern	0	0	Low / Low	0	Unlikely
Ross seal	*Ommatophoca rossii*	Vagrant	SO	Least concern	0	0	NA / Nil	0	Unlikely
Rough-toothed dolphin	*Steno bredanensis*	Data deficient	SO	Least concern	0	0	NA / Moderate	0	Unlikely
Sei whale	*Balaenoptera borealis*	Data deficient	TO	Endangered	1	û***	Low / Moderate	0	Possible

Common Name	Scientific Name	NZ Conservation Status (Baker et al., 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Incident database (No. of stranding events inshore of AOI)	DOC Sightings database (No. reports inside Tauranga Harbour/No. of reports in Marine Mammal AOI)	Modelled habitat suitability of AOI (Stephenson et al., 2020/MacKenzie et al., 2022)	Acoustic detections in Tauranga Harbour	Likelihood of Presence in the AOI
Shepherd's beaked whale	*Tasmacetus shepherdi*	Data deficient	SO	Data deficient	0	0	Low / Low	0	Unlikely
Short-finned pilot whale	*Globicephala macrorhynchus*	Data deficient	S?O	Least concern	0	0	Low / Low	0	Unlikely
Southern bottlenose whale	*Hyperoodon planifrons*	Data deficient	SO	Least concern	1	0	Low / Low	0	Unlikely
Southern elephant seal	*Mirounga leonina*	Nationally critical	RR, SO	Least concern	0	0	NA / Low	0	Unlikely
Southern right whale	*Eubalaena australis*	Recovering	OL, RR, SO	Least concern	0	1/7	Low – Moderate / Low	0	Possible in waters outside Tauranga Harbour
Southern right whale dolphin	*Lissodelphis peronii*	Data deficient	DP,S?O	Least concern	0	0	Low / Low	0	Unlikely
Spade-toothed whale	*Mesoplodon traversii*	Data deficient	S?O	Data deficient	0	0	NA / Moderate	0	Unlikely
Spectacled porpoise	*Phocoena dioptrica*	Data deficient	S?O	Least concern	0	0	Low / Low	0	Unlikely
Sperm whale	*Physeter macrocephalus*	Data deficient	DP, TO	Vulnerable	2	0	Low / Low	0	Unlikely
Strap-toothed whale	*Mesoplodon layardii*	Data deficient	S?O	Least concern	0	0	NA / Low - Moderate	0	Unlikely
Striped dolphin	*Stenella coeruleoalba*	Data deficient	SO	Least concern	1	0	Low / Low	0	Unlikely
Subantarctic fur seal	*Arctocephalus tropicalis*	Vagrant	SO	Least concern	0	0/1	NA / Nil	0	Unlikely
True's beaked whale	*Mesoplodon mirus*	Data deficient	S?O	Least concern	0	0	NA / High	0	Unlikely
Weddell seal	*Leptonychotes weddelli*	Vagrant	SO	Least concern	0	0	NA / Nil	0	Unlikely

* Qualifiers to the New Zealand Threat Classification System are as follows: Secure Overseas (SO), Uncertain whether the taxon is secure overseas (S?O), Threatened Overseas (TO), Data Poor (DP), Conservation Dependent (CD), Sparse (Sp), Range Restricted (RR), Increasing (Inc), One Location (OL), Designated (De), Population Fragmentation (PF)

** The sighting apparently within Tauranga Harbour/Te Awanui was accompanied with conflicting details that stated that the sighting was made by a fisheries observer on a commercial fishing vessel in the Auckland region. Hence, the accuracy of this sighting is questionable

*** Here, I have also considered data from Gaborit-Haverkort (2012) who reported 4 long-finned pilot whale encounters and 7 sei whale encounters in central Bay of Plenty waters.

NA Not Assessed

Appendix B Ecological Summaries for key marine mammal species

Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Bottlenose dolphins

This species is listed as ‘Nationally Endangered’ by the New Zealand Threat Classification Scheme on account of its very small, fragmented population (Baker et al., 2019); it is therefore considered to be a NZCPS policy 11(a) species.

Inshore bottlenose dolphins in New Zealand represent four genetically distinct populations inhabiting; Northland, Marlborough Sounds, Fiordland (Tezanos-Pinto et al., 2009), and Otago/Stewart Island (Brough et al., 2015). Bottlenose dolphins seen in and around Tauranga Harbour/Te Awanui are part of the ‘Northland’ population which extends from Doubtless Bay to Tauranga and numbers 418 – 487 dolphins (Constantine, 2002). Dolphins from this population range widely along the east coast of north-eastern New Zealand, with home-ranges that commonly extend 500 km along the coastline (Constantine, 2002). Genetic interchange with this population and pelagic groups of Pacific Ocean dolphins has also been documented (Tezanos-Pinto et al., 2009), with dolphins found further offshore in summer and closer inshore in shallower waters in winter (Constantine, 2002). Bottlenose dolphins have a varied diet of fish and squid (Blanco et al., 2001; Gowans et al., 2008) and forage in both shallow and deep habitats (to depths of over 500 m) (Wells & Scott, 2009).

The analysis of the DOC Sightings Database suggests that bottlenose dolphins are likely to have an occasional presence around the proposed port development as this species is routinely sighted in the AOI (25 sightings total), including inside Tauranga Harbour (14 sightings). Of the reported sightings from the AOI, several noted the presence of calves; hence this habitat could support some breeding behaviours.

In addition to the DOC Sightings Database records, Gaborit-Haverkort (2012) undertook 2,364 boat-based marine mammal surveys of the central Bay of Plenty (including the waters of the AOI) between March 1998 and May 2011. Throughout this study 53 sightings of bottlenose dolphins were made, including two within Tauranga Harbour/Te Awanui. Sightings of this species were made throughout the year, but encounter rates peaked in winter. Most sightings from this study occurred in waters less than 50 m deep (range 4 – 109 m). Group size ranged from two to 50+ individuals and calves were recorded on five occasions primarily during summer and autumn.

Meissner (2015) assessed marine mammal sightings from a range of validated sources (experts, tour operators and mariners) in the Bay of Plenty to determine historical and seasonal presence of species between 2000 and 2010. Of the 2,049 marine mammal encounters included in the analysis, 81 involved bottlenose dolphins of which five appear to have occurred inside Tauranga Harbour/Te Awanui. Encounters occurred year-round with encounter rates highest in spring. The median water depth of bottlenose dolphin encounters was 98 m.

The information above clearly indicates that bottlenose dolphins utilise habitat in and around Tauranga Harbour/Te Awanui. While there is little specific information available about how dolphins utilise habitat in the AOI, we do however know that this population ranges widely; hence the proposed port development site would represent only a small portion of any individual dolphins’ home-range and their presence within the harbour is infrequent.

Killer whales

This species is listed as ‘Nationally Critical’ by the New Zealand Threat Classification Scheme on account of its very small population size (Baker et al., 2019); it is therefore considered to be a NZCPS policy 11(a) species.

New Zealand killer whales (also known as orca) have been studied since 1992 and the New Zealand population is believed to be made up of at least three sub-populations based on geographic distribution; a North Island only subpopulation, South Island only subpopulation, and North and South Island subpopulation (Visser, 2000), but the overall population size is small (65 – 167 individuals: Visser, 2006). Recent genetic analysis supports geographical segregation of the population and suggests a degree of site fidelity within subpopulations (Olavarria et al., 2014). New Zealand killer whales are wide-ranging, with some whales estimated to travel on average 100 – 150 km per day (Visser, 2007). High re-sighting rates of identifiable individuals suggest that these whales live permanently or at least semi-permanently around the New Zealand coast (Visser, 2007). The presence of killer whales along the North Island's east coast peaks between August and October, remaining relatively high in November, with a secondary peak in May/June (Visser, 2000; 2007). The year-round presence of immature animals suggests that a distinct breeding season is lacking for New Zealand killer whales (Visser, 2000).

The diet of New Zealand killer whales has been recorded to include 27 species of prey, ten of which have not been recorded for killer whales elsewhere (Visser, 2000). These prey species can be categorised into four main types: rays, sharks, finfish, and cetaceans. Benthic foraging for rays is common around New Zealand's coast and appears to be unique to New Zealand killer whales (Visser, 1999; Duignan et al., 2000). Killer whales present around the North Island (the 'North Island only subpopulation' and the 'North and South Island subpopulation') are generalist foragers that opportunistically take advantage of prey (Visser, 2007) and forage extensively inside enclosed harbours and estuarine areas (Visser, 2000).

An analysis of the DOC Sightings Database suggests that killer whales are likely to be present around the proposed port development as sightings in the AOI are relatively common (61 sightings in total), and sightings do occur inside Tauranga Harbour (34 sighting). Of the reported sightings of this species from the AOI, several noted the presence of calves; hence this habitat could support some breeding behaviours.

During the 2,364 surveys undertaken (over three years) by Gaborit-Haverkort (2012) 45 sightings of killer whales were made, including four within Tauranga Harbour/Te Awanui. Sightings of this species were made throughout the year, but encounter rates peaked in spring. Sightings were made over the depth range 4 – 115 m (mean = 39 m). Group size ranged from one to 30+ individuals and calves were recorded on 15 occasions primarily during spring and autumn.

Of the 2,049 marine mammal encounters analysed by Meissner (2015), 105 involved killer whales including some inside Tauranga Harbour/Te Awanui. Encounters occurred year-round with encounter rates highest in winter and spring. The median water depth of killer whale encounters was 70 m.

Killer whales clearly utilise habitat in the AOI on a relatively frequent basis, and based on what we know about prey preferences, habitat use could include benthic foraging for rays in shallow waters (including Tauranga Harbour/Te Awanui). As killer whales readily move large distances between locations (Visser, 2007), the proposed port development would represent only a small portion of any individual whale's home-range; hence the AOI is not specifically considered to be important during the vulnerable life stages of this species, and their presence within Tauranga Harbour/Te Awanui itself is infrequent.

New Zealand fur seals

While the DOC sighting record does not include any records of New Zealand fur seals, this species is likely to be present in the AOI as fur seals are commonly seen in coastal Bay of Plenty waters, particularly over winter months (DOC, 2012; Bay of Plenty Times 2018). In addition, seasonal (winter) sightings of fur seals are becoming more common inside Tauranga Harbour/Te Awanui, for example the following sighting locations were reported in the winter of 2018: Koromiko Street, Kopurererua Valley Reserve, Tauranga Marina, and

Welcome Bay (Bay of Plenty Times, 2018). Both the DOC Sighting Database and the DOC Incident Database are assumed to be biased low for this species, as terrestrial haul-out behaviour and regular occurrence in coastal waters of this common and relatively frequently seen species means that most sightings go unreported. This species is listed as ‘Not Threatened’ by the New Zealand Threat Classification Scheme (Baker et al., 2019).

New Zealand fur seals are widespread around rocky coastlines of the New Zealand mainland and offshore islands. A reliable total abundance estimate is not available for this species but estimates in the vicinity of 100,000 individuals have been suggested (Harcourt, 2001). Most breeding locations for this species occur on the South Island, this species is expanding its range northwards following the cessation of commercial and subsistence hunting (Lalas & Bradshaw, 2001) and regular breeding now occurs as far north as Gannet Island in Waikato (Bouma et al., 2008) and an emerging breeding colony is establishing on Motunau (Plate) Island in the Bay of Plenty (DOC, 2012). The New Zealand non-breeding distribution is much wider, extending from Three Kings Islands in the north to the Subantarctic islands in the south. Several haul-out locations (non-breeding) occur in and around the AOI, including Karewa Island, Motiti Island, Mayor Island and Plate Island (Meissner, 2015). Mauao also supports small numbers of fur seals ashore during winter (DOC, 2012).

This species forages well offshore and returns to shore every few days to rest (Boren, 2005). New Zealand fur seals forage on a range of species, with the relative importance of each prey item varying by season. Arrow squid are important prey items in summer and autumn, lanternfish are taken year-round, barracouta and jack mackerel are major contributors to the summer diet, while red cod, ahuru, and octopus are important winter prey species (Harcourt et al., 2002). In general, the diet of New Zealand fur seals shifts from a squid dominated diet in summer and autumn, to mixed fish dominated in winter (Harcourt et al., 2002). Foraging habitats vary with season and sex although inshore and deeper offshore foraging habitat is used throughout the year (Harcourt et al., 2002). Females tend to forage over continental shelf waters, with males using deeper continental shelf breaks and pelagic waters (Page et al., 2005).

Of the 2,049 marine mammal encounters analysed by Meissner (2015), 90 involved fur seals, including some that occurred inside Tauranga Harbour/Te Awanui. Encounters occurred year-round with encounter rates highest in winter and spring. The median water depth of fur seal encounters at sea was 82 m.

Meissner (2015) also conducted boat-based surveys of her own and noted that at-sea fur seal occurrence was typically higher in deeper waters, but that the number of fur seals occurring in the Bay of Plenty is low overall compared to other regions of New Zealand, indicating early stage recolonisation following historic exploitation. Mayor Island and Plate Island supported the largest concentrations of animals ashore with up to 15 individuals present in winter; however, only three pups were encountered in the western Bay of Plenty between 2010 and 2013.

While New Zealand fur seals will certainly occur in and around the AOI (particularly in the colder months), foraging typically occurs further offshore and Tauranga Harbour/Te Awanui is considered part of the non-breeding distribution for this species and their presence within the harbour is sporadic. Therefore, the proposed development site does not constitute important habitat during the vulnerable life stages of this species.

Common dolphins

This species is listed as ‘Not Threatened’ by the New Zealand Threat Classification Scheme (Baker et al., 2019) and is therefore not considered under NZCPS Policy 11a(i) or (ii).

Common dolphins occur in all regions of New Zealand; however, most sightings occur around the North Island and upper South Island (Berkenbusch et al., 2013). Total abundance of the New Zealand population is unknown, but is likely to be substantial (Berkenbusch et al., 2013). Stomach content analysis of stranded and by-caught common dolphins in New Zealand revealed a diverse diet of fish and cephalopod species, with arrow squid, jack mackerel and anchovy identified as the primary prey species (Meynier et al., 2008).

As described by Gaborit-Haverkort (2012) and Meissner (2015) common dolphins are the species most frequently encountered in the wider AOI (i.e., outside of Tauranga Harbour/Te Awanui). Of the 2,049 marine mammal encounters analysed by Meissner (2015), 1,552 involved common dolphins, with this species being the most frequently encountered of all marine mammals in the Bay of Plenty. Encounter rates were highest in summer and autumn when dolphins were typically observed in shallower water (median 56 m) than winter and spring (82 m and 64 m respectively). Meissner (2015) also conducted boat-based surveys and noted strong seasonality of common dolphins associated with the warm seasons (December to April). The following distributional hotspots were identified for common dolphins in the Bay of Plenty: over the shelf break (100-200 m depth), around islands and reefs (e.g., east of Mayor Island, Penguin Shoal, Pudney Rock, northeast of Motiti Island).

Between March 1998 and May 2011 Gaborit-Haverkort (2012) undertook 2,364 boat-based marine mammal surveys of the central Bay of Plenty (including the waters of the AOI). Common dolphins were encountered on 1,265 of these trips (54%) and were the most frequently sighted marine mammal species. No common dolphins were encountered within Tauranga Harbour/Te Awanui during these surveys with the sightings mostly occurring in the area between Motiti Island, Mayor Island and Waihi in water depths from <5 to 130 m. Encounter rates were highest during summer and autumn when large groups of dolphins with calves were common; hence the AOI could support some breeding behaviours.

Photo-identification evidence confirms that individuals of this species readily move between locations from Hauraki Gulf to Whakatane (200 km); generally indicating that common dolphins are highly mobile throughout a large home-range (Neumann et al., 2002). On this basis the AOI would represent only a small portion of a much wider home-range.

Stephenson et al. (2020) undertook habitat modelling using a wide range of environmental variables to predict the probability of occurrence of marine mammal species throughout New Zealand’s Exclusive Economic Zone. It is noteworthy that the modelling indicates a low probability of occurrence for common dolphins inside Tauranga Harbour/Te Awanui increasing to a moderate-high probability of occurrence within a short distance offshore. The sightings data from the DOC Sighting Database, Meissner (2015) and Gaborit-Haverkort (2012) support this finding.

On the basis of the information presented here, common dolphins are likely to be present in the AOI but are unlikely to occur within Tauranga Harbour/Te Awanui.

Appendix C Acoustic Monitoring Deployment Details, Tauranga Harbour (Provided by Styles Group)

Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Deployment Details for Tauranga Harbour

Sites:
Three monitoring sites were established inside Tauranga Harbour/Te Awanui (Figure 1). The coordinates for each site in Figure 1 are:

- Stella Passage: S 37.66603 E 176.17662.
- Outer West: S 37.63975 E 176.16666.
- Outer East: S 37.637700 E 176.170230.

Figure 1:

Acoustic recorders

Acoustic data were collected using calibrated SoundTrap recorders from Ocean Instruments NZ (Figure 2). Each monitoring site contained a single hydrophone.

Figure 2: Two bottom mounted SoundTrap 600 recorders in their mooring tubes.

Deployments

Each monitoring site was serviced when the batteries and memory of each SoundTrap recorder needed changing. This was scheduled to be every 1.5 months, however, due to the Port's operational timelines or weather conditions, this was sometimes delayed.
The dates of each deployment were:

- Deployment 1: 31/08/2022 to 04/11/2022
- Deployment 2: 04/11/2022 to 08/03/2023
- Deployment 3: 09/03/2022 to 06/07/2023

Data Collected:

For each deployment, because the recorders were operating independently, each ran out of battery or filled their memory cards at different times. Therefore, while the deployment periods covered dates listed above, it did not necessarily mean that data were collected over that whole time.
The periods over which data were collected are summarized in Table 1.

Table 1: Summary of data collected

Monitoring Site	Deployment Period	Period when data were collected
Deployment 1		
Outer East	31/08/2022 – 04/11/2022	31/08/2022 – 29/10/2022
Outer West		31/08/2022 – 04/11/2022
Stella Passage		31/08/2022 – 19/10/2022
Deployment 2		
Outer East	04/11/2022 – 08/03/2023	04/11/2022 – 02/01/2023
Outer West		04/11/2022 – 19/12/2022*
Stella Passage		04/11/2022 – 06/02/2023
Deployment 3		
Outer East	09/03/2023 – 06/07/2023	09/03/2023 – 11/06/2023
Outer West		09/03/2023 – 22/05/2023*
Stella Passage		09/03/2023 – 31/05/2023

*Instrument had technical issues and stopped

Data analysis

Data has been analysed for Deployment 1 and Deployment 2. Data from Deployment 3 are currently being analysed as only recovered last week (10 July 2023).

Dolphins and killer whales were the primary species being detected. Large whales were not detected inside the harbour during Deployment 1 and Deployment 2. There were occasional acoustic detections of baleen calls from outside the harbour from the Outer East and Outer West sites.

Appendix D Acoustic Detections, Tauranga Harbour (Provided by Styles Group)

Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Acoustic Detections from Outer East Site – Deployment 1

DEPLOYMENT 1			
Start	End	Duration	Species
31-08-2022 15:09	31-08-2022 15:10	0:01:00	Dolphin
01-09-2022 3:54	01-09-2022 3:54	0:01:00	Killer whale
01-09-2022 4:25	01-09-2022 4:25	0:01:00	Killer whale
01-09-2022 20:50	01-09-2022 20:51	0:01:00	Killer whale
02-09-2022 2:07	02-09-2022 2:07	0:01:00	Dolphin
02-09-2022 3:07	02-09-2022 3:08	0:01:00	Killer whale
02-09-2022 13:33	02-09-2022 13:37	0:04:00	Dolphin
02-09-2022 15:01	02-09-2022 15:01	0:01:00	Dolphin
04-09-2022 17:05	04-09-2022 17:26	0:21:00	Killer whale
04-09-2022 20:27	04-09-2022 20:27	0:01:00	Killer whale
07-09-2022 11:38	07-09-2022 11:38	0:01:00	Dolphin
09-09-2022 12:35	09-09-2022 12:35	0:01:00	Killer whale
09-09-2022 19:00	09-09-2022 19:00	0:01:00	Killer whale
09-09-2022 19:25	09-09-2022 19:25	0:01:00	Killer whale
18-09-2022 12:55	18-09-2022 12:55	0:01:00	Dolphin
18-09-2022 16:46	18-09-2022 16:46	0:01:00	Dolphin
18-09-2022 20:16	18-09-2022 20:16	0:01:00	Dolphin
24-09-2022 22:06	24-09-2022 22:25	0:19:00	Killer whale
25-09-2022 16:58	25-09-2022 16:58	0:01:00	Dolphin
26-09-2022 0:16	26-09-2022 0:18	0:02:00	Killer whale
27-09-2022 19:01	27-09-2022 19:06	0:05:00	Killer whale
06-10-2022 1:31	06-10-2022 1:33	0:02:00	Killer whale
07-10-2022 11:49	07-10-2022 11:49	0:01:00	Dolphin
07-10-2022 12:32	07-10-2022 12:32	0:01:00	Dolphin
07-10-2022 14:09	07-10-2022 14:09	0:01:00	Dolphin
11-10-2022 7:32	11-10-2022 7:32	0:01:00	Dolphin
11-10-2022 15:23	11-10-2022 15:23	0:01:00	Dolphin
12-10-2022 5:20	12-10-2022 5:20	0:01:00	Dolphin
15-10-2022 15:41	15-10-2022 15:41	0:01:00	Dolphin
16-10-2022 13:25	16-10-2022 13:25	0:01:00	Killer whale

Acoustic Detections from Outer East Site – Deployment 2

DEPLOYMENT 2			
Start	End	Duration	Species
05-11-2022 10:22	05-11-2022 10:27	0:05:00	Dolphin
05-11-2022 12:33	05-11-2022 13:01	0:28:00	Dolphin
05-11-2022 13:30	05-11-2022 14:00	0:30:00	Dolphin
05-11-2022 15:51	05-11-2022 15:51	0:01:00	Dolphin
07-11-2022 17:19	07-11-2022 17:19	0:01:00	Dolphin
12-11-2022 14:21	12-11-2022 14:21	0:01:00	Dolphin
17-11-2022 14:09	17-11-2022 14:10	0:01:00	Killer whale
24-11-2022 17:31	24-11-2022 17:31	0:01:00	Killer whale
24-11-2022 18:12	24-11-2022 18:12	0:01:00	Killer whale
02-12-2022 5:56	02-12-2022 5:59	0:03:00	Killer whale
04-12-2022 12:34	04-12-2022 12:34	0:01:00	Dolphin
04-12-2022 13:20	04-12-2022 13:26	0:06:00	Dolphin
06-12-2022 15:37	06-12-2022 15:37	0:01:00	Dolphin
16-12-2022 15:59	16-12-2022 15:59	0:01:00	Dolphin
17-12-2022 8:24	17-12-2022 8:24	0:01:00	Dolphin
19-12-2022 5:23	19-12-2022 5:23	0:01:00	Dolphin
19-12-2022 9:44	19-12-2022 9:44	0:01:00	Dolphin
19-12-2022 13:15	19-12-2022 13:15	0:01:00	Dolphin
22-12-2022 13:22	22-12-2022 13:22	0:01:00	Dolphin
26-12-2022 9:53	26-12-2022 9:53	0:01:00	Dolphin
26-12-2022 18:19	26-12-2022 18:19	0:01:00	Dolphin
30-12-2022 13:41	30-12-2022 13:41	0:01:00	Dolphin
31-12-2022 10:45	31-12-2022 10:45	0:01:00	Dolphin
01-01-2023 10:21	01-01-2023 10:21	0:01:00	Dolphin

Acoustic Detections from Outer East Site – Deployment 3

DEPLOYMENT 3			
Start	End	Duration	Species
16-03-2023 21:00	16-03-2023 21:00	0:01:00	Dolphin
16-03-2023 21:21	16-03-2023 21:21	0:01:00	Dolphin
19-03-2023 12:31	19-03-2023 12:31	0:01:00	Dolphin
29-03-2023 22:59	29-03-2023 22:59	0:01:00	Dolphin
01-04-2023 0:27	01-04-2023 0:27	0:01:00	Dolphin
01-04-2023 0:50	01-04-2023 0:50	0:01:00	Dolphin
01-04-2023 12:10	01-04-2023 12:16	0:06:00	Dolphin
09-04-2023 7:16	09-04-2023 7:16	0:01:00	Dolphin
10-04-2023 14:29	10-04-2023 14:29	0:01:00	Dolphin
10-04-2023 14:50	10-04-2023 14:50	0:01:00	Dolphin
18-04-2023 11:26	18-04-2023 11:26	0:01:00	Dolphin
18-04-2023 11:49	18-04-2023 11:50	0:01:00	Dolphin
18-04-2023 13:23	18-04-2023 13:23	0:01:00	Dolphin
18-04-2023 14:28	18-04-2023 14:28	0:01:00	Killer whale
20-04-2023 14:21	20-04-2023 14:22	0:01:00	Dolphin
23-04-2023 11:23	23-04-2023 11:23	0:01:00	Dolphin
29-04-2023 14:22	29-04-2023 14:22	0:01:00	Dolphin
05-05-2023 7:03	05-05-2023 7:10	0:07:00	Killer whale
05-05-2023 7:49	05-05-2023 7:52	0:03:00	Killer whale
05-05-2023 8:50	05-05-2023 8:50	0:01:00	Killer whale
08-05-2023 16:29	08-05-2023 16:30	0:01:00	Killer whale
10-05-2023 20:27	10-05-2023 20:27	0:01:00	Dolphin
14-05-2023 1:03	14-05-2023 1:07	0:04:00	Dolphin
17-05-2023 16:46	17-05-2023 16:47	0:01:00	Dolphin
18-05-2023 0:20	18-05-2023 0:20	0:01:00	Dolphin
18-05-2023 7:55	18-05-2023 7:55	0:01:00	Dolphin
18-05-2023 8:28	18-05-2023 8:42	0:14:00	Killer whale
22-05-2023 13:09	22-05-2023 13:09	0:01:00	Killer whale
25-05-2023 13:32	25-05-2023 13:32	0:01:00	Dolphin
02-06-2023 4:48	02-06-2023 4:48	0:01:00	Dolphin

Acoustic Detections from Outer West Site – Deployment 1

DEPLOYMENT 1			
Start	End	Duration	Species
01-09-2022 20:48	01-09-2022 20:55	0:07:00	Killer whale
02-09-2022 0:39	02-09-2022 0:39	0:01:00	Dolphin
02-09-2022 3:08	02-09-2022 3:08	0:01:00	Killer whale
02-09-2022 8:59	02-09-2022 9:06	0:07:00	Dolphin
03-09-2022 1:05	03-09-2022 1:05	0:01:00	Dolphin
03-09-2022 4:10	03-09-2022 4:10	0:01:00	Dolphin
03-09-2022 17:49	03-09-2022 17:49	0:01:00	Dolphin
03-09-2022 18:14	03-09-2022 18:14	0:01:00	Dolphin
03-09-2022 23:24	03-09-2022 23:24	0:01:00	Dolphin
03-09-2022 23:47	03-09-2022 23:47	0:01:00	Dolphin
04-09-2022 18:23	04-09-2022 18:23	0:01:00	Killer whale
04-09-2022 20:27	04-09-2022 20:27	0:01:00	Killer whale
05-09-2022 8:38	05-09-2022 8:38	0:01:00	Dolphin
05-09-2022 15:47	05-09-2022 15:47	0:01:00	Killer whale
05-09-2022 20:57	05-09-2022 20:57	0:01:00	Dolphin
08-09-2022 9:34	08-09-2022 9:34	0:01:00	Dolphin
10-09-2022 13:11	10-09-2022 13:11	0:01:00	Dolphin
13-09-2022 22:35	13-09-2022 22:35	0:01:00	Killer whale
24-09-2022 22:05	24-09-2022 22:23	0:18:00	Killer whale
26-09-2022 0:18	26-09-2022 0:18	0:01:00	Killer whale
26-09-2022 4:40	26-09-2022 4:40	0:01:00	Dolphin
27-09-2022 19:01	27-09-2022 19:09	0:08:00	Killer whale
07-10-2022 11:49	07-10-2022 11:49	0:01:00	Dolphin
07-10-2022 18:14	07-10-2022 18:14	0:01:00	Dolphin
11-10-2022 21:34	11-10-2022 21:34	0:01:00	Dolphin
12-10-2022 22:11	12-10-2022 22:13	0:02:00	Killer whale
16-10-2022 9:12	16-10-2022 9:12	0:01:00	Dolphin
16-10-2022 12:12	16-10-2022 12:12	0:01:00	Dolphin
16-10-2022 12:55	16-10-2022 12:55	0:01:00	Dolphin
18-10-2022 19:27	18-10-2022 19:27	0:01:00	Dolphin
25-10-2022 15:05	25-10-2022 15:05	0:01:00	Dolphin
28-10-2022 11:02	28-10-2022 11:02	0:01:00	Dolphin
28-10-2022 16:52	28-10-2022 16:52	0:01:00	Dolphin

Acoustic Detections from Outer West Site – Deployment 2

DEPLOYMENT 2			
Start	End	Duration	Species
09-11-2022 16:18	09-11-2022 16:23	0:05:00	Unknown (Possible Pinniped)
14-11-2022 17:37	14-11-2022 17:37	0:01:00	Dolphin
16-11-2022 15:55	16-11-2022 15:57	0:02:00	Dolphin
17-11-2022 13:38	17-11-2022 13:38	0:01:00	Killer whale
21-11-2022 11:02	21-11-2022 11:02	0:01:00	Unknown (Possible Pinniped)
21-11-2022 14:04	21-11-2022 14:04	0:01:00	Unknown (Possible Pinniped)
02-12-2022 5:39	02-12-2022 6:00	0:21:00	Killer whale
12-12-2022 10:01	12-12-2022 10:01	0:01:00	Dolphin
12-12-2022 11:27	12-12-2022 11:27	0:01:00	Dolphin

Acoustic Detections from Outer West Site – Deployment 3

DEPLOYMENT 3			
Start	End	Duration	Species
15-03-2023 14:59	15-03-2023 15:09	0:10:00	Dolphin
16-03-2023 1:55	16-03-2023 1:55	0:01:00	Dolphin
16-03-2023 20:59	16-03-2023 21:26	0:27:00	Dolphin
17-03-2023 1:55	17-03-2023 2:12	0:17:00	Killer whale
17-03-2023 2:51	17-03-2023 2:51	0:01:00	Killer whale
17-03-2023 11:37	17-03-2023 11:37	0:01:00	Dolphin
17-03-2023 23:53	18-03-2023 0:11	0:18:00	Killer whale
25-03-2023 17:35	25-03-2023 17:35	0:01:00	Dolphin
26-03-2023 17:00	26-03-2023 17:01	0:01:00	Dolphin
27-03-2023 17:26	27-03-2023 17:26	0:01:00	Killer whale
02-04-2023 8:10	02-04-2023 8:23	0:13:00	Dolphin
02-04-2023 10:35	02-04-2023 10:48	0:13:00	Dolphin
02-04-2023 11:19	02-04-2023 11:27	0:08:00	Dolphin
08-04-2023 8:41	08-04-2023 8:41	0:01:00	Dolphin
09-04-2023 5:40	09-04-2023 5:40	0:01:00	Killer whale
09-04-2023 19:46	09-04-2023 19:46	0:01:00	Killer whale
09-04-2023 20:21	09-04-2023 20:21	0:01:00	Killer whale
10-04-2023 11:11	10-04-2023 11:11	0:01:00	Dolphin
10-04-2023 16:12	10-04-2023 16:12	0:01:00	Dolphin
11-04-2023 17:23	11-04-2023 17:23	0:01:00	Dolphin
17-04-2023 12:55	17-04-2023 13:09	0:14:00	Killer whale
18-04-2023 14:05	18-04-2023 14:05	0:01:00	Killer whale
27-04-2023 16:52	27-04-2023 16:52	0:01:00	Dolphin
01-05-2023 23:05	01-05-2023 23:05	0:01:00	Dolphin
05-05-2023 13:29	05-05-2023 13:29	0:01:00	Dolphin
08-05-2023 16:24	08-05-2023 16:28	0:04:00	Killer whale
09-05-2023 3:18	09-05-2023 3:18	0:01:00	Dolphin
12-05-2023 20:59	12-05-2023 20:59	0:01:00	Killer whale
13-05-2023 22:02	13-05-2023 22:08	0:06:00	Killer whale
14-05-2023 18:10	14-05-2023 18:11	0:01:00	Dolphin
17-05-2023 16:45	17-05-2023 16:46	0:01:00	Killer whale
18-05-2023 8:32	18-05-2023 8:32	0:01:00	Dolphin
20-05-2023 3:52	20-05-2023 3:52	0:01:00	Dolphin

Acoustic Detections from Stella Passage – Deployments 1, 2 & 3

DEPLOYMENT 1			
Start	End	Duration	Species
21-09-2022 16:00	21-09-2022 16:00	0:01:00	Dolphin
23-09-2022 20:00	23-09-2022 20:00	0:01:00	Dolphin
DEPLOYMENT 2			
Start	End	Duration	Species
10-11-2022 19:00	10-11-2022 19:00	0:01:00	Dolphin
11-11-2022 16:50	11-11-2022 16:51	0:01:00	Dolphin
19-11-2022 14:00	19-11-2022 14:00	0:01:00	Dolphin
DEPLOYMENT 3			
Start	End	Duration	Species
31-03-2023 13:46	31-03-2023 14:02	0:15:00	Dolphin

Appendix E Underwater Acoustic Modelling Report - Pile Driving

Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Underwater Piling Noise Modelling

Stella Passage Development

Port of Tauranga

Private Bag 12504, Tauranga

Prepared by:

SLR Consulting (Canada) Ltd.

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SLR Project No.: 840.030138.00001

February 5, 2025

Revision: 3

Revision Record

Revision	Date	Prepared By	Checked By	Authorized By
1.0	August 16, 2021	Binghui Li Dana Lewis	Helen McConnell	DRAFT
2.0	August 26, 2021	Binghui Li Dana Lewis	Helen McConnell	Binghui Li
3.0	February 5, 2025	Jonathan Vallarta Justin Eickmeier	Justin Eickmeier	Jonathan Vallarta

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Executive Summary

To enable the Port of Tauranga to accommodate growth in cargo and vessel sizes while also catering for projected export and import volume in the future, Port of Tauranga Ltd (POTL) is proposing development within the existing port area consisting of reclamations and wharf extensions on both sides of Stella Passage and dredging to extend the shipping channel in Stella Passage. POTL is currently preparing an application to undertake this work under the Fast-track Approvals Act 2024.

SLR Consulting Australia Pty Ltd (SLR) has been appointed to undertake underwater noise modelling and assessment of relevant zones of noise impacts on marine mammal species from piling activities of the proposed expansion works.

This report provides a marine noise modelling study and an assessment of zones of impact from the proposed pile driving operations associated with the Stella Passage Development project. The assessment process relies on the findings of McConnell (2025) which identifies key marine mammal species potentially impacted by the underwater noise emissions and their relevant assessment criteria, characterisation of existing underwater noise environment based on literature review of general ocean noise environment, the characterisation of underwater piling noise, detailed modelling prediction of unmitigated underwater noise propagations, and the assessment of potential zones of impact.

The marine mammal species of greatest concern are those that have an intermittent occurrence within the inner harbour area, namely bottlenose dolphins, killer whales and New Zealand fur seals. The noise impact criteria in terms of physiological and behavioural impacts for these and other marine mammal species that could occur outside the harbour have also been established via a review of the most relevant guidelines or literature.

Detailed modelling predictions have been undertaken for noise emissions from pile driving operations using impact hammers. The zones of noise impact from the nominated piling locations have been estimated for marine mammal species based on comparisons between predicted noise levels and impact criteria, with results presented in **Section 5.2**.

These results identify that Low Frequency cetaceans and Phocid pinnipeds are the marine mammal groups with the largest potential zones of impact for auditory injuries (AUD INJ) and temporary threshold shift (TTS). The zones of impact are also expanded if both sources are active simultaneously. However, zones of impact for cumulative exposure over an entire piling event would only be applicable if an animal remains at the noise source throughout the entire operation and thus remains exposed to elevated underwater noise levels for an extended period of time. Instead, it is highly likely that animals will not remain in close proximity to the noise source and that their exposure to sound levels above the various thresholds will be much shorter. Therefore, the distances identified for cumulative thresholds are conservative and likely to overstate the extent of the typical impact area. Furthermore, for those species expected intermittently inside the harbour, the predicted zones of impact are comparatively small and could easily be managed by the implementation of shutdown zones.

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Appendices

1.0 Introduction

The Port of Tauranga (the port) is the largest port in New Zealand, catering for numerous imports and exports of containers, bulk cargo (e.g., grains, fertiliser, coal and logs), break bulk cargo (e.g., kiwifruit, timber and steel) and bulk liquids and cement. Since 2000 the number of ships and the size of vessels has steadily increased. The port has been visited annually by up to 1,700 vessels, with the average container vessel length greater than 230 m (up to a maximum of 347 m). On this basis the port has high berth utilisation and delays to shipping lines are common as vessels wait for berth space. To enable the Port of Tauranga to accommodate growth in cargo and vessel sizes while also catering for projected export and import volume in the future, Port of Tauranga Ltd (POTL) is proposing development of the port, including reclamation works and wharf extensions on both sides of Stella Passage, and dredging to extend the shipping channel in Stella Passage. This report provides an assessment of environmental effects (AEE) of underwater piling noise associated with the Stella Passage Project ('the project') on marine mammals.

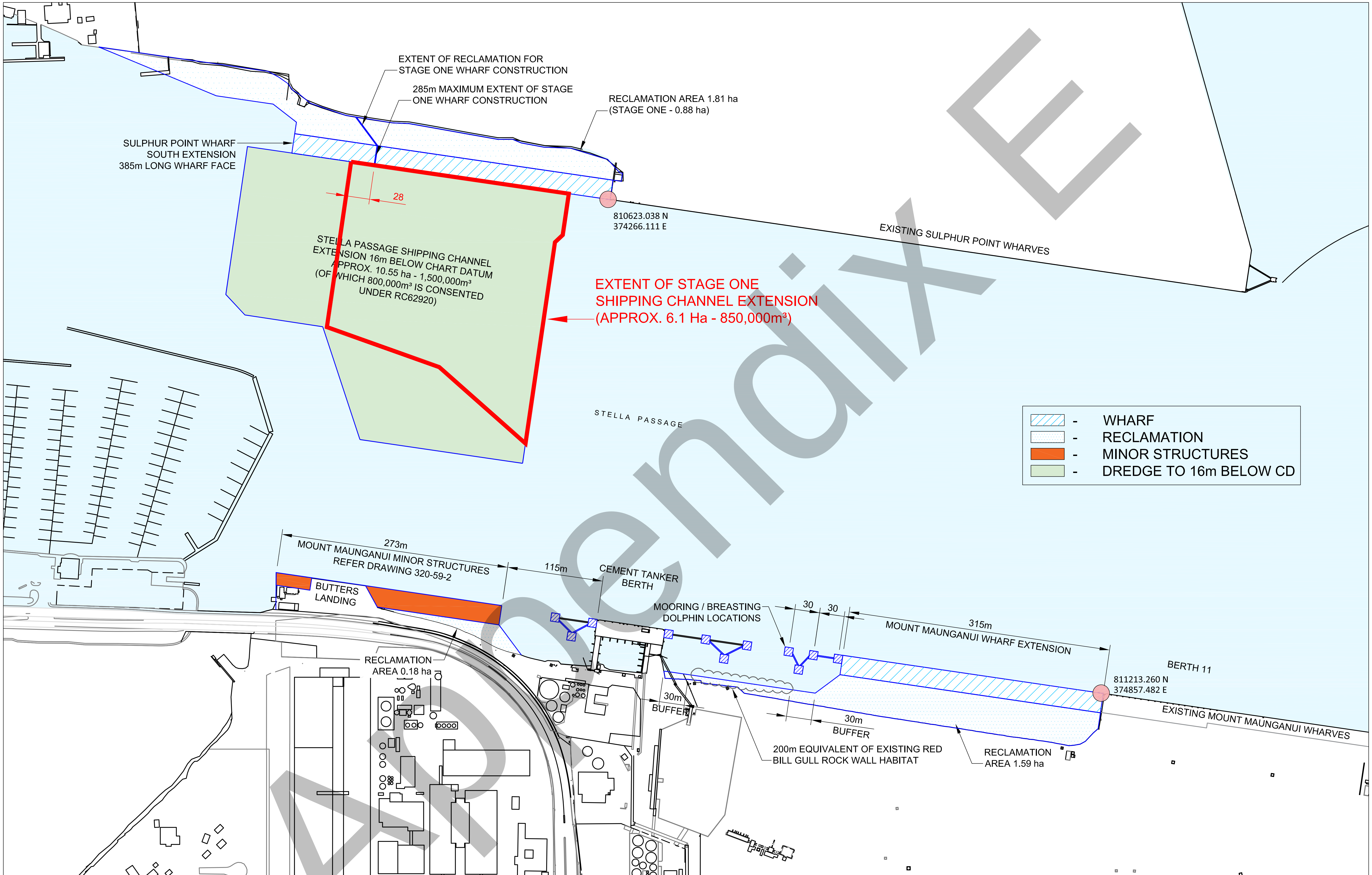
1.1 Project overview

A full description of the proposed works associated with the Stella Passage Project is provided in the Assessment of Environmental Effects provided with the application. On this basis, extensive technical details of the proposed activities are not repeated here; however, in summary the project is comprised of the following components which are to be undertaken in two stages as detailed in **Table 1**

- Sulphur Point Wharf Southern Extension;
- Sulphur Point Southern Extension Reclamation;
- Mount Maunganui Wharf Southern Extension;
- Mount Maunganui Southern Extension Reclamation; and
- Capital and maintenance dredging of the Stella Passage Shipping Channel Extension.

The scope of POTL's Fast-track Approvals Act 2024 (**FTA**) application includes the proposed works associated with both Stage 1 and Stage 2 (as summarised in **Table 1)**.

Figure 1 summarises the scale of the development in relation to existing port assets and surrounds.



REV.	AMENDMENT	DRAWN	CHECK	DATE
B	NOTES UPDATED	D.B		14.10.24
A	NOTES REVISED	D.B		22.05.24
0	FOR INFORMATION	D.B	-	13.12.23

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PROPOSED WHARF / RECLAMATIONS / DREDGING RESOURCE CONSENT DRAWINGS

-

SCALES: (A3) 1:4000		FILENAME 320-64.dwg	LAST PLOT DATE 14.10.24
DESIGNED	-	DRAWING No.	REV.
DATE	-	320-64	B
DRAWN	D.B		
DATE	13.12.23		
CHECKED	-		
DATE	-		

Table 1: Description of the staged approach to the project

Site	Stage 1	Stage 2
Sulphur Point	Reclaim 0.88 ha of the coastal marine area south of the existing wharf.	Reclaim 0.93 ha of the coastal marine area south of the stage 1 reclamation.
	Develop a 285 m southern extension to the wharf in front of the stage 1 reclamation.	Develop a 100 m southern extension to the wharf in front of the stage 2 reclamation.
Stella Passage	Dredge 6.1 ha and 850,000 m^3 within the footprint of dredging previously consented under permit 62920 to 16 m depth. Maintain this depth.	Dredge the shipping channel (outside the 62920-permit footprint) to 16 m deep: approximately 4.45 ha and 650,000 m^3. Maintain this depth.
Mount Maunganui	Nil	Reclaim 1.77 ha of the coastal marine area south of the existing Mt Maunganui wharf.
		Develop a 315 m southern extension to the Mt Maunganui wharf in front of the reclamation and install mooring dolphins.
		Provide the equivalent of 200 m of existing gull habitat south of the wharf extension.
		Install mooring dolphins beside the existing cement tanker berth.
		Move the existing ferry ramp northwards.
		Move an existing jetty north towards the ferry ramp and construct a third jetty.
		Develop a bunker barge jetty between Butters Landing and the ferry ramp.
		Develop penguin ramp and habitat at the south end of Butters Landing.

The scope of this report is to assess the effects of underwater pile driving noise on marine mammals. A basic description of this component of the project is provided below.

1.1.1 Pile Driving

Piles for wharf construction will be steel tubes with capped ends that are required to be driven their entire length into the seabed. It is estimated that eight piles will be required for every c. 6 m of wharf length. Piles will range in diameter from 785 – 914 mm and will be driven to a depth of up to 30 m by impact hammers (10-14 tonne falling weight). The hammer would run at 50% energy for most of the driving and then 100% for the last 2-3 m. After driving to the appropriate finished depth, each pile will be integrity tested before a steel reinforcing cage is inserted and the pile is filled with concrete. The estimated number of piles required for each site and stage are provided in **Table 2.**

It is estimated that Stage 1 pile driving will extend over a c.260 day period using two crews. Two days of full driving time per week is a ‘likely’ intensity, equating to c. 78 cumulative days of driving time.

It is estimated that the full extent of the Stage 2 pile driving would extend over a c.466 day period using two crews. Two days of full driving time per week is a ‘likely’ intensity, equating to c. 140 cumulative days of driving time.

On days when pile driving occurs, it is estimated that up to 8,000 hammer strikes could occur. Pile driving will only occur during daylight hours. Noting that from Monday to Friday, piling will only be allowed between the hours of 7:30 am and 8 pm and will be further restricted to between 9 am and 7 pm on Saturdays. No pile driving will occur on Sundays or public holidays.

Table 2: Estimated number of piles required for the project

Site	Stage 1	Stage 2
Sulphur Point	Approximately 420 piles to complete the 285 m wharf extension.	Approximately 152 piles to complete the 100 m wharf extension.
Mount Maunganui	0	Approximately 600 piles in total, comprised of: - Approximately 464 piles to complete the 315 m wharf extension. - Approximately 120 piles to complete the mooring and breasting dolphins. - Approximately 12 piles to complete the Butters Landing Jetty. - Approximately 4 piles to complete the penguin ramp.

In addition to impact piling associated with wharf construction, vibro-piling will be used during the initial process of reclamation whereby small sections of sheet piling will be installed in order to create a platform on which the main wharf extension works will occur from. On this basis, vibro-piling will occur for short periods at the project outset but will only constitute a minor part of the overall project.

1.2 Marine Mammals in and around Tauranga Harbour

Based on multiple data sources that represent the best available information on marine mammal distribution in and around Tauranga Harbour, McConnell (2025) has conducted an assessment of potential marine mammal occurrence in the vicinity of the Stella Passage Development, concluding that:

- Within the harbour in the immediate vicinity around the proposed development site, three species, i.e., bottlenose dolphins, killer whales and New Zealand fur seals, are likely to occur on an occasional basis.
- Outside the harbour, the following species could possibly be present: blue whales, minke whales, Bryde’s whales, false killer whales, Gray’s beaked whales, humpback whales, long-finned pilot whales, southern right whales, sei whales, and leopard seals.
  The species with a certain frequent presence outside of the harbour are common dolphins, bottlenose dolphins, killer whales and New Zealand fur seals.

1.3 Underwater piling noise modelling - methodology

This modelling and zones of impact study has been undertaken with consideration of the current best practice in assessing underwater noise impact on marine mammal species applied both nationally and internationally. The study methodology is detailed within the report structure below.

- **Section 2.0** provides the characterisation of the existing acoustic environment, based on a review of general ocean noise environment, as well as the site-specific marine environment and shipping traffic conditions surrounding the project area;
- **Section 3.0** outlines the assessment criteria for generic marine mammal species, based on relevant guidelines and criteria that represent current industry best practice;
- **Section 4.0** provides detailed noise modelling prediction methodology and procedure, relevant modelling environmental inputs and assumptions, modelling source locations and operational scenarios associated with pile driving activities, and source levels of these inputs; and
- **Sections 5.0** provides the detailed modelling results, and the subsequent zones of impact estimated for marine mammal species based on criteria set out in **Section 3.0.**

An explanation of the acoustic terminologies used in the report is provided in **Appendix A**.

2.0 Existing Underwater Noise Environment

2.1 General ocean ambient noise

Ocean ambient noise poses a baseline limitation on the use of sound by marine animals as signals of interest must be detected against noise background. The level and frequency characteristics of the ambient noise environment are the two major factors that control how far away a given sound signal can be detected (Richardson et al, 1995).

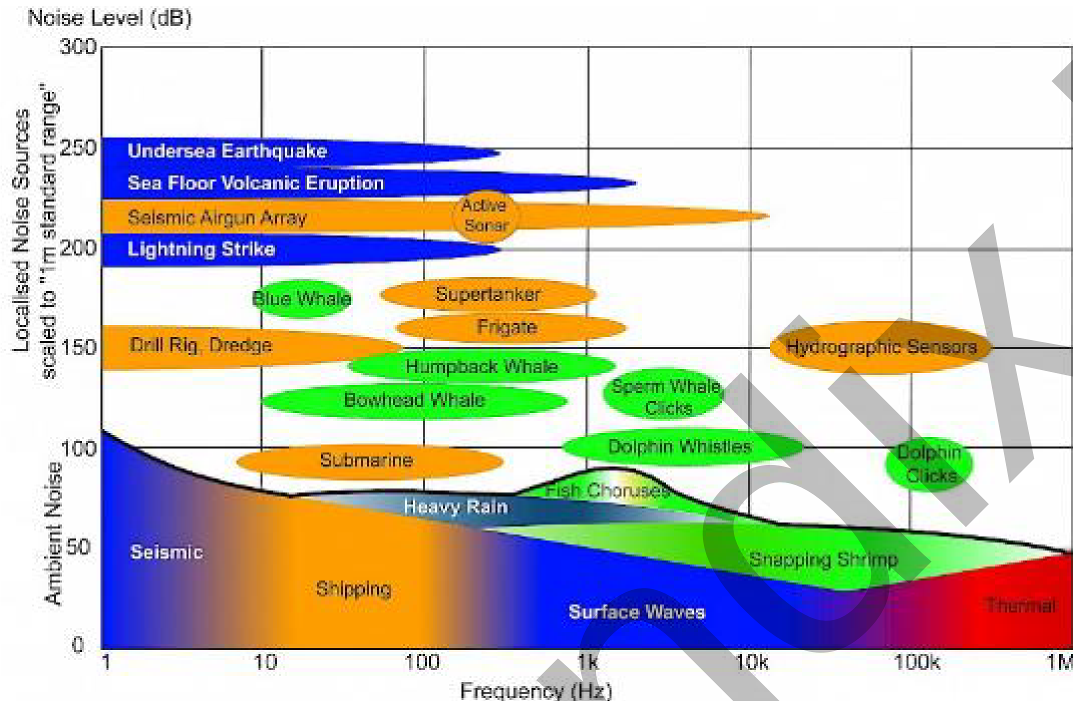
Ocean ambient noise is comprised of a variety of sounds of different origin at different frequency ranges, having both temporal and spatial variations. It primarily consists of noise from natural physical events, noise produced by marine biological species and anthropogenic noise. These sources are detailed as follows:

- Natural events: the major natural physical events contributing to ocean ambient noise include, but are not limited to, wave/turbulence interactions, wind, precipitation (rain and hail), breaking waves and seismic events (e.g. earthquakes/tremors):
  - The interactions between waves/turbulence can cause very low frequency noise in the infrasonic range (below 20 Hz). Seismic events such as earthquakes/tremors and underwater volcanos also generate noise predominantly at low frequencies from a few Hz to a few hundred Hz;
  - Wind and breaking waves, as the prevailing noise sources in much of the world’s oceans, generate noise across a very wide frequency range, typically dominating the ambient environment from 100 Hz to 20 kHz in the absence of biological noise sources. The wind-dependent noise spectral levels also strongly depend on sea states which are essentially correlated with wind force; and
  - Precipitation, particularly heavy rainfall, can produce much higher noise levels over a wider frequency range of approximately 500 Hz to 20 kHz.

- Bioacoustic production: some marine animals produce various sounds (e.g. whistles, clicks) for different purposes (e.g. communication, navigation or detection):
  - Baleen whales (e.g. great whales like humpback whales) regularly produce intense low-frequency sound (whale songs) that can be detected at long range in the open water. Odontocete whales, including dolphins, can produce rapid burst of high-frequency clicks (up to 150 kHz) that are primarily for echolocation purposes;
  - Some fish species produce sounds individually, and some species also make noise in choruses. Typically, fish chorusing sounds depend on species, time of day and time of season; and
  - Snapping shrimps are important contributors among marine biological species to the ocean ambient noise environment, particularly in shallow coastal waters. The noise from snapping shrimps is extremely broadband in nature, covering a frequency range from below 100 Hz to above 100 kHz. Snapping shrimp noise can interfere with other measurement and recording exercises, for example it can adversely affect sonar performance.
- Anthropogenic sources: anthropogenic noise primarily consists of noise from shipping activities, offshore seismic explorations, marine industrial developments and operations, as well as equipment such as sonar and echo sounders:
  - Shipping traffic from various sizes of ships is the prevailing man-made noise source around nearshore port areas. Shipping noise is typically due to cavitation from propellers and thrusters, with energy predominantly below 1 kHz;
  - Pile driving and offshore seismic exploration generate repetitive pulse signals with intense energy at relatively low frequencies (hundreds of Hz) that can potentially cause physical injuries to marine species close to the noise source. The full frequency range for these impulsive signals could be up to 10k Hz; and
  - Dredging activities and other marine industry operations are additional man-made sources, generating broadband noise over relatively long durations.

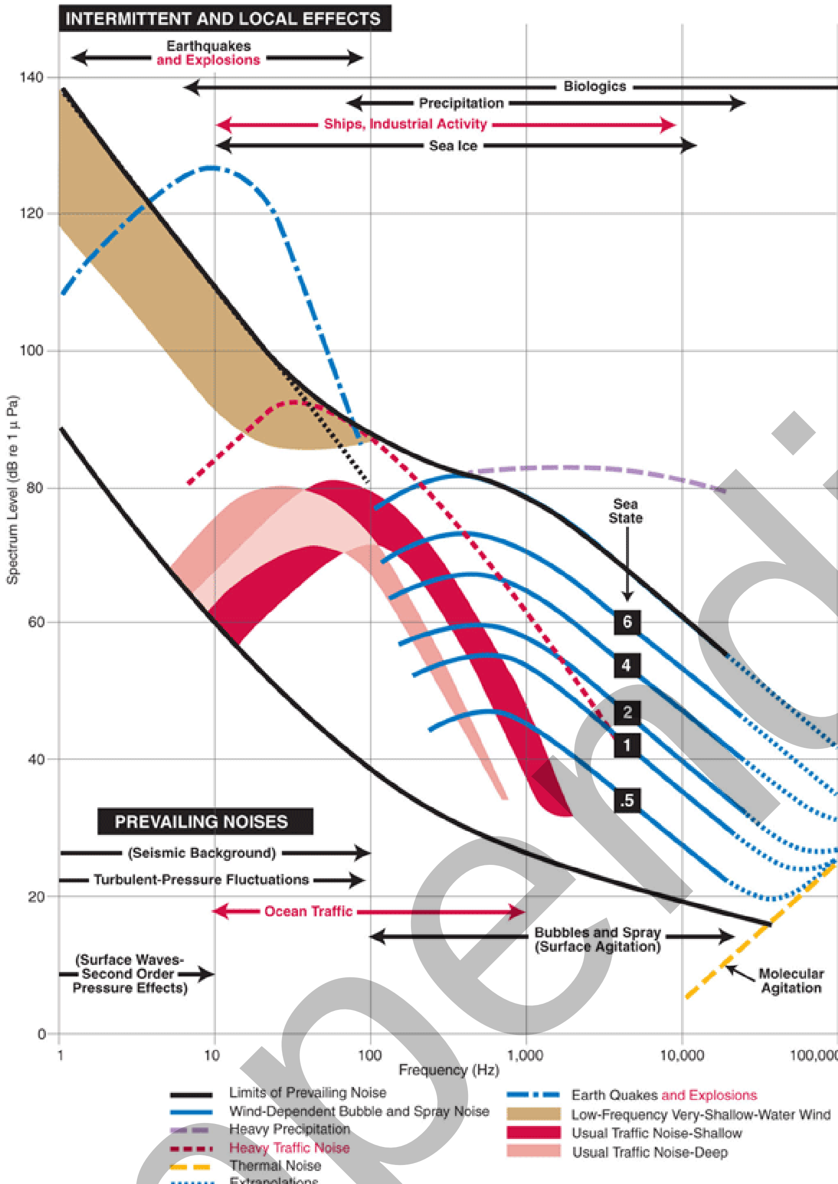
Figure 2 provides an overview of the indicative noise spectral levels produced by various natural and anthropogenic sources, relative to typical background or ambient noise levels in the ocean. Human contributions to ambient noise are often significant at low frequencies, between about 20 Hz and 500 Hz, with ambient noise in this frequency range being predominantly from distant shipping (Hildebrand, 2009). In areas located away from anthropogenic sources, background noise at higher frequencies tends to be dominated by natural physical or bioacoustics sources such as rainfall, surface waves and spray, as well as fish choruses and snapping shrimp for coastal waters.

Figure 2: Levels and frequencies of anthropogenic and naturally occurring sound sources in the marine environment (from https://www.ospar.org/work-areas/eiha/noise). Natural physical noise sources represented in blue; marine fauna noise sources in green; human noise sources in orange



A summary of the spectra of various ambient noise sources based on a review study undertaken by Wenz (1962) is shown in **Figure 3**. It should be noted that although the spectral curves in the figure are based on average levels from reviewed references primarily for the North Atlantic Ocean, they are regarded as representative in general for respective ocean ambient noise spectral components.

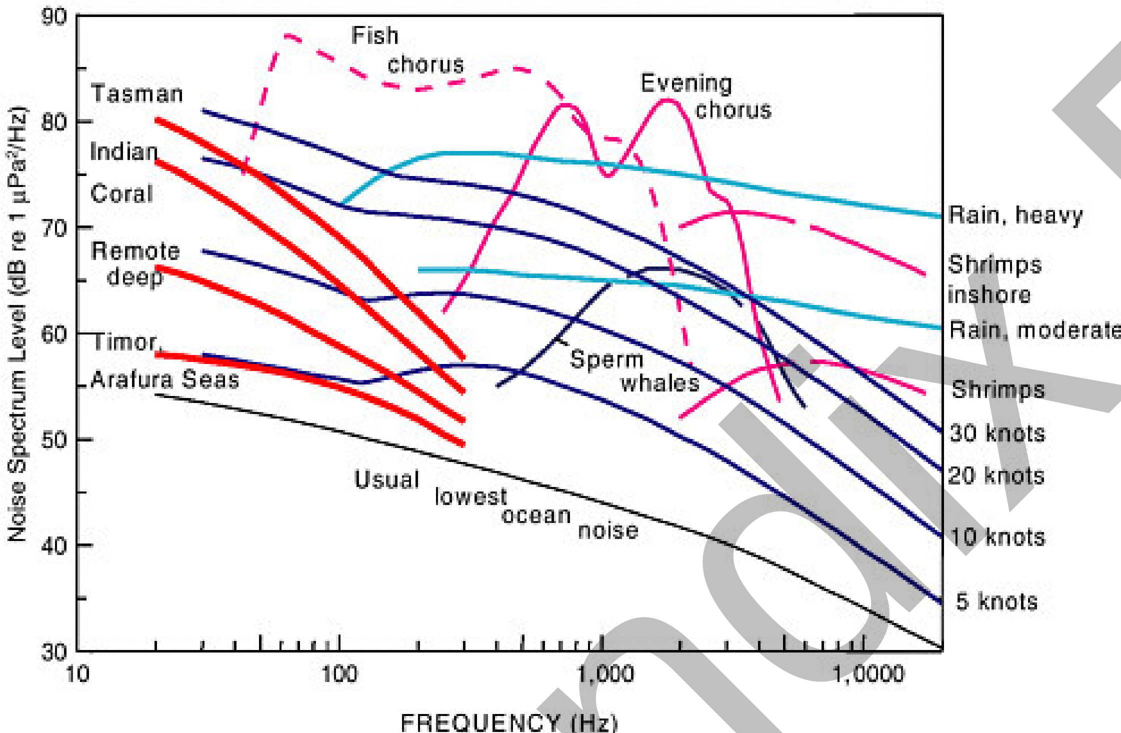
Figure 3: Composite of Ocean Ambient Noise Spectra (from Wenz (1962))



There have been no large-scale systematic ocean ambient noise studies for the New Zealand waters. However, relevant studies conducted in the southern hemisphere around Australian waters could provide some insights regarding various source contributions to the ocean ambient noise environment, supplementary to the review study by Wenz (1962) for the northern hemisphere waters.

Studies in Australian waters have shown that there are some significant differences in the ambient noise compared to the colder Northern Hemisphere waters where most existing measurements have been recorded. **Figure 4** summarises the main components of ambient noise for the Australian regions, where the differences from Wenz's ambient noise spectra are due to the different environment of tropical waters, particularly in respect to noise from marine animals. Wind-generated noise and the traffic noise due to shipping activities are generally consistent in level range between the two studies (Wenz, 1962 and Carto, 1997).

Figure 4: Summary of Ocean Ambient Noise Spectra for the Australian Region (from Cato (1997))



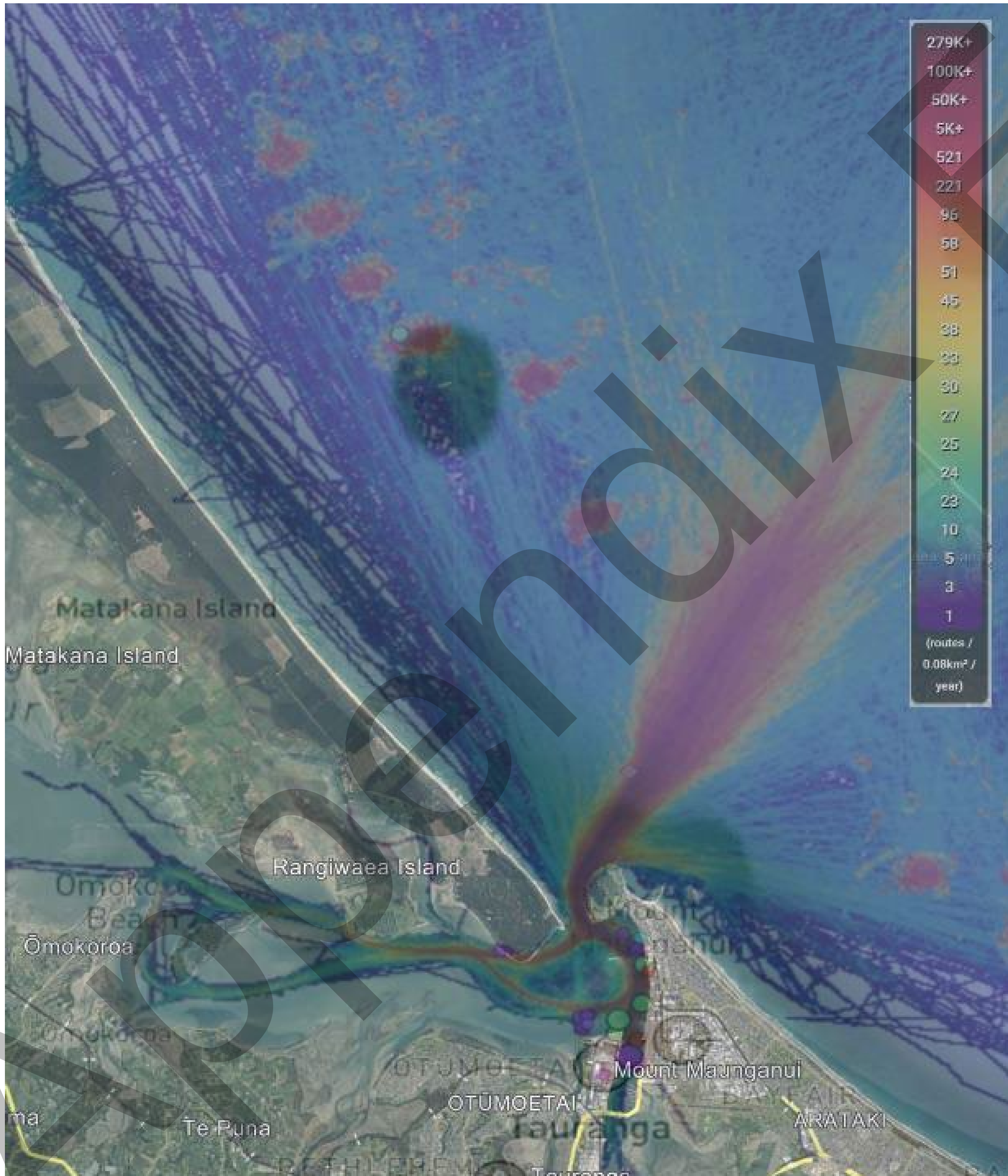
The overall ambient noise levels are typically 80 - 120 dB re 1 µPa for the frequency range 10 – 10k Hz, from light surrounding shipping movements and calm sea surface condition, to moderate to heavy remote shipping traffic and medium to high wind conditions.

2.2 Site specific ocean ambient noise

The Port of Tauranga, situated in Tauranga New Zealand, is the largest port in the country both in terms of total cargo volume with a throughput of over 13 million tons a year, and in terms of container throughput with container volumes exceeding 1,200,000 TEUs (Twenty Foot Equivalent Units). The port area has high density shipping traffic of predominately large cargo ships for commodity imports and exports, particularly along the shipping routes as shown in **Figure 5** below.

Due to the noise contribution from the shipping activities along the shipping route and around the port area, as well as the expected biological noise, the overall ambient noise levels for the inner harbour area and immediate outer port area are expected to be much higher than the typical baseline noise level range (i.e. 80 - 120 dB re 1 µPa).

Figure 5: Shipping traffic density near the Port of Tauranga region (Source: http://www.marinetraffic.com/, accessed 17th January 2025)



3.0 Underwater Noise Impact Assessment Criteria

3.1 Marine Fauna Hearing Sensitivity

A sound is audible when the receiver is able to perceive it over background noise. The audibility is also determined by the individual's threshold of hearing, which varies with frequency. Hearing ability is typically described using audiograms, which display hearing threshold (the sound level at which sound is just detectable) as a function of sound wave frequency. A low sound pressure level on an audiogram indicates a low hearing threshold at a given frequency, which means that even a very weak sound is still audible and indicates a higher auditory sensitivity.

Hearing capabilities differ between different groups of species, with some more sensitive to low- frequency sounds, while others hear better in the high-frequency range. Hipsey and Booth (2012) considered several marine mammal (and turtle) species and compiled composite audiograms for different groups (see **Figure 6**).

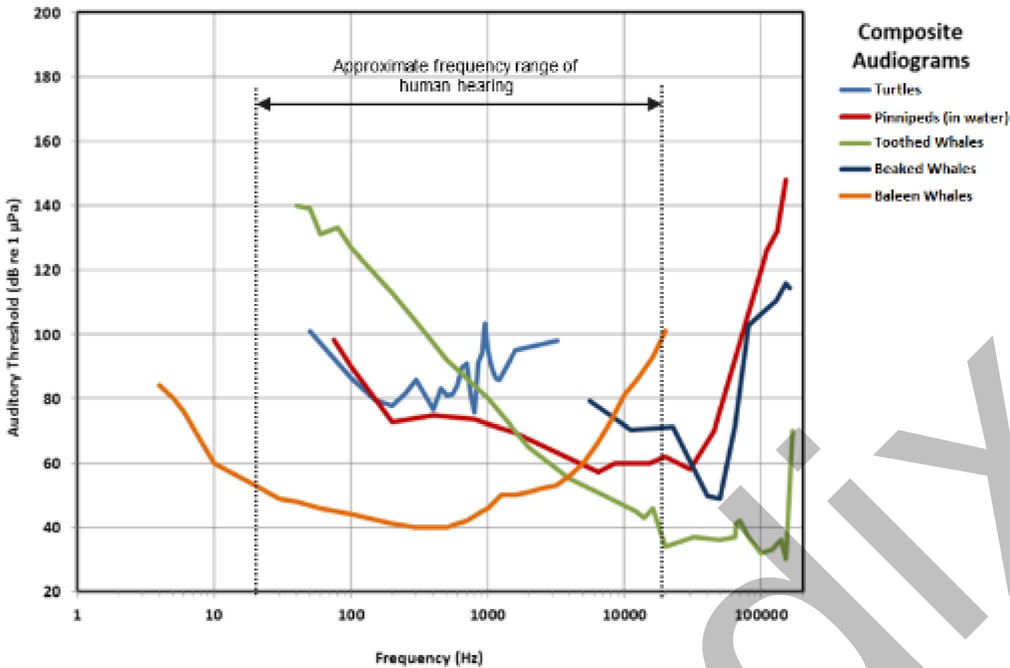
Marine mammals and fish species usually have U-shaped audiograms, meaning that within their respective hearing ranges, they are more sensitive to the sound energy component in the mid- frequency range and less sensitive to the energy components in the lower and upper- frequency ranges (Finneran 2016, Southall et al. 2019; Popper et al. 2019).

Table 3: Hearing capabilities of marina fauna groups based on composite audiograms

Marine Species Group	Hearing Capability (Hz)		Peak Hearing Sensitivity (Hz)	
	Minimum	Maximum	Minimum	Maximum
Toothed whales (odontocetes)[1]	20,000	120,000	20,000	120,000
Beaked whales (ziphiids)[2]	5,600	160,000	40,000	50,000
Baleen whales (mysticetes)[3]	20	20,000	100	200
Pinnipeds (seals; under water)	70	>100,000	7,000	30,000

[1]Some odontocete species can hear well below this range.
[2]Based on two studies in which single individuals were tested.
[3]Based on theoretical evidence only (no empirical data).
Sources: Hipsey & Booth 2012

Figure 6: Composite audiograms of marine fauna based on various studies



Source: adapted from Hipsey & Booth 2012

3.2 Possible Noise Impacts on Marine Fauna

The potential impacts of noise on marine fauna species include masking of communication and other biologically important sounds, behavioural responses, and physiological impacts (including discomfort, hearing impairment, and physical injury or mortality in extreme cases) (Richardson et al. 2013; Hawkins and Popper 2017; Erbe et al. 2018; Popper and Hawkins 2019).

The type and distance of noise impacts on marine fauna depend on the acoustic characteristics of the noise (e.g., source level, spectral content, temporal characteristics, directionality, etc.), the sound propagation environment, as well as the hearing ability and physical reaction of an individual to detect sound. The individual types of impacts are discussed below. The severity of these impacts decreases with increasing distance from the noise source, as illustrated by the potential zones of noise impact shown in **Figure 7**.

3.2.1 Masking

Masking occurs when the introduced noise is loud enough to impair the detection of biologically relevant sound signals, such as communication signals, echolocation clicks and passive detection cues that are used for navigation and finding prey (Clark et al. 2009). The extent of the masking area depends on the differences in the animal's hearing frequency range, received sound levels, and the introduced anthropogenic and background ambient noise (Richardson et al. 2013). The masking effect can be partly compensated by an animal’s frequency and temporal discrimination ability, directional hearing, co-modulation masking release (if noise is amplitude modulated over several frequency bands) and multiple looks (if the noise has gaps or the signal is repetitive), as well as anti-masking strategies (increasing call level, shifting frequency, repetition, etc.) (Erbe 2016).

3.2.2 Behavioural Responses

Sound that is significantly above ambient noise levels and the animal's audiogram range can trigger behavioural responses that can include changes in vocalization, resting, diving, and breathing patterns, changes in mother-infant relationships, and in most cases, the avoidance of the noise source (Wartzok et al. 2003). The behavioural response effects can be challenging to measure and depend on a wide variety of factors such as the physical characteristics of the signal, the behavioural and motivational state of the receiver, its age, sex and social status and many other aspects. Therefore, the type and magnitude of behavioural disturbance for any given signal can vary both within a population and for the same individual over time and can vary significantly, from very subtle changes in behaviour to strong avoidance reactions (Ellison et al. 2012; Richardson et al. 2013).

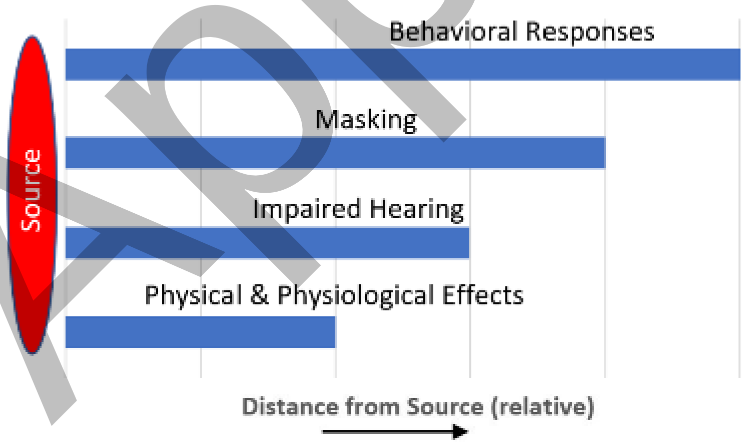
3.2.3 Hearing Impairment

The physiological effects of underwater noise are primarily associated with the auditory system, which is likely to be most sensitive to noise. Exposure to noise sources can cause a loss of sensitivity to sound. If noise exposure is below a critical level of sound energy or for a certain duration, hearing loss is usually temporary and the animal recovers; this effect is called temporary threshold shift (TTS). If damage occurs to the inner ear that can lead to tissue destruction, the effect is called auditory injury (AUD INJ) and may or may not result in permanent hearing loss or permanent threshold shift (PTS). Noise exposure can cause a reduction in the animal's hearing sensitivity or increase the hearing threshold (i.e., the sound level that is just audible to the animal) (Finneran 2016; Popper and Hawkins 2019; Southall et al. 2019).

3.2.4 Physical Injury

Noise at very high sound pressure levels may cause concussive effects and physical damage to tissues, organs, and cavitation or result in the rapid formation of bubbles in the blood system due to massive pressure oscillations (Groton 1998). The physiological systems of marine animals that are potentially affected include the vestibular system, reproductive system, nervous system, liver, or organs with high concentrations of dissolved gas and gas-filled spaces (swim-bladders).

Figure 7: Potential zones of noise impact on marine fauna



Source: adapted from Hawkins and Popper 2017

3.3 Criteria for Determining Adverse Noise Effects on Marine mammals

There have been extensive scientific studies and research efforts to develop quantitative links between marine noise and impacts on marine mammal species. For example, Southall et al (2007 & 2019) have proposed noise exposure criteria associated with various sound types, including impulsive noise (e.g. piling noise and seismic airgun noise) and non-impulsive noise (e.g. vessel and drilling noise) for certain marine mammal species (i.e. cetaceans and sirenians and carnivores), based on a review of expanding literature on marine mammal hearing and on physiological and behavioural responses to anthropogenic sounds.

The following two subsections provide the recommended frequency-weighting functions for use in assessing the effects of relatively intense sounds on hearing, as well as the noise exposure levels above which adverse effects on various groups of marine mammals are expected, and they are derived based on all available relevant data and published literature (i.e. the state of current knowledge).

3.3.1 Marine mammal auditory weighting functions

Marine animals do not hear equally well at all frequencies within their functional hearing range. Based on the hearing range and sensitivities, the updated 2024 Technical Guidance NMFS (Version 3.0) have categorised marine mammal species (i.e. cetaceans and pinnipeds) into five underwater hearing groups: low-frequency (LF), high-frequency (HF), very high-frequency (VHF) cetaceans, Phocid pinnipeds in water (PCW) and Otariid pinnipeds in water (OCW). For each specific marine mammal species, refer to Appendix I – 6 within the reference document (Southall et al, 2019) for their corresponding hearing groups. A summary of these appendices is presented as **Appendix B** in this report.

The potential noise effects on animals depend on how well the animals can hear the noise. Frequency weighting is a method of quantitatively compensating for the differential frequency response of sensory systems (Southall et al, 2007 & 2019, NMFS 2024).

When developing updated scientific recommendations in marine mammal noise exposure criteria, Southall et al (2019) adopt the auditory weighting functions as expressed in the equation below, which are based on a quantitative method and are consistent with the U.S. National Oceanic and Atmospheric Administration (NOAA) technical guidance (NMFS, 2024).

$$W(f) = C + 10log10\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+ (f/f_2)^2]^b}\right\} \tag{3.1}$$

Where:

- ***W(f)*** is the weighting function amplitude (in dB) at frequency f (in kHz).
- $\boldsymbol{f_1}$ represents LF transition value (in kHz), i.e. the lower frequency at which the function amplitude begins to change from the flat, central portion of the curve.
- $\boldsymbol{f_2}$ represents HF transition value (in kHz), i.e. the upper frequency at which the function amplitude begins to change from the flat, central portion of the curve.
- ***a*** represents the LF exponent value (dimensionless) which defines the rate of decline of the weighting function amplitude at low frequencies. The change in weighting function amplitude with frequency at low frequencies (the LF slope) is 20*a* dB/decade.

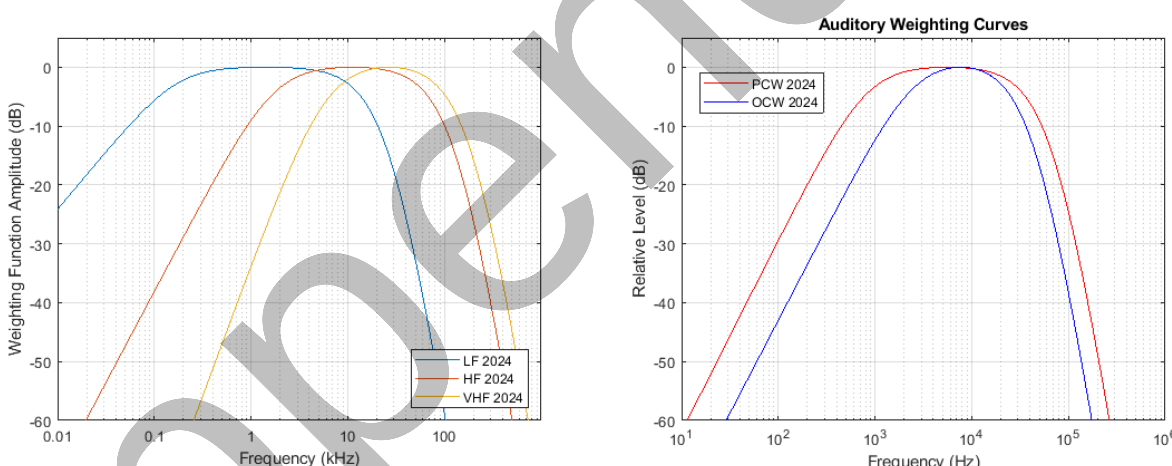
- ***b*** represents the HF exponent value (dimensionless) which defines the rate of decline of weighting function amplitude at high frequencies, becoming linear with the logarithm of frequency. The change in weighting function amplitude with frequency at high frequencies (the HF slope) is -20*b* dB/decade.
- ***C*** is the constant that defines the vertical position of the curve. It is defined so that the maximum amplitude of the weighting function equals 0 dB (with all other values being negative).

Table 4 lists the auditory weighting parameters for the six hearing groups. The corresponding auditory weighting functions for all hearing groups are presented in **Figure 8.**

Table 4: Parameters for the auditory weighting functions (NMFS, 2024)

Marine mammal hearing group	*a*	*b*	f_1 (Hz)	f_2 (Hz)	*C* (dB)
Low-frequency cetaceans (LF)	0.99	5	168	26,600	0.12
High-frequency cetaceans (HF)	1.55	5	1,730	129,000	0.32
Very high-frequency cetaceans (VHF)	2.23	5	5,930	186,000	0.91
Phocid pinnipeds (PCW)	1.63	5	810	68,300	0.29
Otariid pinnipeds (OCW)	1.58	5	2,530	43,800	1.37

Figure 8: Auditory weighting functions - LF, HF, VHF, PCW and OCW



3.3.2 Noise impact criteria for marine mammals

The newly updated scientific recommendations in marine mammal noise exposure criteria (NMFS, 2024) propose auditory injury (AUD INJ) onset and temporary threshold shift (TTS) onset criteria for both impulsive noise and non-impulsive noise events. The AUD INJ-onset and TTS-onset criteria for impulsive noise are outlined in **Table 5**, which incorporate a dual-criteria approach based on both peak sound pressure level (PK SPL) and cumulative sound exposure level (SEL) within a 24-hour period (SEL_{24hr}).

For behavioural changes, the widely used assessment criterion for the onset of possible behavioural disruption in marine mammals is RMS SPL of 160 dB re 1µPa for impulsive noise (NOAA, 2021), as shown in **Table 6**.

Table 5: AUD INJ and TTS-onset threshold levels for marine mammals exposed to impulsive noise (NMFS, 2024)

Marine mammal hearing group	AUD INJ and TTS threshold levels – impulsive noise			
	AUD INJ onset		TTS onset	
	PK SPL, dB re 1µPa (unweighted)	SEL_{24hr}, dB re 1µPa²·S (weighted)	PK SPL, dB re 1µPa (unweighted)	SEL_{24hr}, dB re 1µPa²·S (weighted)
Low-frequency cetaceans (LF)	222	183	216	168
High-frequency cetaceans (HF)	230	193	224	178
Very high-frequency cetaceans (VHF)	202	159	196	144
Phocid pinnipeds (PCW)	223	183	217	168
Otariid pinnipeds (OCW)	230	185	224	170

Table 6: The behavioural disruption threshold level for marine mammals – impulsive noise (NOAA, 2021)

Marine mammal hearing group	Behavioural disruption threshold levels, RMS SPL, dB re 1µPa
	Impulsive noise
All hearing groups	160

3.4 Zones of bioacoustics impact

The received noise levels within and around the Project area can be predicted using known source levels in combination with models of sound propagation transmission loss between the source and the receiver locations. Zones of impact can be determined by comparison of the predicted received levels to the noise exposure criteria.

Predicted zones of impact define the environmental footprint of the noise generating activities and indicate the locations within which the activities may have an adverse impact on a marine fauna species, either behaviourally or physiologically.

In this report, zones of impact for marine mammals are defined as follows:

- immediate impact from a single pulse – this is applicable if animals move out of or avoid entering the impact zone and are thus exposed at most for a short period; and
- cumulative impact from exposure over an entire event to impulsive noise – this would be applicable if an animal remains or moves with the noise source footprint over an entire period and thus remains within the impact zone over an extended period of time. It is highly likely that animals <u>will not</u> remain in proximity of the noise source and that their exposure to sound levels above the various thresholds is much shorter. The distances

identified for cumulative thresholds are thus very conservative (worst case) and very likely to overstate the extent of the typical impact area.

This information can be used to assess the risk (likelihood) of potential adverse noise impacts, by combining the acoustic zones of impact with ecological information such as habitat significance and migratory routes in the affected area.

4.0 Underwater Noise Modelling Predictions

4.1 Underwater noise assessment scenarios and source levels

Based on project information as provided in **Section 1.0**, impact pile driving operations are identified as the primary noise-generating construction activities that have the potential to have the most significant adverse impact (physiological impact) on marine mammal species and therefore are to be assessed in this study. Source levels of the proposed impact piling activities and their spectra have been sourced from relevant literature.

4.1.1 Impact piling operations

As per the pile driving operation information in **Section 1.2**, the proposed installation schedule and equipment specifications are summarised in **Table 7** below.

The source spectral curve (one-third octave spectra) for the proposed piling activities is based on reference piling signals of an overall SEL source level 199 dB re $\mu Pa^2 \cdot S$ from a 49 kNm impact hammer (Salgado Kent et al, 2009) which were averaged to account for hammer energy variability. To scale the piling noise emissions with the smaller 49 kNm hammer to the noise emissions with the worst case 210 kNm impact hammer, it is assumed that the piling noise emissions from a piling strike is proportional to the energy delivered to the pile, according to the following relationship:

$$dB_o = 10 * \log10 (E/E_r) \quad (4.1)$$

where dB_o is the offset from the assessed pile to the reference pile in dB, E is the energy delivered to the assessed pile and E_r is the energy delivered to the reference pile (kNm). Using this equation (4.1) the piling noise emissions under the impact hammer energy of 210 kNm would have 6.3 dB increase over the reference piling noise emissions under the impact hammer energy of 49 kNm.

The overall SEL source level is estimated as 205 dB re $\mu Pa^2 \cdot S$, with a conversion factor of 24 dB between the source Pk SPL and SEL levels, based on the previous assessment prediction results for the piling noise created by a hammer of the same diameter for port facility constructions (Hastings and Popper, 2005). A conversion factor of 14 dB applied between the source RMS SPL and SEL levels is derived from historical measurements described in the literature (Salgado Kent et al, 2009). For receiving distances further away from the source location (1 – 10 km) where significant pulse signal dispersion is expected, a conservative conversion factor between 15 – 10 dB with a logarithmic decline trend is applied to the predicted SEL values to derive the parameter RMS SPL.

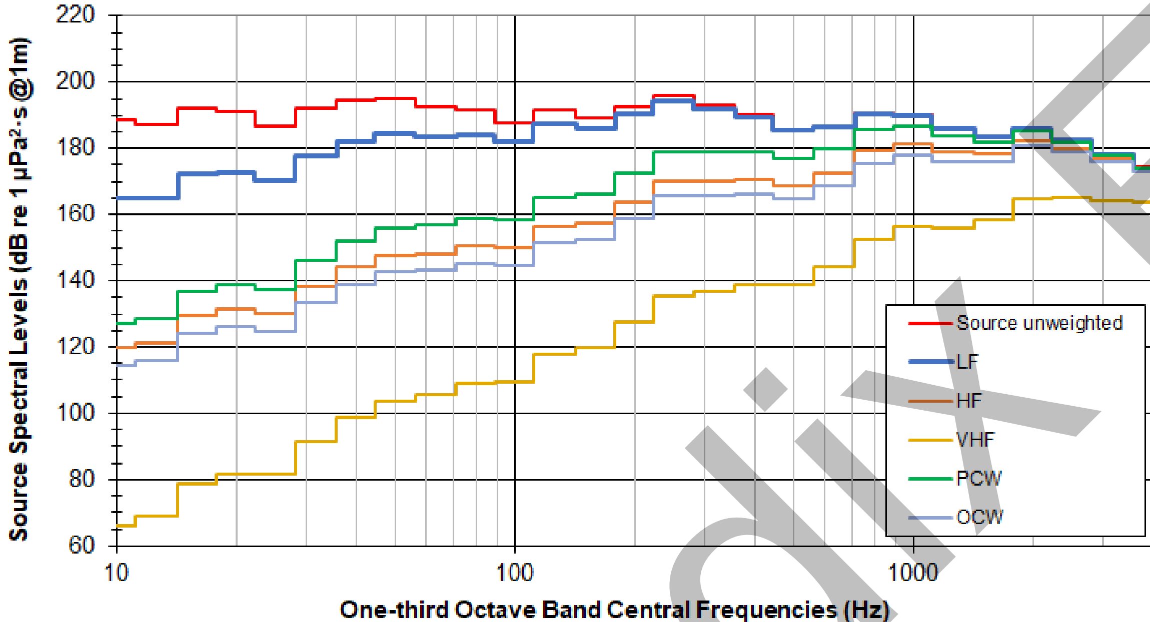
The one-third octave SEL source spectral levels (unweighted and M-weighted) for the impact piling noise at 1 metre are shown in **Figure 9.**

Table 7: Proposed impact piling operations

Equipment / operation	Specifications / operation schedule
Pile	• Steel tubes with capped ends • Diameters 785 mm to 914 mm
Impact hammer	• 210 kNm - a 14 tonne weight falling 1.5 m for the back three rows of piles • 150 kNm - a 10 tonne weight falling 1.5 m for the rest of the piles

Piling installation	• Eight piles required for every 6 m of wharf length
	• A total of 1,737 piles to be required for the full project scope
	• About 800 – 1,000 blows per pile to drive about 15 – 20 meters
	• Likely intensity of 2 days of full driving time, extending over a c. 200 days period using two crews, equating to c. 60 cumulative days of driving time for a 220 m extension.
	• The blow count is variable with drop height (30 – 100 per min), with the lower rate being applicable toward the full energy used toward the end-of drive.
	• Normal cycle of pile driving operation:
	  ○ Day one – set up piling gate – which may include short periods of pile driving to stabilise gate
	  ○ Day two - Pitch and vibro 7-8 piles, hammer run time ~2hrs
	  ○ Day three – drive to founding level – a full 1 to 1.5 days day of driving time being made up of ~1hr driving and some downtime doing set cards, and moving hammer etc
	  ○ Day four + five – Final set cards and PDA's
	  ○ Day six - Cut piles off and move crane to new platform where required
	  ○ Day 7/8 - Move gate and repeat

Figure 9: One-third octave SEL source spectral levels (unweighted and M-weighted) for the impact piling noise



4.2 Modelling methodology and procedure

Underwater noise propagation models predict the sound transmission loss between the noise source and the receiver. When the source level (SL) of the assessed noise-generating activity is known, the predicted transmission loss (TL) is then used to predict the received level (RL) at the receiver location as:

$$RL = SL - TL \tag{4.1}$$

The modelling study uses the dBSea software package (dBSea 2023), which applies the parabolic equation (PE) modelling algorithm with up to 2 Padé terms to calculate the transmission loss between the source and the receiver at low frequencies (1/3-octave bands, 12.5 Hz up to 8000 Hz).

The received noise levels throughout the Project were calculated following the procedure outlined below:

1. One-third octave source spectral levels are obtained via reference spectral curves with subsequent corrections based on their corresponding overall source levels;
2. Transmission loss is modelled at one-third octave band central frequencies along 50 radial paths at regular increments around each source location, out to the maximum range of the bathymetry data set or until constrained by land;
3. The bathymetry variation of the vertical plane along each modelling path is obtained via interpolation of the bathymetry dataset, which has a 10 m grid resolution;
4. The one-third octave source levels and transmission loss are combined to obtain the received levels as a function of range, depth and frequency; and
5. The overall received levels are calculated at a 1-m depth resolution along each propagation path by summing all frequency band spectral levels.

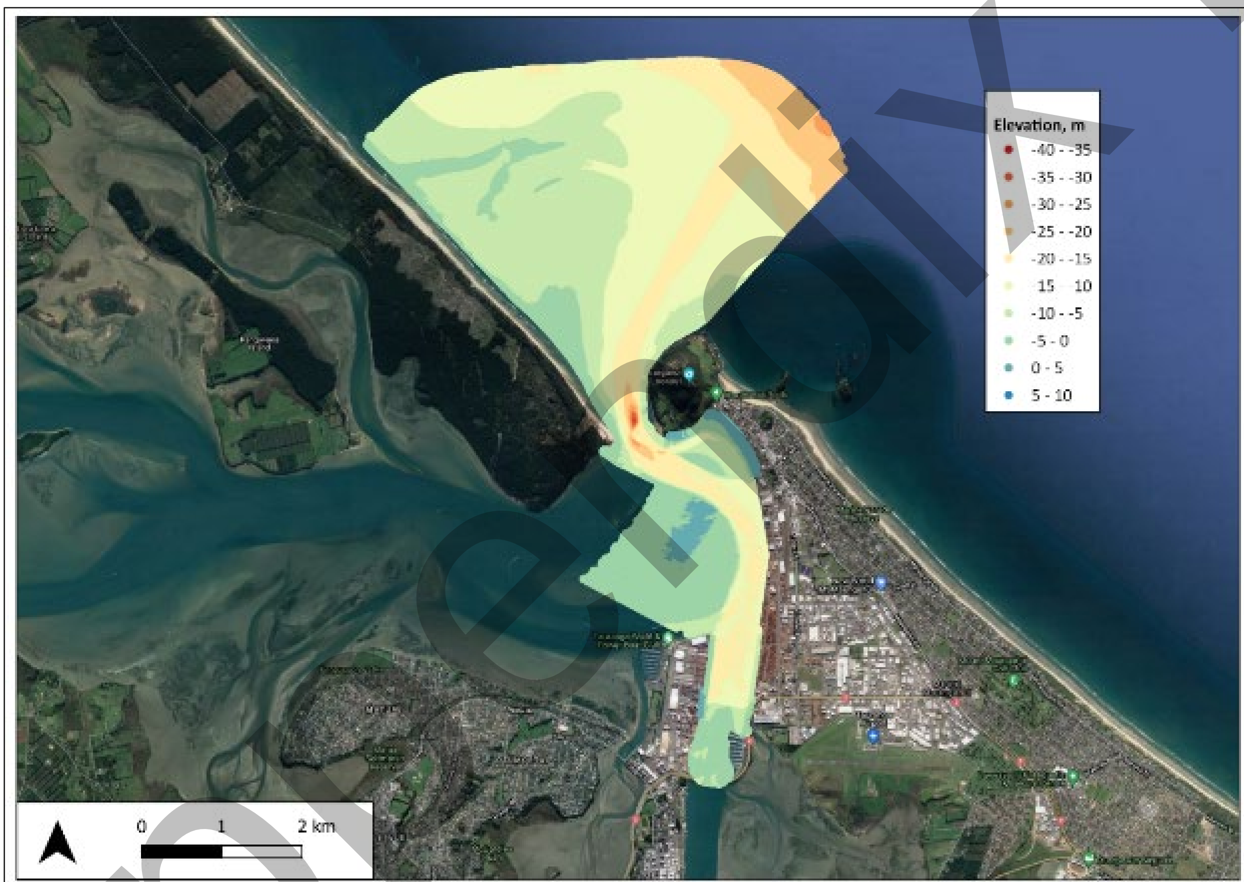
4.3 Modelling Input Parameters

4.3.1 Bathymetry

The bathymetry data grid used for the sound propagation modelling was provided by the Port of Tauranga based on the results of relevant hydrodynamic model for the port area.

The bathymetry data points overlaying satellite image within and surrounding the project area is presented in **Figure 10** below.

Figure 10: The bathymetry data points overlaying satellite image within and surrounding the project area.



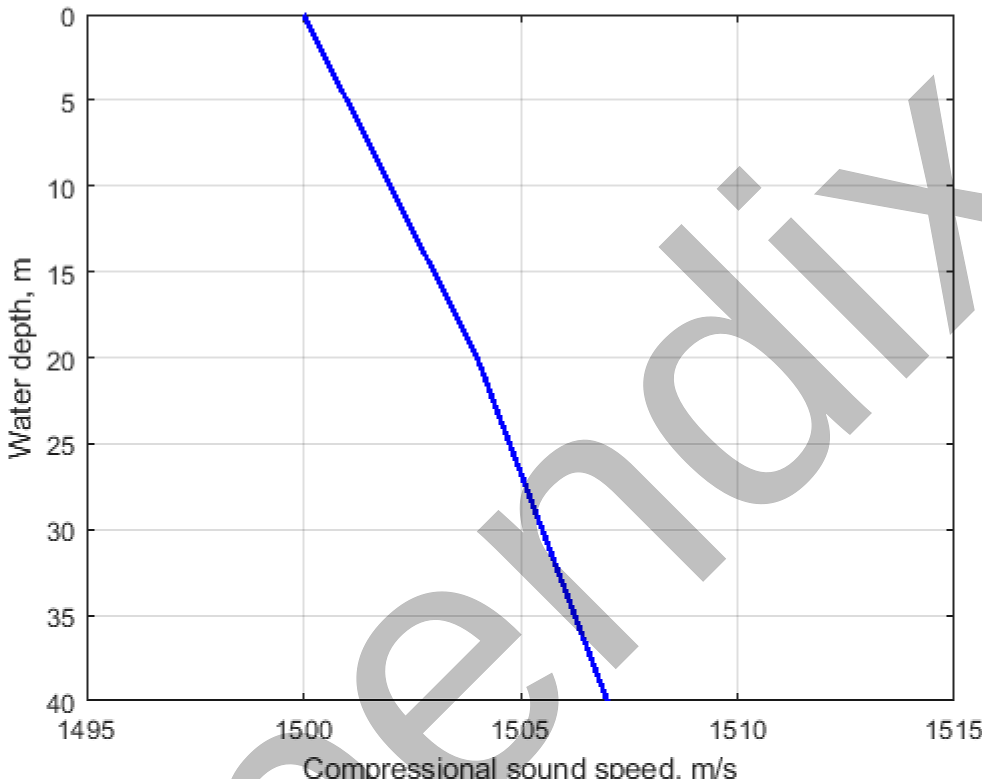
4.3.2 Sound Speed Profile

For typical New Zealand coastal and offshore water regions, the most significant seasonal differences in sound speed profiles are expected to occur within the mixed layer near the surface. The depth of the mixed surface layer varies with the seasons and is expected to be deeper in the winter season than in other seasons. The winter season sound speed profile generally has the strongest upward refraction characteristics and is expected to be most favourable to propagation of sound for near-surface acoustic sources.

As such, the representative winter season sound speed profile for the project area is derived based on an empirical function of the three independent variables (temperature (*T*) in degrees centigrade, salinity (*S*) in parts per thousand, and depth (*z*) in meters) (Medwin et al, 1997), with the worst-case (i.e. the lowest) water surface temperature distracted from the monitoring datasets, and under the assumptions that salinity levels remain consistent across the water column, and the sea temperature increases by up to 2°C down to the water depth of 40 m.

Figure 11 presents the derived representative seasonal sound speed profiles within the nearshore region in close proximity to the project area.

Figure 11: Representative winter season sound speed profile within the nearshore and inner harbour region surrounding the proposed project area



4.3.3 Seafloor Geoacoustic Model

The seafloor geoacoustic model for the modelling area is developed based on the sub-surface stratigraphy study report prepared for the Stella Passage, Tauranga Harbour (Moon, et al, 2013).

The sub-surface stratigraphy study identifies predominantly silt and clays mixed with silty sand surface sediment layers within the project area based on historical borehole data (Moon, et al, 2013). The sediment layers beneath the surface layer are pumiceous / quart sand layers (Moon, et al, 2013).

As such, it is proposed that the seafloor geoacoustic model for the entire modelling area comprises of a 10.0-m silt surface sediment layer, a 40-m silty sand sediment layer, followed by a fine to coarse sandy half space as detailed in **Table 8**. It should be noted that due to the variability of the seabed sediments across the inner port area, the proposed geoacoustic model does not universally reflect the actual seafloor conditions across the port area. The accuracy of the overall sound modelling prediction could be validated based in situ measurements.

The geoacoustic properties for relevant sediments are as described in Hamilton (1980) and Jensen et al (2011). The elastic properties are treated as negligible based on a conservative consideration.

Table 8: Geoacoustic parameters for the proposed seafloor model

Seafloor Materials	Thickness, m	Density, ρ, (kg·m^{-3})	Compressional Wave	
			Speed, c_p, (m·s^{-1})	Attenuation, α_p, (dB/λ)
Silt	0 – 10.0	1,740 – 1,770	1,615 – 1,650	1.0
Silty sand	10.0 – 50.0	1,770 – 1,900	1,650 – 1,800	1.0 – 0.8
Fine to coarse sandy layer	50.0 - ∞	1,900	1,800	0.8

4.4 Modelling source locations

In order to understand the extent of underwater noise impacts throughout the proposed project development, two representative source locations at the northern ends of the two wharf extensions (i.e. Sulphur Point Wharf extension and Mount Maunganui Wharf extension) are nominated for the detailed piling noise modelling study.

Further details of the two selected locations with their corresponding coordinates, water depths and localities are outlined in **Table 9** below.

Table 9: Details of the two selected pling source locations for noise modelling. The coordinate system is based on WGS 84/ UTM 60S projection.

Source Location	Water Depth, m	[Easting, Northing], m	Locality
L1	14.3	[374266.111, 810623.038]	Northern end of the Sulphur Point Wharf extension
L2	12.6	[374857.482, 811213.260]	Northern end of the Mount Maunganui Wharf extension

5.0 Modelling Results and Zones of Impact Estimates

5.1 Modelling prediction results

The noise contour figures for all modelling scenarios are presented in **Appendix C**. The contour figures are the modelling results based on both linear and M-weighted SEL source level inputs in dB re 1μPa^2·S as given in **Section 4.1**.

The weighted SEL modelling results for different marine mammal hearing groups are based on weighted SEL source level inputs which are derived by applying relevant auditory hearing functions as in **Figure 8** of **Section 3.3.1** to the unweighted SEL source levels.

For cumulative SEL estimates, the following cumulative factor (*CF*) is applied:

$$CF = 10 \times \log10 (N) \quad (5.1)$$

Where *N* is the number of pulses for piling noise.

Based on noise modelling prediction results and relevant post processing analysis as described above, the zones of impact for marine mammal species assessed from all modelling scenarios are detailed in the following section.

5.2 Estimated zones of impact

The predicted noise levels of considered modelling scenarios were compared with relevant threshold criteria as listed in **Section 3.0**. The zones of different levels of noise impact for marine mammal species were calculated and the maximum threshold distances are presented in **Table 10** - **Table 12**, including:

- Impact zones regarding immediate impact from single piling pulses, as shown in **Table 10** to **Table 11**, and
- Impact zones regarding cumulative impact from multiple piling pulses exposure (i.e. under 10, 100, 200, 1,000, 2,000, 5,000 and 8,000 pulses exposure) within a 24-hour period, as shown in **Table 12**. Noting that 8,000 is the maximum possible number of hammer strikes per day during the project.

5.2.1 Zones of impact from individual impact piling sources

Due to the high level of individual impulsive signal emissions from the impact piling, LF cetaceans are predicted to experience AUD INJ in close proximity (within 10 m) to the source. VHF cetaceans are also predicted to experience AUD INJ up to 100 m from the source. The zones of TTS due to a single pulse exposure for LF cetaceans and PCW hearing groups of concern are predicted to be within approximately 20 m from the piling locations and 170 m for the VHF cetaceans, as shown in **Table 10**. No AUD INJ or TTS is predicted for HF cetaceans or OCW pinnipeds exposed to single pulses of piling noise.

The zones of behavioural disturbance for marine mammals of all hearing groups caused by the immediate exposure to individual pulses are predicted to be within 1.7 km of the piling locations, as presented in **Table 11**. On this basis, behavioural disturbance is not predicted to extend beyond the confines of Tauranga Harbour.

Among marine mammals of all four hearing groups of concern (noting that VHF cetaceans are not predicted to enter the harbour except in very rare circumstances), LF cetaceans have the highest zones of AUD INJ and TTS impact from cumulative exposure, as can be seen in

Table 12. For this group, the zones of AUD INJ impact are predicted to be within 940 m from piling locations with exposure to 1,000 pulses and within 1.93 km from piling locations with exposure to 8,000 pulses. Phocid pinnipeds have slightly lower zones of AUD INJ and TTS impact, with the AUD INJ impact predicted to be within 450 m from piling locations with 1,000 piling pulses exposure and within 1.17 km from piling locations with up to 8,000 piling pulses exposure. Compared with LF cetaceans and PW, the remaining hearing groups of relevance (HF cetaceans and OCW) have much lower impact zones, and it is noteworthy that those species of marine mammal that have the highest rates of occurrence in Tauranga Harbour (hence are of the greatest concern) belong to these functional hearing groups (i.e. bottlenose dolphins, killer whales and New Zealand fur seals that have an intermittent presence inside the harbour).

Overall, the maximum TTS zone extends to 2.62 km (for VHF cetaceans). It is noted that 2.85 km is the maximum impact distance along the shipping channel from the piling location, and the sound propagation from the piling location does not extend into open waters due to the very high attenuation along the inner harbour area beyond the channel as illustrated in **Appendix C**.

Table 10: Zones of immediate impact from single impact piling pulses for AUD INJ and TTS – marine mammals

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels			
	AUD INJ onset		TTS onset	
	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m	Criteria - Pk SPL dB re 1µPa	Maximum threshold distance, m
Low-frequency cetaceans (LF)	222	10	216	20
High-frequency cetaceans (HF)	230	-	224	-
Very-High Frequency cetaceans (VHF)	202	100	196	170
Phocid pinnipeds (PCW)	223	-	217	20
Otariid pinnipeds (OCW)	230	-	224	-
Note: a dash indicates the threshold is not applicable.				

Table 11: Zones of immediate impact from single impact piling pulses for behavioural changes – marine mammals

Type of animal	Zones of impact – maximum horizontal distances from source to impact threshold levels	
	Behavioural disturbance	
	Criteria - SPL RMS, dB re 1μPa	Maximum threshold distance, m
Marine mammals – all hearing groups	160	1,700

Table 12: Zones of cumulative impact from multiple impact piling pulses (up to 8,000) for AUD INJ and TTS – marine mammals

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels					
	AUD INJ onset			TTS onset		
	Criteria - Weighted SEL_{24hr} dB re 1 $\mu Pa^2\cdot s$	No. of pulses	Maximum threshold distance, m	Criteria - Weighted SEL_{24hr} dB re 1 $\mu Pa^2\cdot s$	No. of pulses	Maximum threshold distance, m
Low-frequency cetaceans (LF)	183	10	120	168	10	640
		100	330		100	1,430
		200	520		200	1,850
		1,000	940		1,000	2,390
		2,000	1,190		2,000	2,450
		5,000	1,680		5,000	2,460
		8,000	**1,930**		**8,000**	**2,550**
High-frequency cetaceans (HF)	193	10	20	178	10	50
		100	40		100	150
		200	50		200	210
		1,000	110		1,000	510
		2,000	130		2,000	670
		5,000	180		5,000	940
		8,000	**240**		**8,000**	**1,170**
Very High-frequency cetaceans (VHF)	159	10	90	144	10	300
		100	190		100	910
		200	250		200	1,260
		1,000	540		1,000	2,350
		2,000	720		2,000	2,440
		5,000	1,140		5,000	2,620
		8,000	**1,310**		**8,000**	**2,620**

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels					
	AUD INJ onset			TTS onset		
	Criteria - Weighted SEL_{24hr} dB re 1 μPa²·s	No. of pulses	Maximum threshold distance, m	Criteria - Weighted SEL_{24hr} dB re 1 μPa²·s	No. of pulses	Maximum threshold distance, m
Phocid pinnipeds (PCW)	183	10 100 200 1,000 2,000 5,000 **8,000**	60 170 240 450 640 940 **1,170**	168	10 100 200 1,000 2,000 5,000 **8,000**	270 810 1,130 2,160 2,380 2,450 **2,450**
Otariid pinnipeds (OCW)	185	10 100 200 1,000 2,000 5,000 **8,000**	30 70 100 150 240 320 **430**	170	10 100 200 1,000 2,000 5,000 **8,000**	110 270 380 870 1,170 1,680 **2,200**

5.2.2 Zones of impact from two simultaneous impact piling sources

Theoretically, two identical noise sources at the same location summed together will add 3 dB to the overall noise level. However, assuming the two source locations are separated by a considerable distance, further modelling was necessary. Although peak noise levels (SPLs) in the channel between the two locations are slightly higher when both sources are active, no AUD INJ and TTS are expected to exceed 500 m for either marine mammal hearing group when a single and simultaneous strike occurs on both sources.

Regarding cumulative scenarios, where the two sources at different locations are active with multiple pulses (up to 8,000 pulses per source), **Table 13** shows the results for two marine mammal hearing groups, HF cetaceans and OCW pinnipeds. HF cetaceans have slightly higher AUD INJ zones, with maximum distances projected to be 250 m from the piling source. On the other hand, OCW pinnipeds exposed to combined pulses from simultaneous piling sources are projected to have AUD INJ zones that exceed distances of 500 m, with maximum distances of 990 m from the piling source.

In general terms, assuming the worst-case project scenario of the two piling units being active simultaneously at a strike rate of 8,000 strikes per day, the maximum cumulative zones of impact for potential AUD INJ on OCW pinnipeds is approximately 1 km.

Table 13: Zones of cumulative impact from two simultaneous impact piling sources (up to 8,000 pulses per source) for AUD INJ and TTS – marine mammals

Marine mammal hearing group	Zones of impact – maximum horizontal distances from source to impact threshold levels					
	AUD INJ onset			TTS onset		
	Criteria - Weighted SEL_{24hr} dB re 1 μPa²·s	No. of pulses	Maximum threshold distance, m	Criteria - Weighted SEL_{24hr} dB re 1 μPa²·s	No. of pulses	Maximum threshold distance, m
High-frequency cetaceans (HF)	193	8,000	250	178	8,000	1,460
Otariid pinnipeds (OCW)	185	8,000	**990**	170	8,000	2,200

6.0 Conclusions

SLR has been appointed to undertake underwater noise modelling and assessment of underwater piling noise impacts on marine mammal species of concern during the Stella Passage Development.

The detailed noise modelling prediction and assessment results show that impact piling activities are predicted to result in adverse noise impacts on the assessed marine mammal species due to the cumulative piling source noise emissions and the impulsive characteristics of the impact piling noise. The zones of noise impact from the piling locations have been estimated for all marine mammal species of concern based on comparisons between predicted noise levels and impact criteria, with results presented in **Section 5.2**. While zones of impact vary in size for different functional hearing groups and under different operational regimes (e.g. number of piling pulses), a fundamental finding of this assessment is that underwater noise effects are predicted to be restricted to inside Tauranga Harbour.

LF cetaceans and PCW hearing groups are the marine mammal species with the largest potential zones of impact for AUD INJ and TTS. The zones of impact are expanded if both sources are active simultaneously. However, the zones of impact for cumulative exposure would only be applicable if an animal remained at the noise source throughout the entire piling operation and thus was exposed to elevated underwater noise levels for an extended period of time. It is highly likely that animals will not remain in close proximity to the noise source and that their exposure to sound levels above the various thresholds will be much shorter. Therefore, the distances identified for cumulative thresholds are conservative and likely to overstate the extent of the typical impact area. Furthermore, the predicted zones of impact for those marine mammal species with the highest rates of occurrence in Tauranga Harbour (i.e. bottlenose dolphins, killer whales and New Zealand fur seals that have an intermittent presence inside the harbour) are comparatively small.

Regards,

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Appendix A Acoustic Terminology

Underwater Piling Noise Modelling

Stella Passage Development

Port of Tauranga

SLR Project No.: 840.030138.00001

February 5, 2025

A.1 Acoustic Terminology

Table A-1: Acoustic Terminology

Sound Pressure	A deviation from the ambient hydrostatic pressure caused by a sound wave
1/3 Octave Band Levels	The energy of a sound split into a series of adjacent frequency bands, each being 1/3 of an octave wide
Auditory Injury (AUD INJ)	
Peak Sound Pressure Level (Pk SPL)	The peak sound pressure level is the logarithmic ratio of the peak pressure over the impulsive signal event to the reference pressure
Peak-to-Peak Sound Pressure Level (Pk-Pk SPL)	The peak-to-peak sound pressure level is the logarithmic ratio of the difference between the maximum and minimum pressure over the impulsive signal event to the reference pressure
Power Spectral Density (PSD)	PSD describes how the power of a signal is distributed with frequency
Root-Mean-Square Sound Pressure Level (RMS SPL)	The mean-square sound pressure is the average of the squared pressure over the pulse duration. The root-mean-square sound pressure level is the logarithmic ratio of the root of the mean-square pressure to the reference pressure. Pulse duration is taken as the duration between the 5% and the 95% points on the cumulative energy curve
Sound Exposure Level (SEL)	SEL is a measure of energy. Specifically, it is the dB level of the time integral of the squared instantaneous sound pressure normalised to a 1-s period
Sound Pressure Level (SPL)	The logarithmic ratio of sound pressure to the reference pressure. The reference pressure underwater is P_{ref} = 1 µPa
Sound Speed Profile	A graph of the speed of sound in the water column as a function of depth
Source Level (SL)	The acoustic source level is the level referenced to a distance of 1m from a point source
Temporary Threshold Shift (TTS)	

Appendix B Marine Mammal Hearing Group Classification

Underwater Piling Noise Modelling

Stella Passage Development

Port of Tauranga

SLR Project No.: 840.030138.00001

February 5, 2025

B.1 Marine Mammal Hearing Group Classification

The following table gives a summary of marine mammal hearing group classification.

Table B-1: Summary of marine mammal classification

Classification	Common Name	Scientific Name
Low frequency cetaceans (extracted from Appendix 1 Southall *et al.* (2019))	Bowhead whale	*Balaena mysticetus*
	Southern right whale	*Eubalaena australias*
	North Atlantic right whale	*Eubalaena glacialis*
	North Pacific right whale	*Eubalaena japonica*
	Common minke whale	*Balaenoptera acutorostrata*
	Antarctic minke whale	*Balaenoptera bonaerensis*
	Sei whale	*Balaenoptera borealis*
	Bryde's whale	*Balaenoptera edeni*
	Blue whale	*Balaenoptera musculus*
	Omura's whale	*Balaenoptera omurai*
	Fin whale	*Balaenoptera physalus*
	Humpback whale	*Megaptera novaeangliae*
	Pygmy right whale	*Caperea marginate*
	Gray whale	*Eschrichtius robustus*
High frequency cetaceans (extracted from Appendix 2 Southall *et al.* (2019))	Sperm whale	*Physeter macrocephalus*
	Arnoux' beaked whale	*Berardius arnuxii*
	Baird's beaked whale	*Berardius bairdii*
	Northern bottlenose whale	*Hyperoodon ampullatus*
	Southern bottlenose whale	*Hyperoodon planifrons*
	Tropical bottlenose whale	*Indopacetus pacificus*
	Sowerby's beaked whale	*Mesoplodon bidens*
	Andrews' beaked whale	*Mesoplodon bowdoini*
	Hubb's beaked whale	*Mesoplodon carlbubbsi*
	Blainville's beaked whale	*Mesoplodon densirostris*
	Gervais' beaked whale	*Mesoplodon europaeus*
	Ginkgo-toothed beaked whale	*Mesoplodon ginkgodens*
	Gray's beaked whale	*Mesoplodon grayi*
	Hector's beaked whale	*Mesoplodon hectori*
	Deraniyagala's beaked whale	*Mesoplodon hotaula*

Classification	Common Name	Scientific Name
	Layard's beaked whale	*Mesoplodon layardii*
	True's beaked whale	*Mesoplodon mirus*
	Perrin's beaked whale	*Mesoplodon perrini*
	Pygmy beaked whale	*Mesoplodon peruvianus*
	Stejneger's beaked whale	*Mesoplodon stejnegeri*
	Spade-toothed whale	*Mesoplodon traversii*
	Tasman beaked whale	*Tasmacetus shepherdi*
	Cuvier's beaked whale	*Ziphius cavirostris*
	Killer whale	*Orcinus orca*
	Beluga	*Delphinapterus leucas*
	Narwhal	*Monodon monoceros*
	Short- and long-beaked common dolphins	*Delphinus delphis*
	Pygmy killer whale	*Feresa attenuata*
	Short-finned pilot whale	*Globicephala macrorhynchus*
	Long-finned pilot whale	*Globicephala melas*
	Risso's dolphin	*Grampus griseus*
	Fraser's dolphin	*Lagenodelphis hosei*
	Atlantic white-sided dolphin	*Lagenorhynchus acutus*
	White-beaked dolphin	*Lagenorhynchus albirostris*
	Pacific white-sided dolphin	*Lagenorhynchus obliquidens*
	Dusky dolphin	*Lagenorhynchus obscurus*
	Northern right whale dolphin	*Lissodelphis borealis*
	Southern right whale dolphin	*Lissodelphis peronii*
	Irrawaddy dolphin	*Orcaella brevirostris*
	Australian snubfin dolphin	*Orcaella heinsohni*
	Melon-headed whale	*Peponocephala electra*
	whale	*Pseudorca crassidens*
	Indo-Pacific humpback dolphin	*Sousa chinensis*
	Indian Ocean humpback dolphin	*Sousa plumbea*
	Australian humpback dolphin	*Sousa sahulensis*
	Atlantic humpback dolphin	*Sousa teuszii*

Classification	Common Name	Scientific Name
	Tucuxi	*Sotalia fluviatilis*
	Guiana dolphin	*Sotalia guianensis*
	Pantropical spotted dolphin	*Stenella attenuata*
	Clymene dolphin	*Stenella clymene*
	Striped dolphin	*Stenella coeruleoalba*
	Atlantic spotted dolphin	*Stenella frontalis*
	Spinner dolphin	*Stenella longirostris*
	Rough-toothed dolphin	*Steno bredanensis*
	Indo-Pacific bottlenose dolphin	*Tursiops aduncus*
	Common bottlenose dolphin	*Tursiops truncatus*
	South Asian river dolphin	*Platanista gangetica*
Very high frequency cetaceans (extracted from Appendix 3 Southall *et al.* (2019))	Peale's dolphin	*Lagenorhynchus australis*
	Hourglass dolphin	*Lagenorhynchus cruciger*
	Commerson's dolphin	*Cephalorhynchus commersonii*
	Chilean dolphin	*Cephalorhynchus eutropia*
	Heaviside's dolphin	*Cephalorhynchus heavisidii*
	Hector's dolphin	*Cephalorhynchus hectori*
	Narrow-ridged finless porpoise	*Neophocaena asiaeorientalis*
	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*
	Spectacled porpoise	*Phocoena dioptrica*
	Harbor porpoise	*Phocoena phocoena*
	Vaquita	*Phocoena sinus*
	Burmeister's porpoise	*Phocoena spinipinnis*
	Dall's porpoise	*Phocoenoides dalli*
	Amazon river dolphin	*Inia geoffrensis*
	Yangtze river dolphin	*Lipotes vexillifer*
	Franciscana	*Pontoporia blainvillei*
	Pygmy sperm whale	*Kogia breviceps*
	Dwarf sperm whale	*Kogia sima*

Classification	Common Name	Scientific Name
Sirenians (extracted from Appendix 4 Southall *et al.* (2019))	Amazonian manatee	*Trichechus inunguis*
	West Indian manatee	*Trichechus manatus*
	West African manatee	*Trichechus senegalensis*
	Dugong	*Dugong dugon*
Phocid pinnipeds in water (extracted from Appendix 5 Southall *et al.* (2019))	Hooded seal	*Cystophora cristata*
	Bearded seal	*Erignathus barbatus*
	Gray seal	*Halichoerus grypus*
	Ribbon seal	*Histriophoca fasciata*
	Leopard seal	*Hydrurga leptonyx*
	Weddell seal	*Leptonychotes weddellii*
	Crabeater seal	*Lobodon carcinophaga*
	Northern elephant seal	*Mirounga angustirostris*
	Southern elephant seal	*Mirounga leonina*
	Mediterranean monk seal	*Monachus monachus*
	Hawaiian monk seal	*Neomonachus schauinslandi*
	Ross seal	*Ommatophoca rossii*
	Harp seal	*Pagophilus groenlandicus*
	Spotted seal	*Phoca largha*
	Harbor seal	*Phoca vitulina*
	Caspian seal	*Pusa caspica*
	Ringed seal	*Pusa hispida*
	Baikal seal	*Pusa sibirica*
Otariid pinnipeds in water (extracted from Appendix 6 Southall *et al.* (2019))	Walrus	*Odobenus rosmarus*
	South American fur seal	*Arctocephalus australis*
	New Zealand fur seal	*Arctocephalus forsteri*
	Galapagos fur seal	*Arctocephalus galapagoensis*
	Antarctic fur seal	*Arctocephalus gazella*
	Juan Fernandez fur seal	*Arctocephalus philippii*
	Cape fur seal	*Arctocephalus pusillus*
	Subantarctic fur seal	*Arctocephalus tropicalis*
	Northern fur seal	*Callorhinus ursinus*
	Steller sea lion	*Eumetopias jubatus*

Classification	Common Name	Scientific Name
	Australian sea lion	*Neophoca cinerea*
	South American sea lion	*Otaria byronia*
	Hooker's sea lion	*Phocarctos hookeri*
	California sea lion	*Zalophus californianus*
	Galapagos sea lion	*Zalophus wollebaeki*
	Polar bear	*Ursus maritimus*
	Sea otter	*Enhydra lutris*
	Marine otter	*Lontra feline*

Appendix C Noise Modelling Contour Figures

Underwater Piling Noise Modelling

Stella Passage Development

Port of Tauranga

SLR Project No.: 840.030138.00001

February 5, 2025

Figure C-1: Modelled peak SPL (maximum level across water column) contours for impact piling noise emission of single piling pulse from the source location L1 to a maximum range, overlaying with satellite image

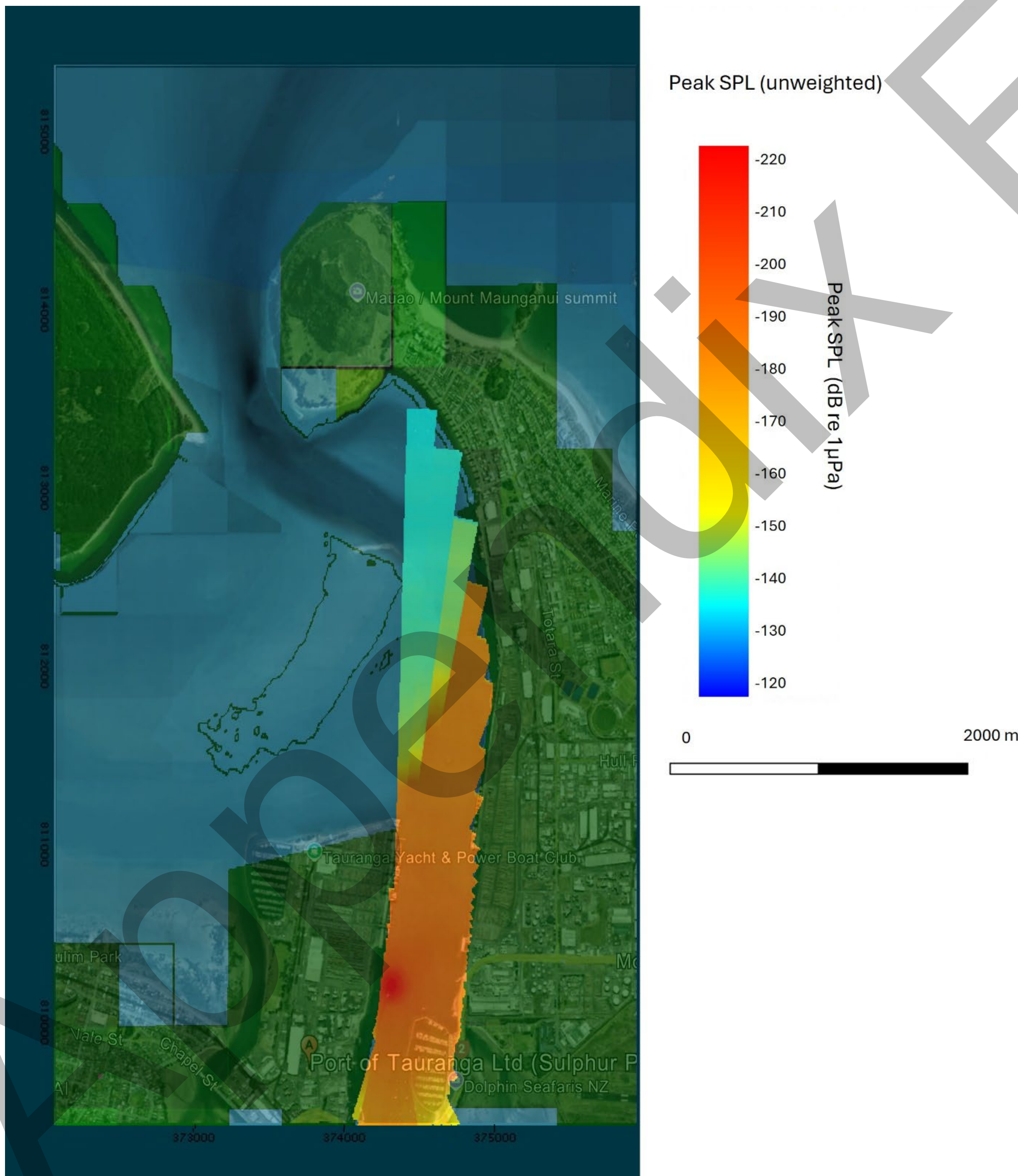


Figure C-2: Modelled peak SPL (maximum level across water column) contours for impact piling noise emission of single piling pulse from the source location L2 to a maximum range, overlaying with satellite image

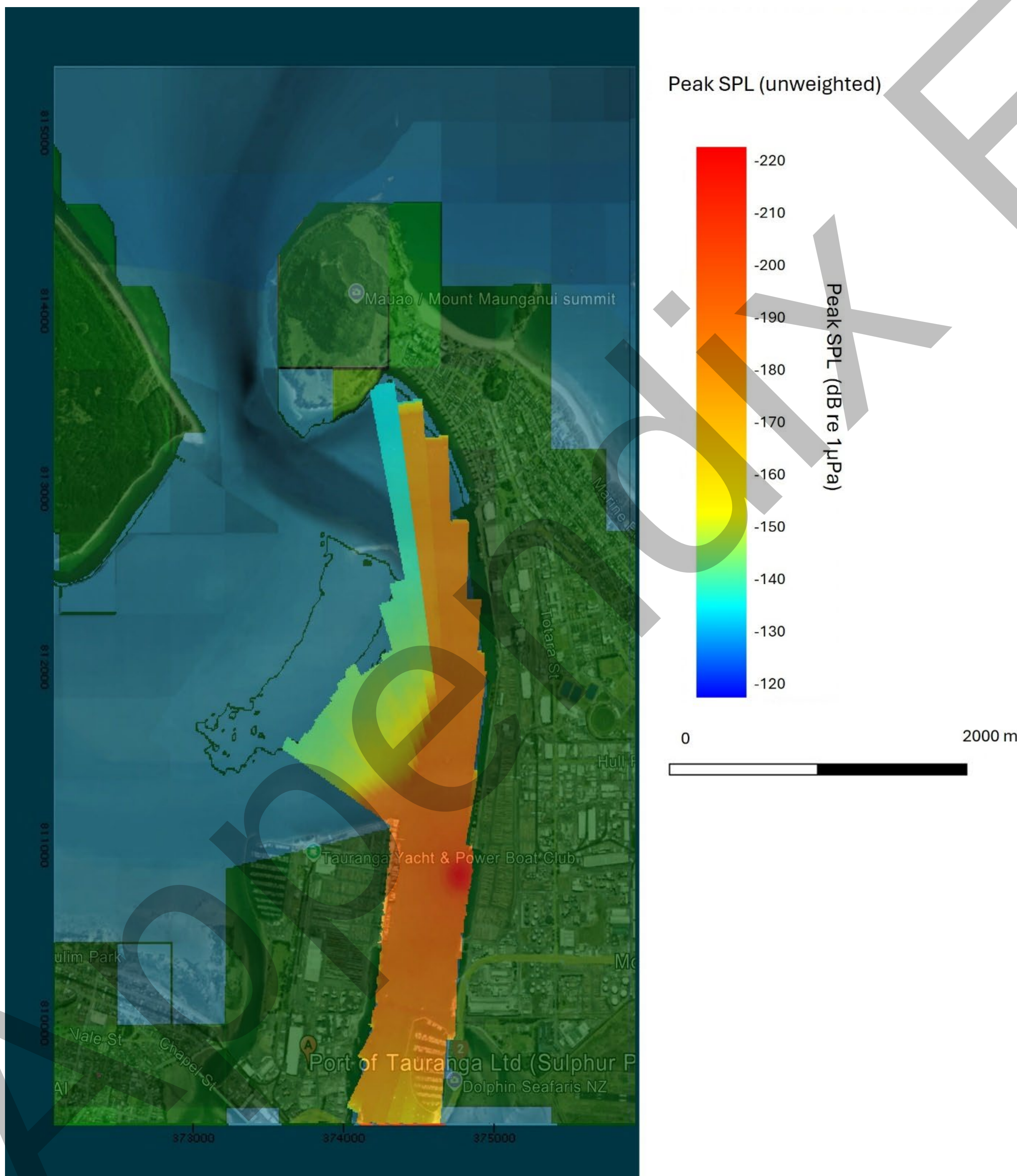


Figure C-3: Modelled LF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L1 to a maximum range, overlaying with satellite image

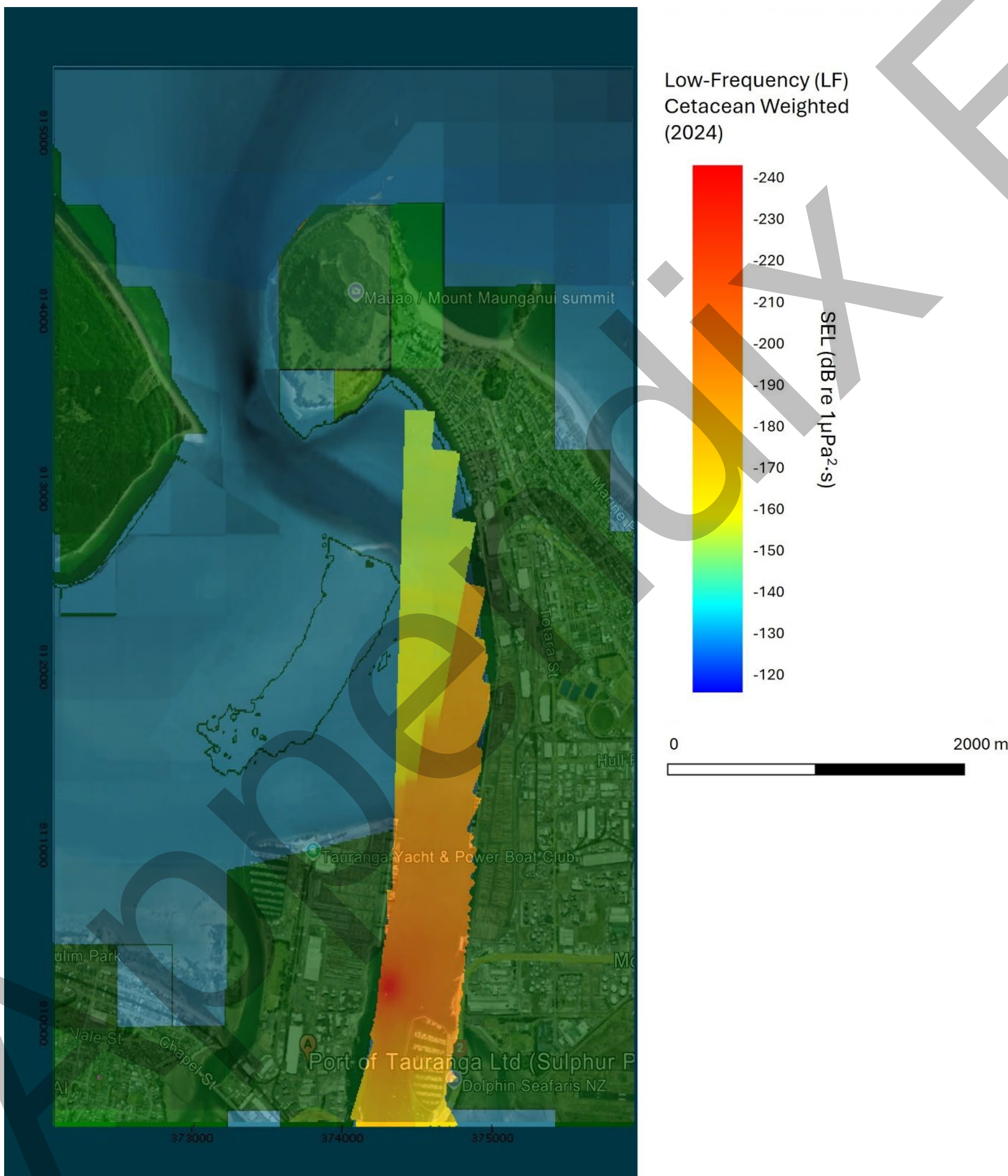


Figure C-4: Modelled LF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L2 to a maximum range, overlaying with satellite image

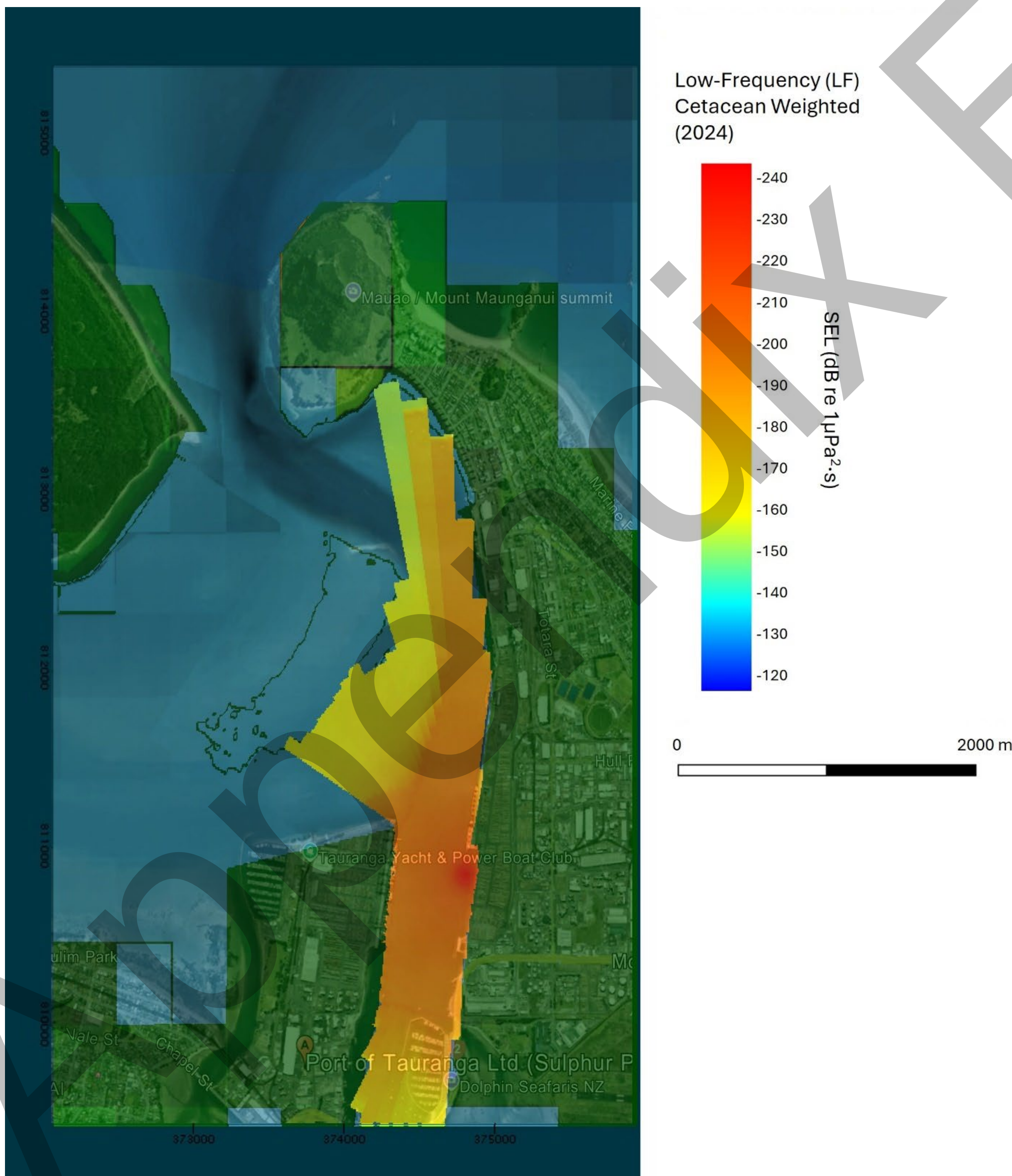


Figure C-5: Modelled HF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L1 to a maximum range, overlaying with satellite image

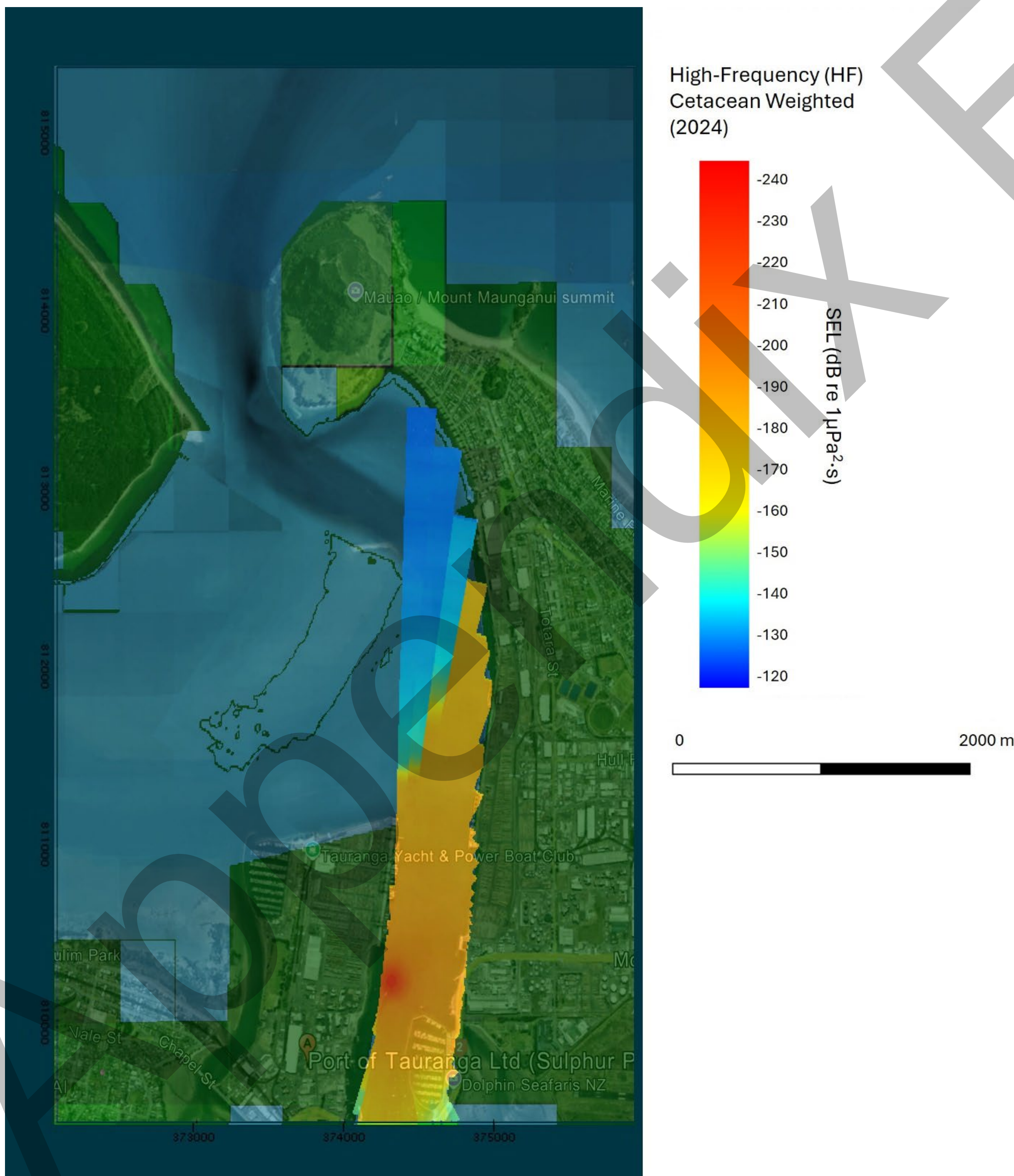


Figure C-6: Modelled HF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L2 to a maximum range, overlaying with satellite image

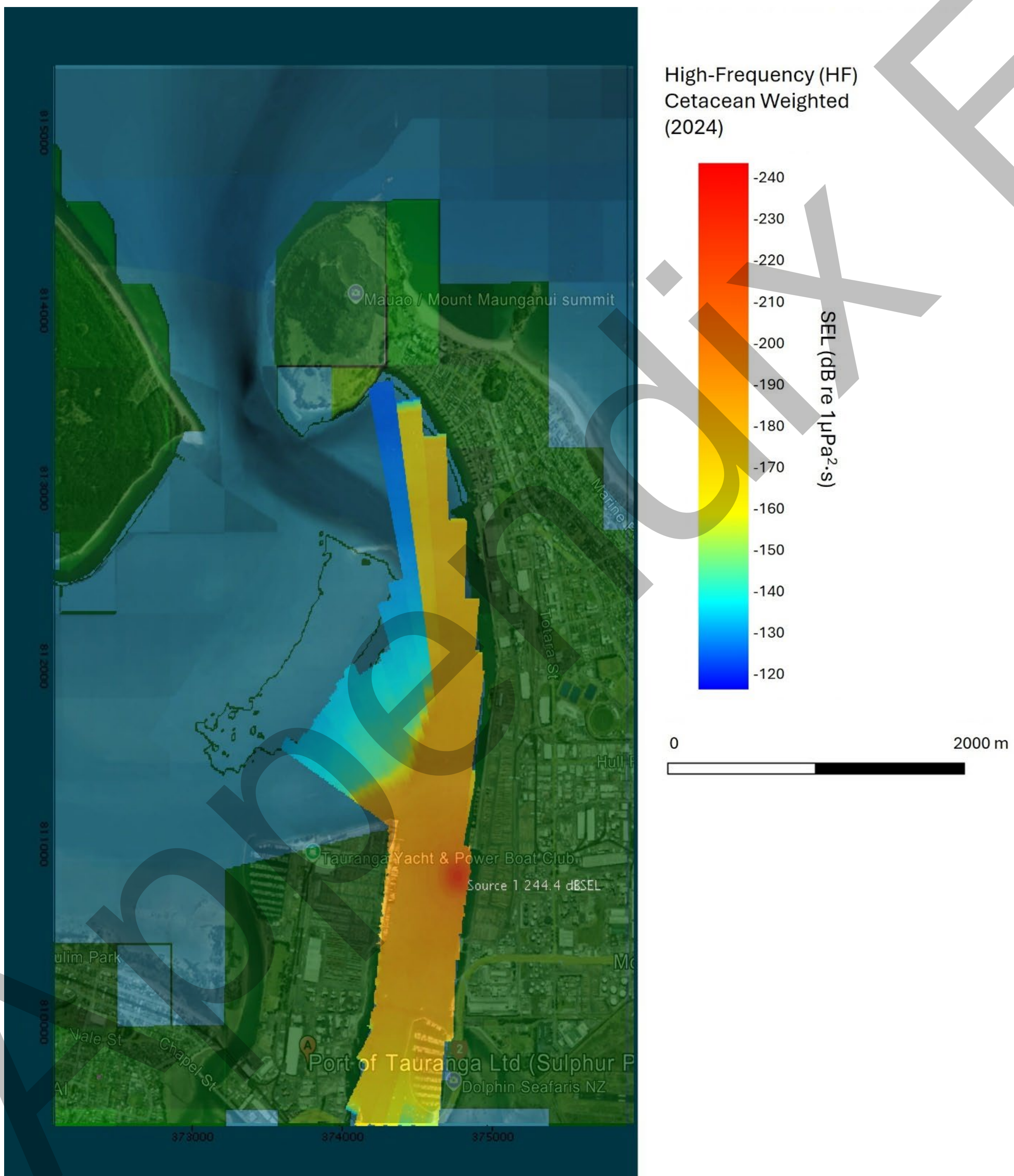


Figure C-7: Modelled VHF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L1 to a maximum range, overlaying with satellite image

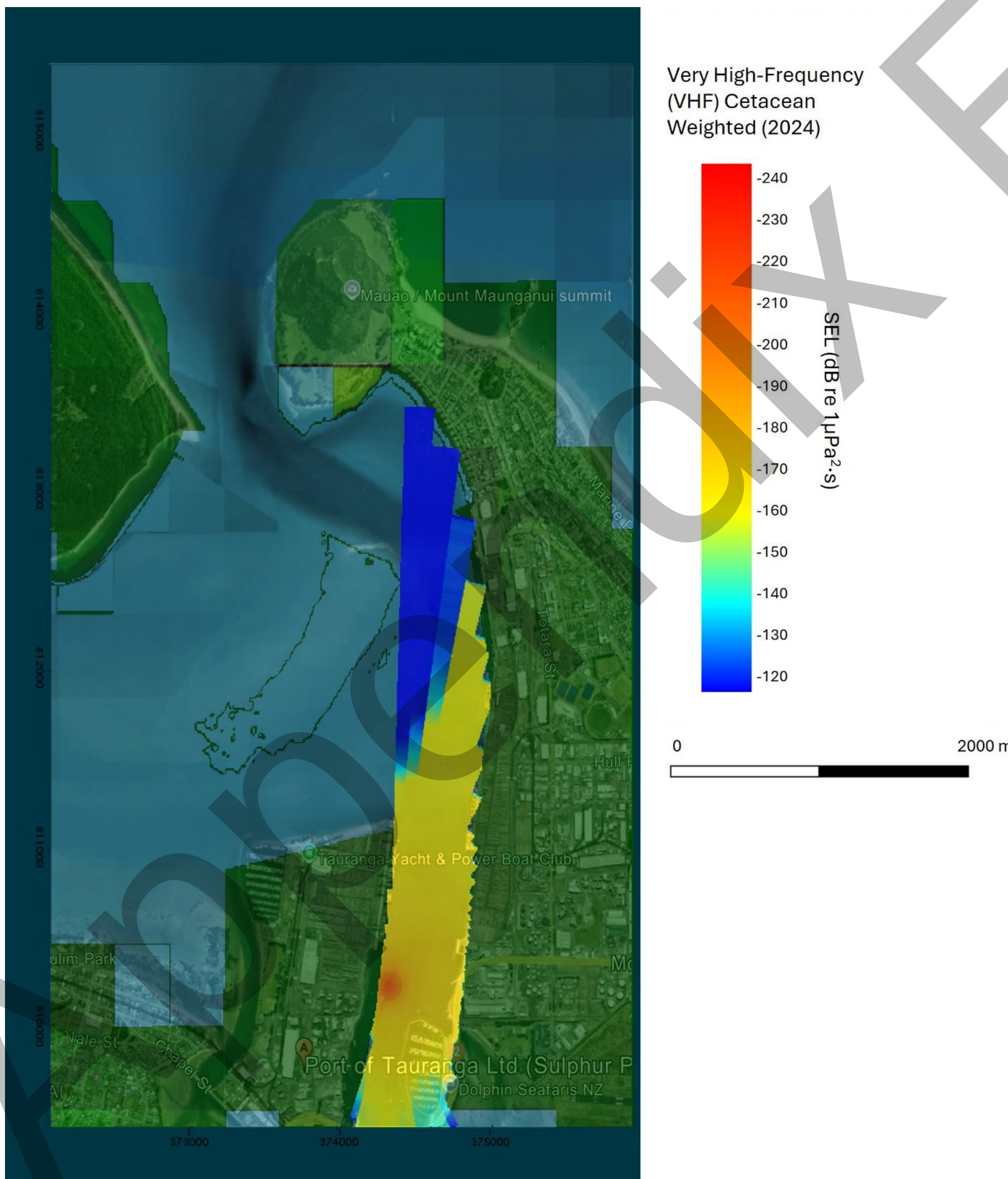


Figure C-8: Modelled VHF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L2 to a maximum range, overlaying with satellite image

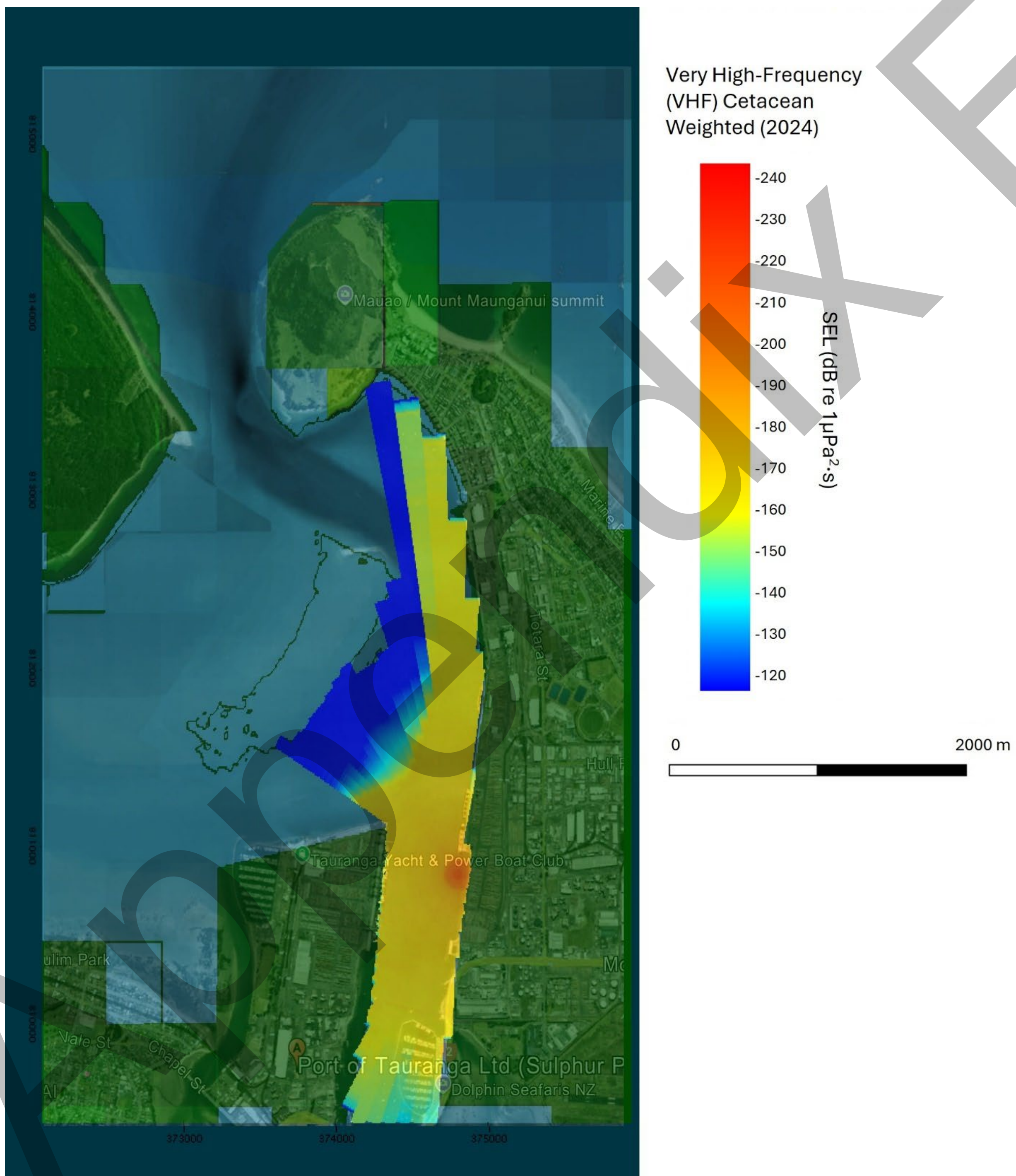


Figure C-9: Modelled PCW weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L1 to a maximum range, overlaying with satellite image

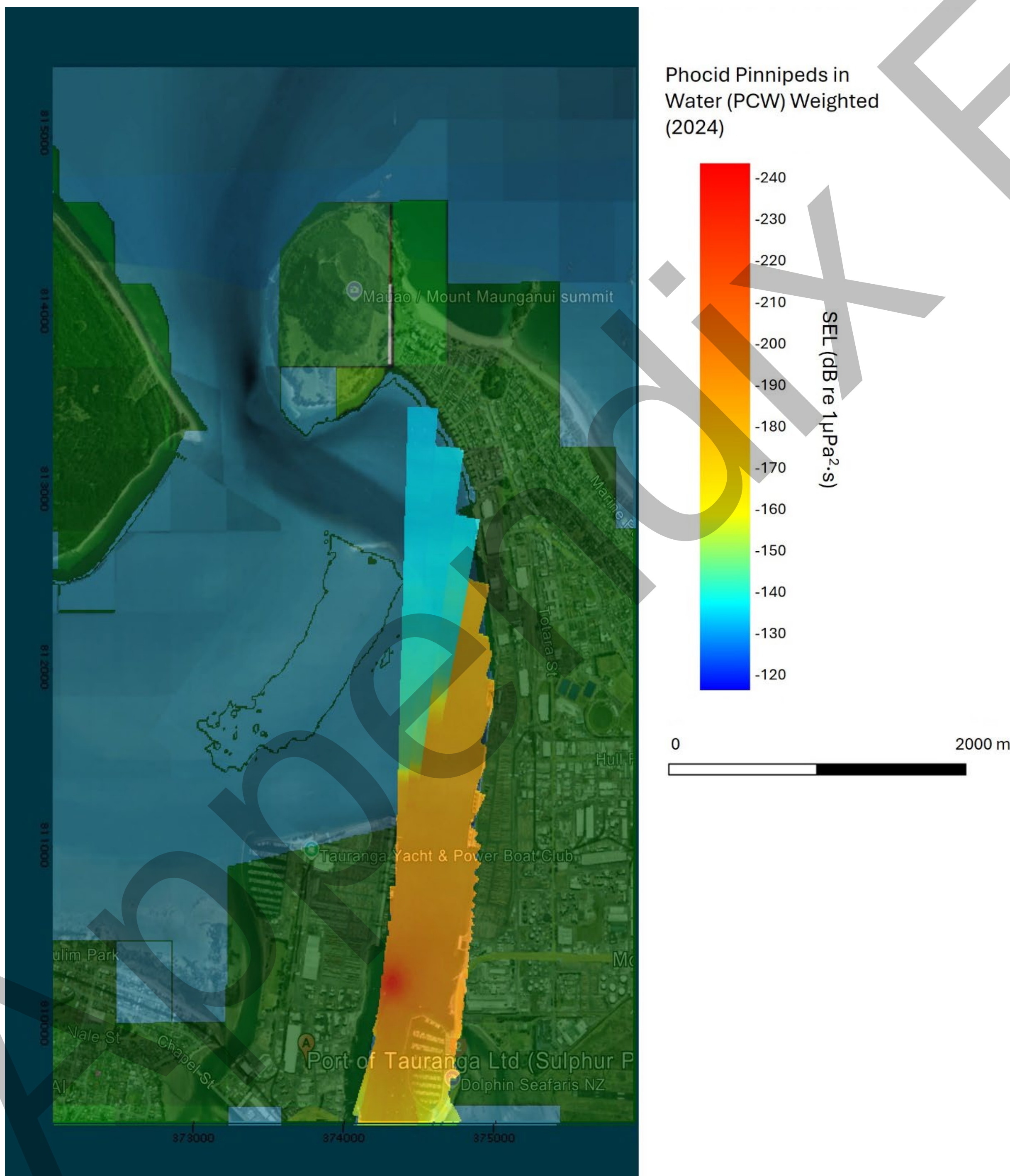


Figure C-10: Modelled PCW weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L2 to a maximum range, overlaying with satellite image

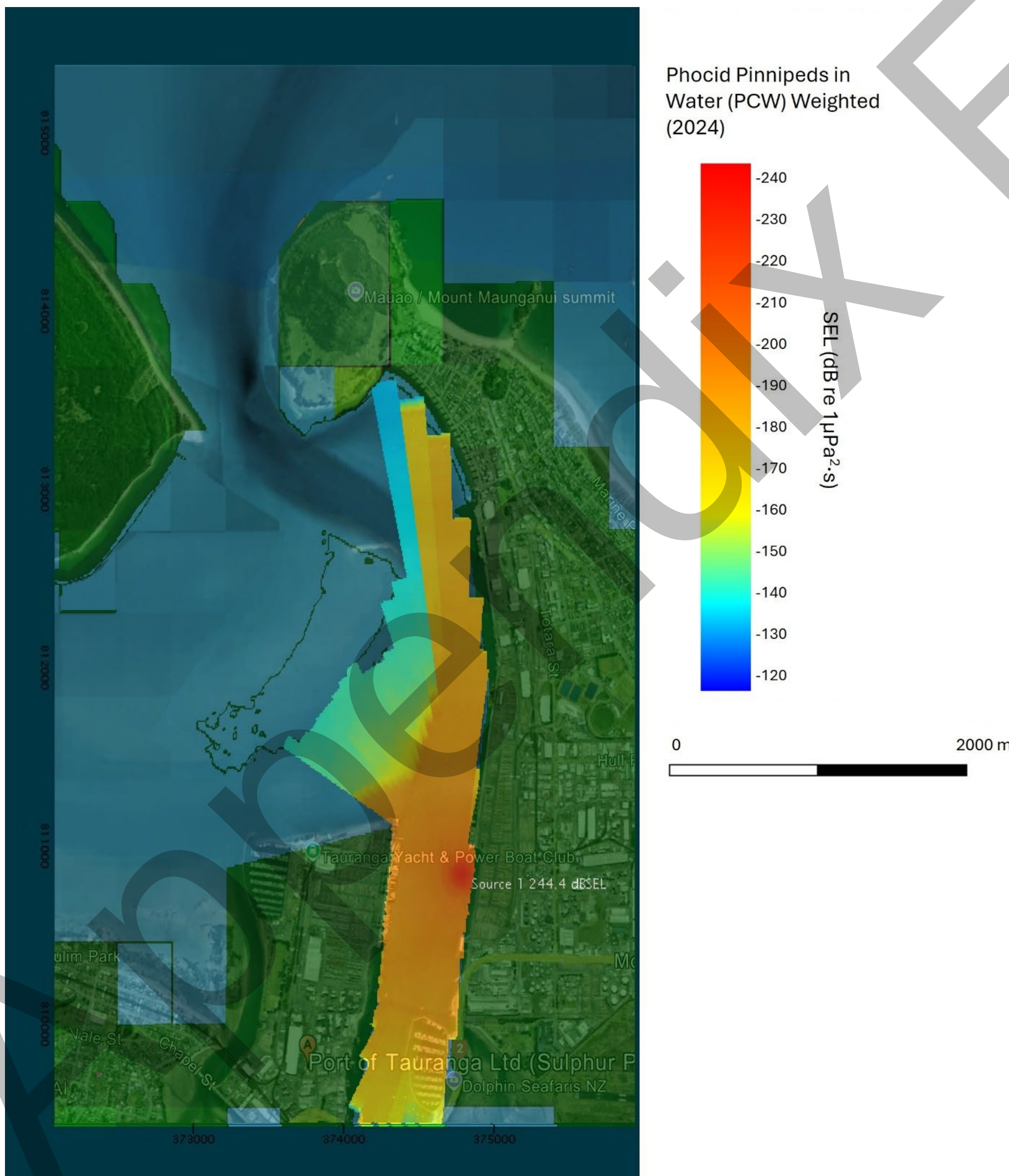


Figure C-11: Modelled OCW weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L1 to a maximum range, overlaying with satellite image

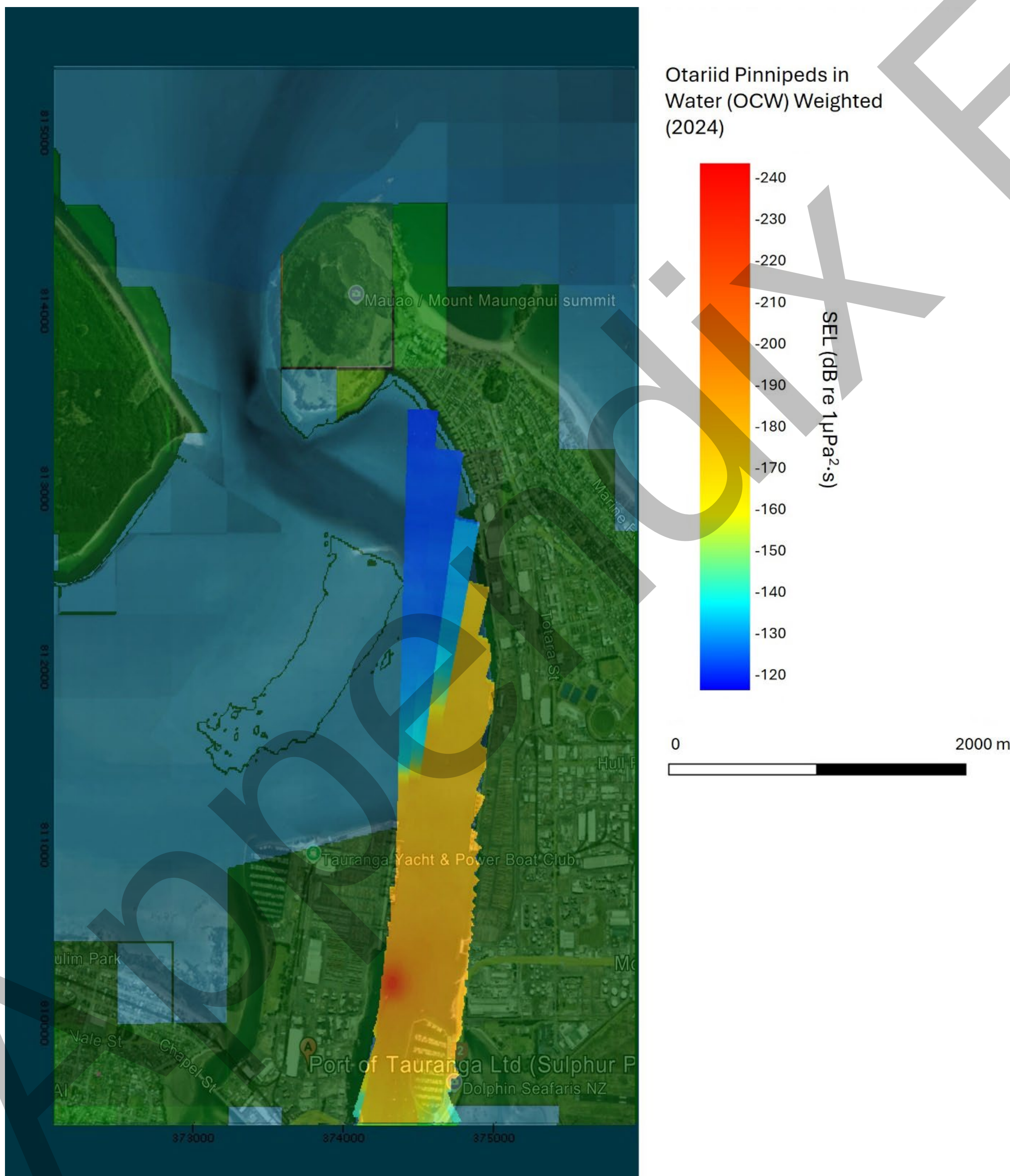


Figure C-12: Modelled maximum OCW weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from the source location L2 to a maximum range, overlaying with satellite image

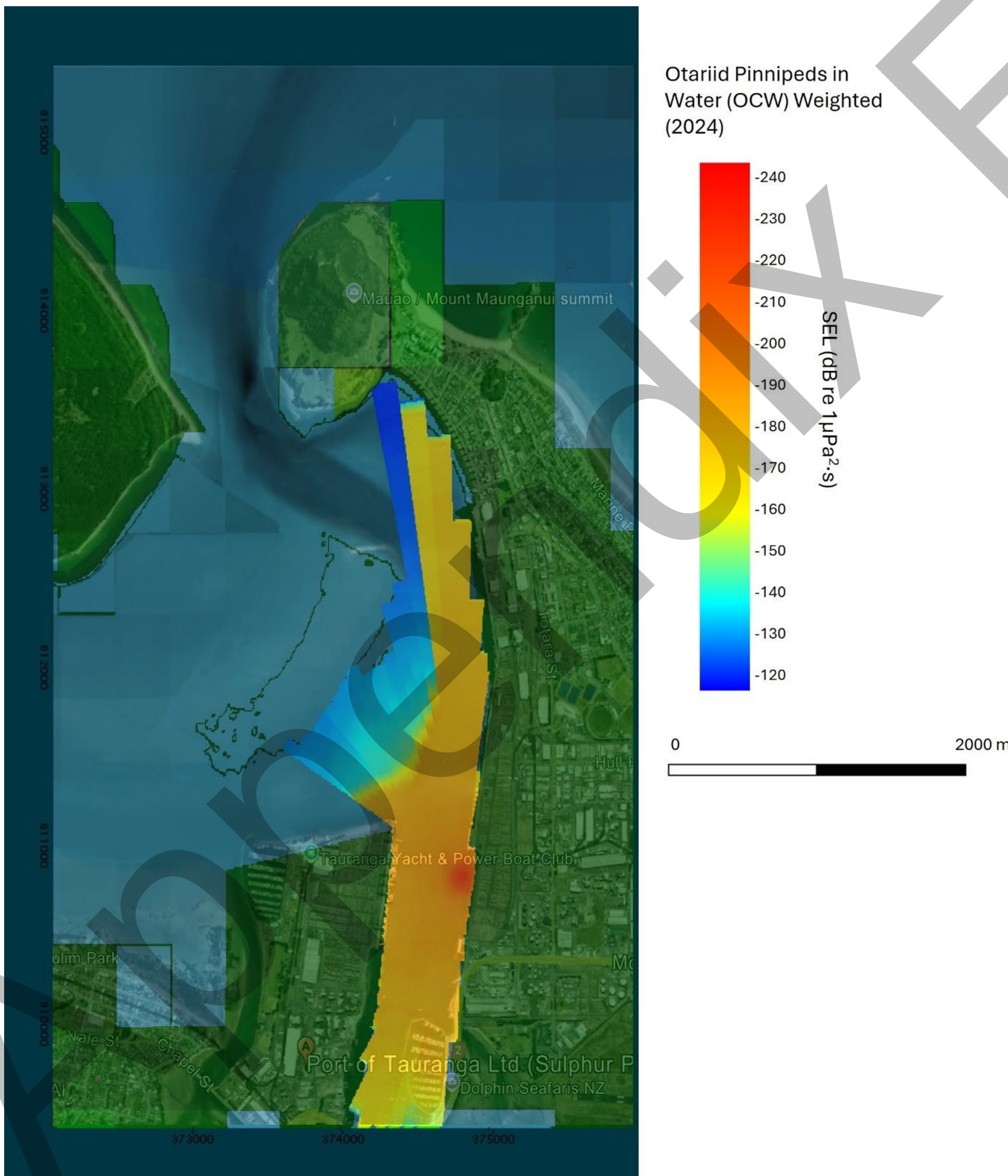


Figure C-13: Modelled peak SPL (maximum level across water column) contours for impact piling noise emission of a single pulse from two source locations to a maximum range, overlaying with satellite image

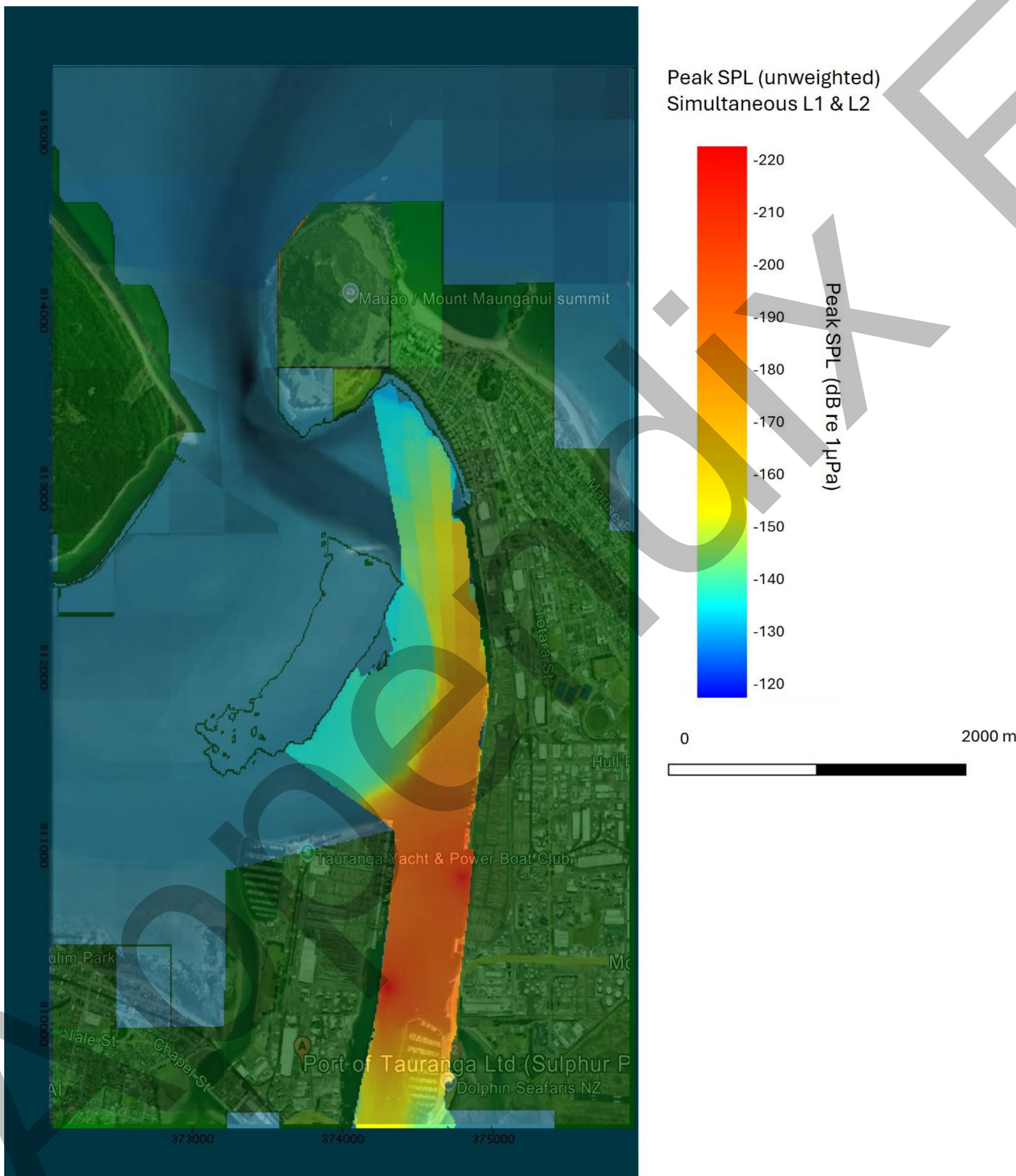


Figure C-14: Modelled HF weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from two source locations to a maximum range, overlaying with satellite image

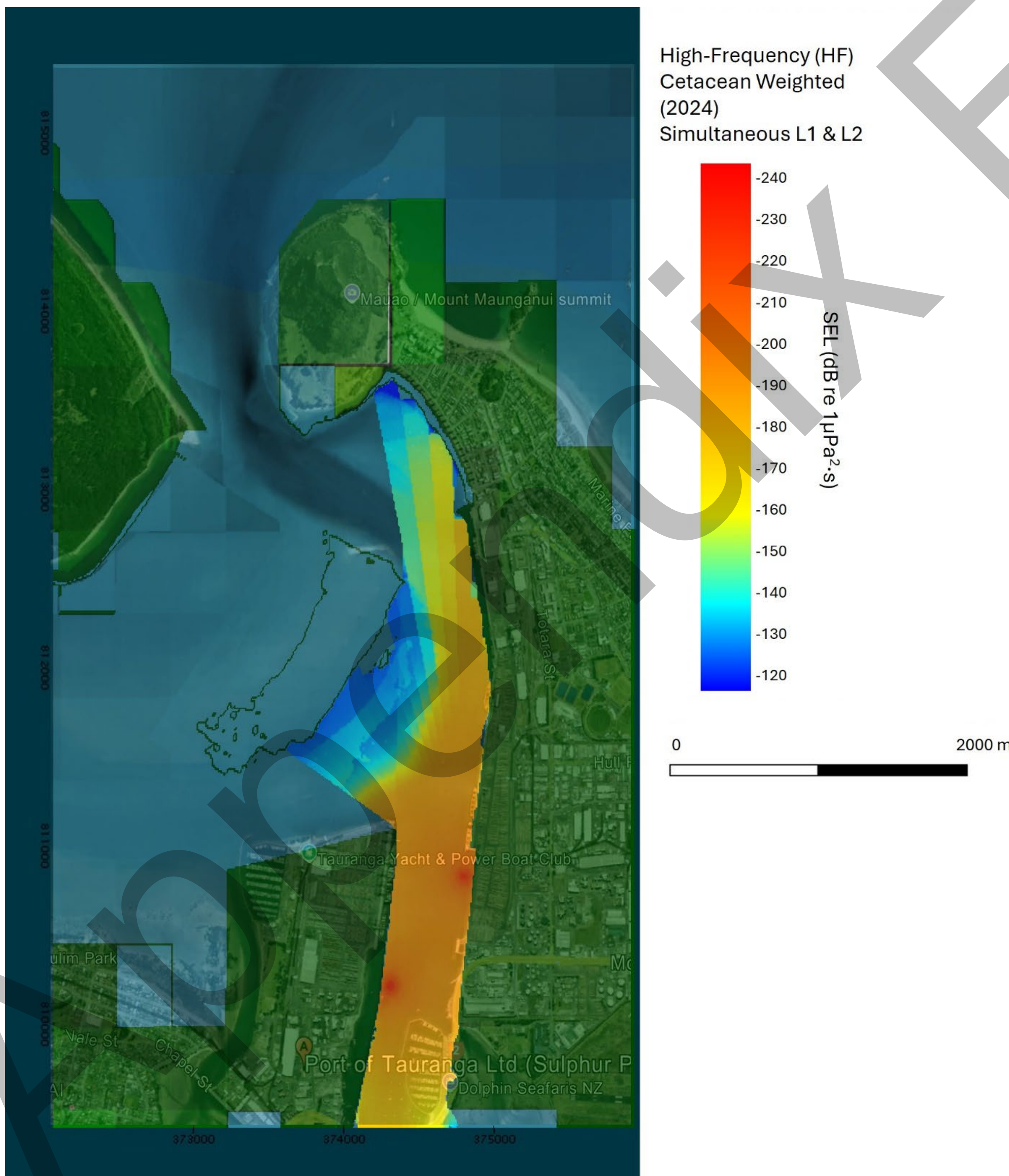
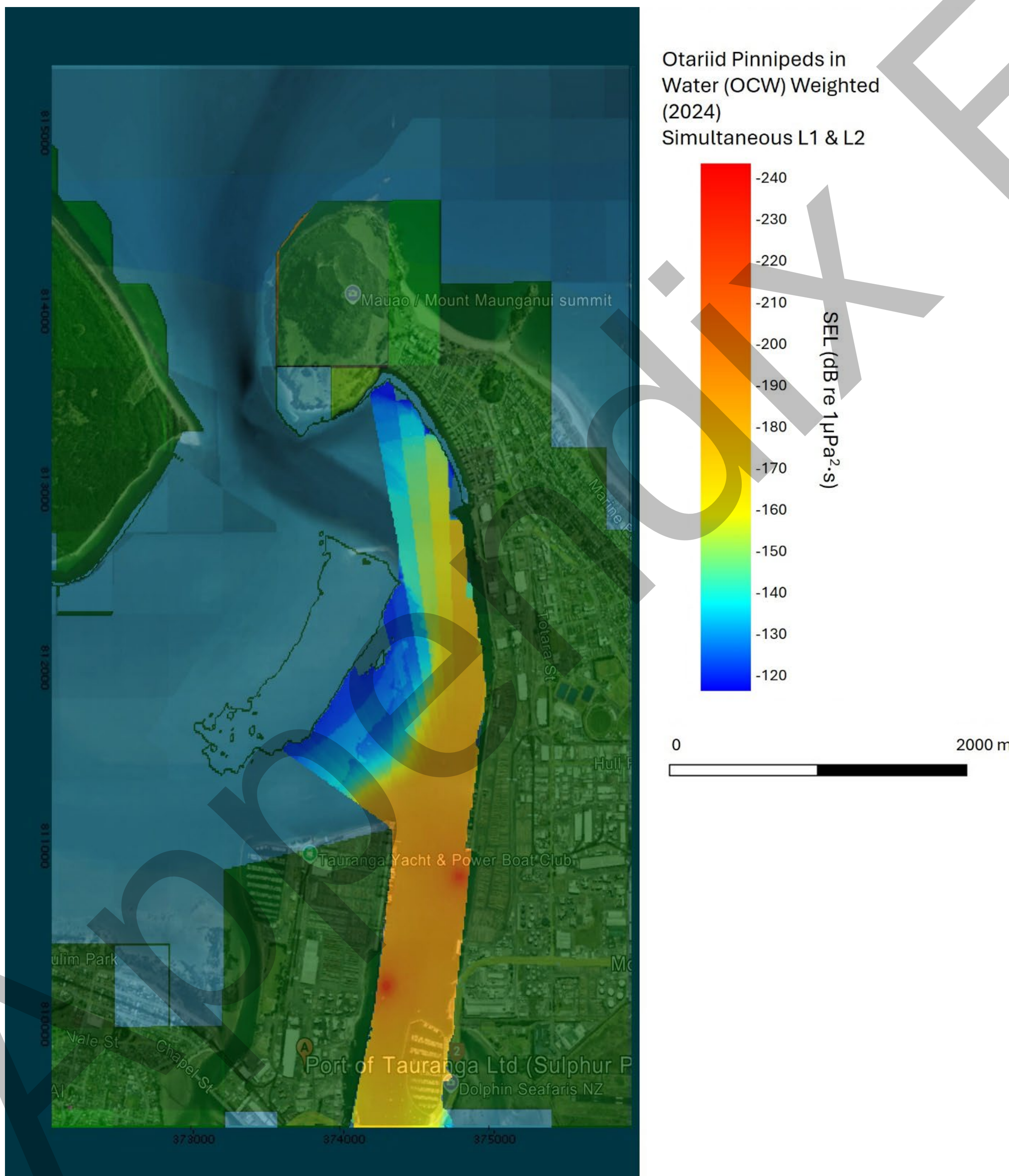


Figure C-15: Modelled maximum OCW weighted SEL (maximum level across water column) contours for cumulative impact piling noise emission of 8,000 pulses from two source locations to a maximum range, overlaying with satellite image



Appendix E

Making Sustainability Happen

Appendix F Draft Marine Mammal Management Plan

Assessment of Effects on Marine Mammals

Stella Passage: Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Marine Mammal Management Plan

Stella Passage Fast Track Approval Application

Port of Tauranga Limited

Private Bag 12504
Tauranga Mail Centre
Tauranga 3143

Prepared by:

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New Zealand

SLR Project No.: 840.030138.00001

10 April 2025

Revision: 05 FINAL

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
01	30 June 2022	HM	RJ	DG
02	18 October 2024	HM	MDL	HM
03	17 February 2025	HM	MDL	HM
04	27 February 2025	HM	RJ	HM
05	10 April 2025	HM	RJ, MDL	HM

Basis of Management Plan

This management plan has been prepared by SLR Holdings NZ (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Port of Tauranga Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This management plan is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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Acronyms and Abbreviations

CSC	Customer Service Centre, Port of Tauranga
DOC	Department of Conservation
FTA	Fast Track Approvals Act 2024
IHOZ	Inner Harbour Observation Zone
MMMP	Marine Mammal Management Plan
MMO	Marine Mammal Observer
MMOZ	The primary 500 m Marine Mammal Observation Zone
MMPR	Marine Mammal Protection Regulations 1992
POTL	Port of Tauranga Limited

1.0 Introduction

1.1 Purpose of the Marine Mammal Management Plan

The purpose of this Marine Mammal Management Plan (**MMMP**) is to outline procedures to be implemented during construction of the Stella Passage Development (**project**) to ensure compliance with the Marine Mammals Protection Act 1978.

1.2 Description of Construction Activities

Construction activities associated with the project will occur in accordance with the description of works described in the relevant Fast Track Approvals Act 2024 (**FTA**) application. The primary activity associated with the project that has the potential to adversely affect marine mammals is pile driving, where underwater noise generated can affect marine mammal hearing, behaviour, and communication. On this basis, the MMMP focusses on the potential adverse effects associated with pile driving noise, and dredging effects are managed directly through consent conditions. A full description of all potential effects on marine mammals from the project is provided in the Assessment of Effects report for Marine Mammals (SLR, 2025) that forms part of the FTA application.

1.3 Marine Mammals in and around Te Awanui / Tauranga Harbour

A comprehensive assessment of marine mammal presence and habitat use in around Te Awanui / Tauranga Harbour is provided in SLR (2024). The assessment found that the following three species of marine mammal are likely to occur on an occasional basis within the harbour:

- bottlenose dolphins;
- killer whales (orca); and
- New Zealand fur seals.

With the addition of common dolphins, the three species listed above are also frequently present in regional waters outside of Te Awanui / Tauranga Harbour.

Other species that can sometimes be seen in regional coastal waters include blue whales, minke whales, Bryde's whales, false killer whales, Gray's beaked whales, humpback whales, long-finned pilot whales, southern right whales, sei whales, and leopard seals. On rare occasions humpback whales, southern right whales and leopard seals have been seen inside Te Awanui / Tauranga Harbour.

Appendix A provides identification information for the marine mammals of relevance to Te Awanui / Tauranga Harbour.

1.4 Potential Effects of Project Activities on Marine Mammals

The individual potential effects of the project on marine mammals are briefly summarised in **Table 1** below. A full description and discussion of these effects is given in SLR (2025).

Table 1 Potential effects on marine mammals from Stella Passage Development

Potential Effect	Description	Likelihood of Effect	Magnitude of Effect
Underwater noise from pile driving	Because of their reliance on sound for critical life functions, underwater noise can have significant effects on marine mammals. Effects can include masking, behavioural changes, and hearing damage. Measures to manage underwater noise are outlined in **Section 3.0**. Management measures focus on avoidance of physical effects (particularly hearing damage) and behavioural effects (particularly entrapment in the inner harbour).	Moderate	Minor
Underwater noise from dredging	While dredging activities do generate underwater noise, dredging noise poses less of a threat to marine mammals than pile driving as the risk of hearing damage is very low. Effects are most likely to be limited to low level masking or temporary behavioural responses. On this basis, the recommended controls relating to dredging are addressed by consent conditions and are not included as part of this MMMP.	Low	Negligible
Presence of structures in the water column	Physical structures (e.g. new piles) can act as obstacles in the marine environment and can increase the potential risk of displacement, collision, entanglement, or entrapment for marine mammals. Marine mammals are typically highly aware of their surroundings and possess exceptional abilities to detect and avoid obstacles in the water column and any displacement from wharf extensions will be miniscule compared to the large ranges of mammals.	Low	Minor
Habitat modification	Disturbance to the seabed (by dredging or construction) may increase turbidity in the surrounding water column and 1) reduce visibility for marine mammals; or 2) affect the quality and availability of benthic prey. However, turbidity plumes will be highly localised and temporary, marine mammals will have ample opportunity to avoid them, and none of the marine mammals expected in Te Awanui / Tauranga Harbour are entirely reliant on benthic prey.	Remote	Negligible
Ship strike	The risk of ship strike exists with any project vessel use (including dredging) and is influenced by vessel size, vessel speed, the species present and their behaviour. Large vessels travelling > 12 knots present the greatest risk, and collisions are more likely to occur with large whales that are less agile. Compliance with the Marine Mammal Protection Regulations 1992 will adequately manage this potential effect. See **Appendix D** for an outline of the rules vessels must follow when operating near marine mammals.	Remote (during extraction) Low (during transit)	Negligible (during extraction) Minor (during transit)
Exposure to contaminants	Prey of marine mammals could potentially bioaccumulate contaminants released during construction. The sediments to be dredged do not contain concerning levels of contaminants. Therefore, although some exposure to contaminants either directly or indirectly (via prey) is possible, the likelihood of marine mammals spending extended periods in direct contact with contaminants in plumes or consuming significant amounts of contaminated prey is remote.	Remote	Negligible
Marine debris	Marine debris can affect marine mammals through ingestion or entanglement. The project presents a remote likelihood of adverse effects associated with marine debris if the guidelines in **Section 5.0** are followed.	Remote	Negligible
Artificial lighting	Fur seals and dolphins are the most probable candidates for attraction by artificial lighting. However, the project area has not been identified as important habitat for any marine mammal and the slow speed of the dredge, and the agility of these species reduces any potential ship strike risk that could arise from attraction.	Remote	Negligible

2.0 General Protocols

2.1 Compliance with the Marine Mammals Protection Act 1978

All marine mammals in New Zealand waters are fully protected under the Marine Mammals Protection Act 1978. It is an offence to 'take' a marine mammal without a permit. 'Take' is defined as:

- To take, catch, kill, injure, attract, poison, tranquillise, herd, harass, disturb or possess;
- To brand, tag, mark, or do any similar thing; and
- To flense, render down, or separate any part from a carcass.

Port of Tauranga Ltd (**POTL**) does not hold a permit to 'take' marine mammals. Any individual involved in any action in respect of marine mammals is responsible for their own actions within the framework of the Marine Mammals Protection Act 1978. Any non-compliance may result in legal sanction under the Marine Mammals Protection Act 1978. However, defences under the Marine Mammals Protection Act 1978 provide exemptions in some circumstances in relation to: 1) Assisting an injured marine mammal; 2) Retrieval of dead marine mammals under the direction of the Department of Conservation (**DOC**); and 3) Disposal of a dead marine mammal under the direction of DOC.

2.2 Compliance with Marine Mammals Protection Regulations 1992

Part 3 of the Marine Mammals Protection Regulations 1992 (**MMPR**) outline the behaviours that must be adhered to by all persons around marine mammals. Compliance with these regulations is a legal requirement.

2.3 Compliance with Company Common Practice

Members of POTL's marine department typically inform each other of the presence of marine mammals in Te Awanui / Tauranga Harbour. POTL will implement a formal policy regarding this practise during the Stella Passage Development (see **Section 3.14** for further detail).

3.0 Controls for Pile Driving Operations

Unless specifically stated these controls apply to both impact piling and vibro-piling when any pile or section of pile is in the water column ("pile driving").

3.1 Pile Driving Methodology to Reduce Noise at Source

Pile driving will proceed in accordance with the Reclamation and Construction Management Plan associated with the project. Adherence to the following controls is required during all pile driving:

- Pile driving equipment will be selected (i.e., hammer type, hammer size and driving force) and operated (i.e., hammer energy/power level) to ensure underwater noise is minimised to the extent practicable while still achieving construction goals;
- Pile driving equipment will be regularly maintained, including lubrication and repair;
- The duration of pile driving will be minimised to the extent practicable[1];
- Restricted hours of operation will be observed when appropriate (see **Section 3.13**);
- The use of cushion blocks is mandatory for all impact pile driving of steel piles[2];
- The use of bubble curtains is mandatory for all impact pile driving of steel piles[3]; and
- Impact pile driving shall not result in more than 8,000 strikes per day.

3.2 Marine Mammal Observation Zones

The establishment of Marine Mammal Observation Zones and Shutdown Zones are fundamental to managing effects of underwater pile driving noise on marine mammals. The marine mammal observation zones outlined below define the area over which the on-duty Marine Mammal Observer (**MMO**) is required to monitor for marine mammals as per the duties outlined in **Section 3.4** (including initiation of procedures to cease pile driving, or 'shutdowns'). The standard marine mammal observation zones for the project are described below.

- The primary marine mammal observation zone (**MMOZ**) for all marine mammal species is a 500 m radius around each individual pile driving location. **Figure 1** gives examples of the MMOZ as it would be applied around two different pile locations. At any one time during piling the MMOZ will be limited to the immediate 500 m radius from the active piling unit.
- The Extended MMOZ, encompasses the area down the shipping channel towards the harbour entrance shown in **Figure 1.** The Extended MMOZ shall be implemented where practicable (i.e. whenever weather conditions and shipping traffic permit observations across this area).

[1] Noting that oftentimes a balance will need to be struck between pile driving duration and hammer type/size/force. These decisions should always be taken with the over-riding principle of minimising underwater acoustic noise.

[2] Cushion blocks consist of blocks of material atop a pile during pile driving to minimise the noise generated during impact hammering. Materials typically used for cushion blocks include wood, polymer, nylon or micarta.

[3] Contractor to provide and operate bubble curtain technology. On a similar project in Wellington Harbour they reduced the overall sound levels by 5 dB which equated to a reduction of 15-20 dB when results were weighted for the hearing range of high frequency cetaceans (Warren, 2021).

- The Inner Harbour Observation Zone (**IHOZ**) shall also be implemented in relation to Pre-start Observations (as described in **Section 3.8**). The required field of view for IHOZ observations is illustrated in **Figure 3**.

3.3 Standard Marine Mammal Shutdown Zones

The following species-specific Shutdown Zones shall be established for all pile driving (with the exception of Simultaneous pile driving which is covered separately in **Section 3.4**):

- Odontocetes (all dolphins and all toothed whales, including but not limited to orca) and fur seals:
  These species are expected most frequently in Te Awanui / Tauranga Harbour. For these species, a **Shutdown Zone of 500 m** will be established. If any odontocete or fur seal is detected in the water within a 500 m radius around each individual pile driving location, pile driving operations must cease immediately. For this reason, maintenance of the 500 m MMOZ is to be prioritised at all times during active piling. Note that fur seals ashore will not trigger a shutdown but will be subject to monitoring as pile driving must cease when they enter the waters of this Shutdown Zone.

- Baleen whales and leopard seals:
  The Shutdown Zone for baleen whales and leopard seals (which are rare visitors inside Te Awanui / Tauranga Harbour) is **the extent of Te Awanui / Tauranga Harbour** illustrated in **Figure 2**. If any baleen whale or leopard seal is detected in the waters of this Shutdown Zone by an MMO or reported by a third party through the 'Alert System' described in **Section 3.7**, pile driving operations must cease immediately. Note that leopard seals ashore will not trigger a shutdown but will be subject to monitoring as pile driving must cease when they enter the waters of this Shutdown Zone.

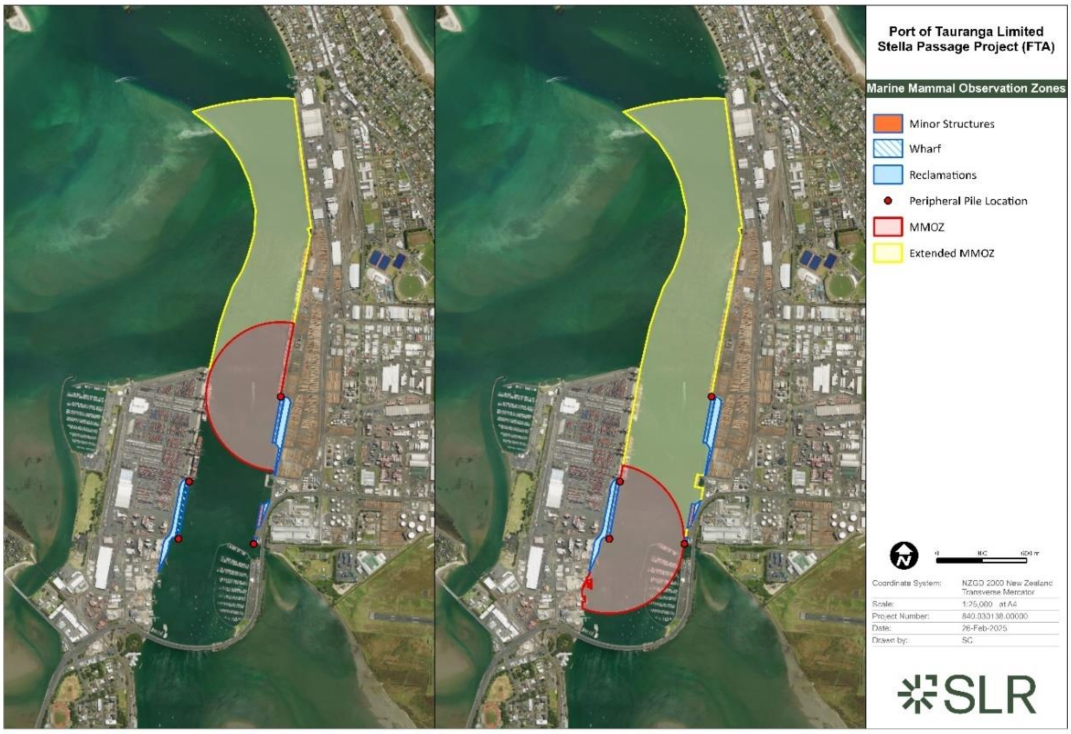


Figure 1 Marine Mammal Observation Zone: examples of two different pile locations

***Note**, the priority MMOZ for each pile is the 500 m radius around each specific pile driving location.*

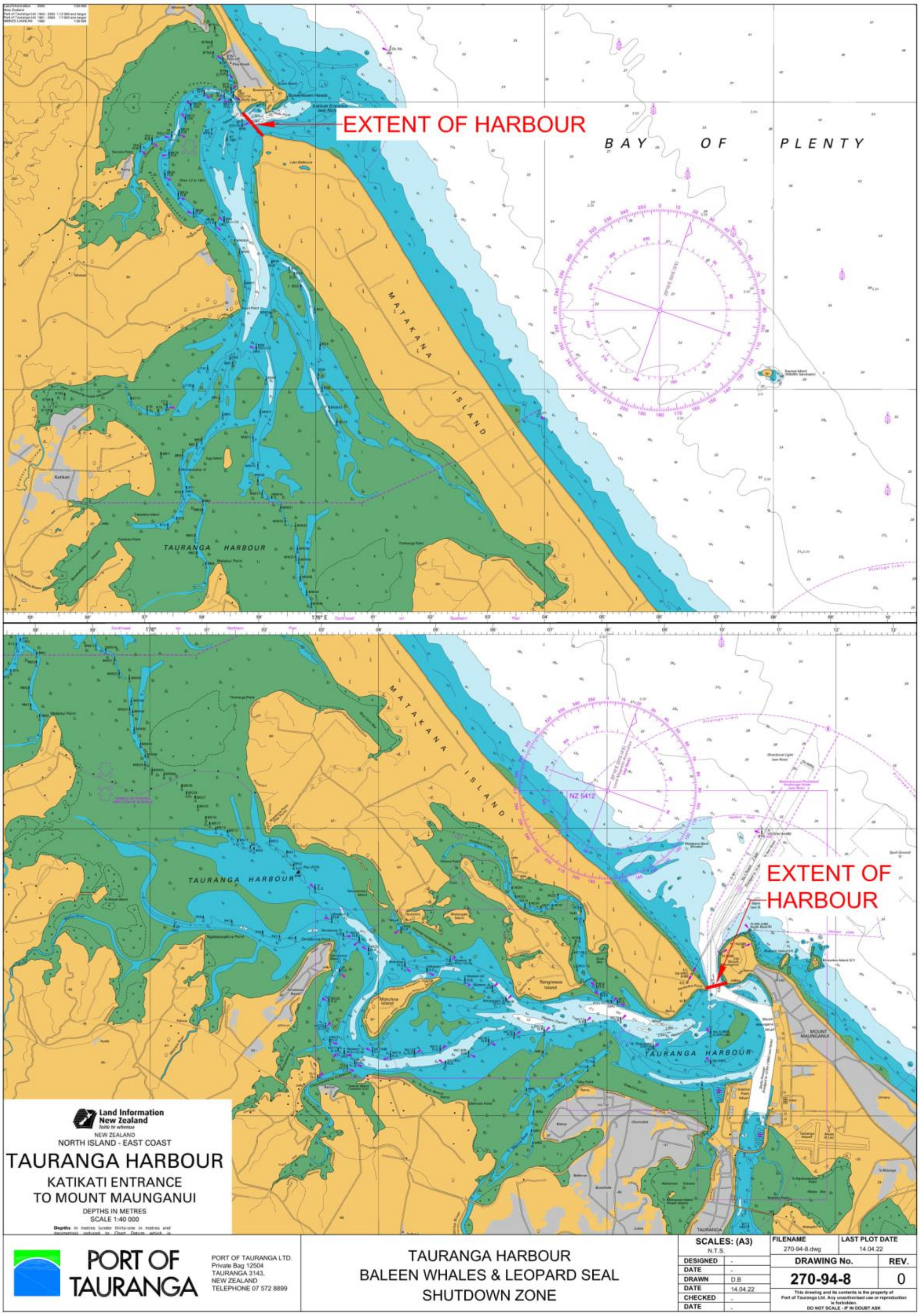


Figure 2 Limits of the Extended Shutdown Zone for Baleen Whales & Leopard Seals

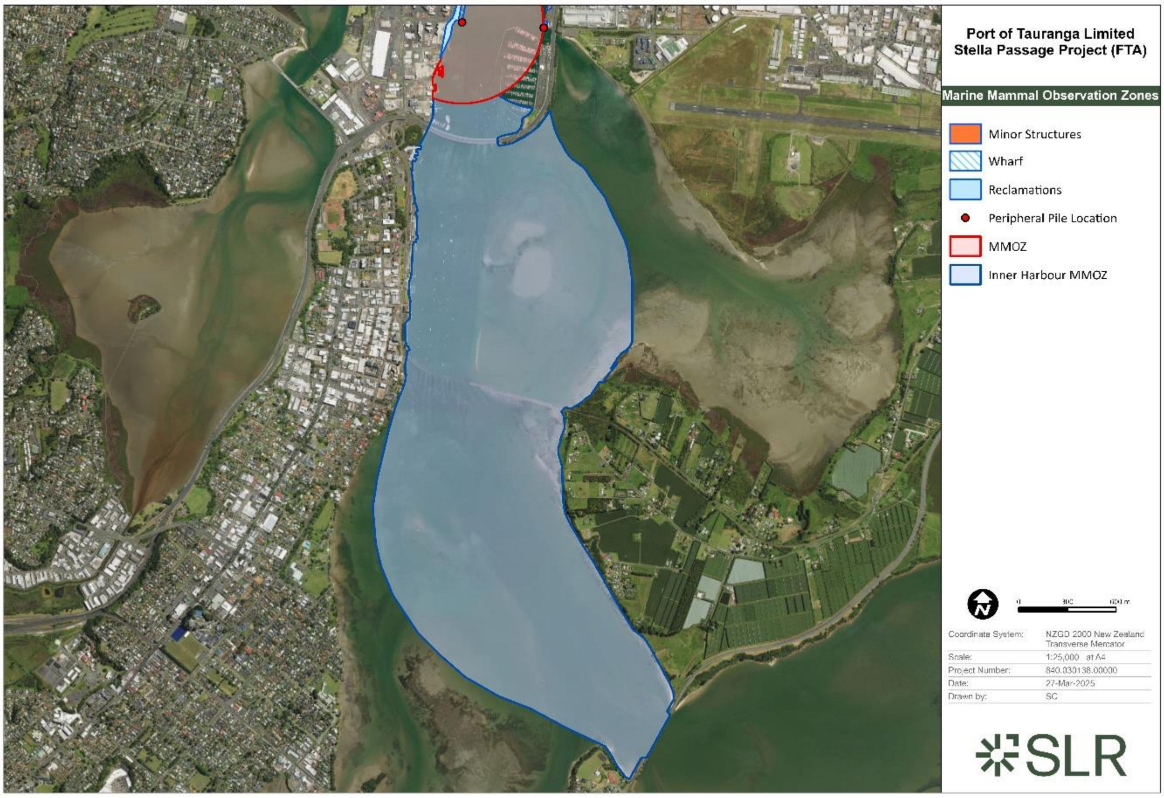


Figure 3 Inner Harbour Observation Zone

***Note**, the IHOZ is shown here relative to the MMOZ around the southernmost pile location as an example.*

3.4 Simultaneous Impact Pile Driving

Simultaneous pile driving is defined as when two piling units are operating concurrently AND the timing of the hammer strikes is synchronised across the two units.

In these instances, the following additional controls will be implemented:

- The size of the MMOZ for all marine mammal species will increase to cover a 1000 m radius around each individual pile driving location; and
- A **Shutdown Zone of 1,000 m** will be established for all odontocetes and fur seals. If any odontocete or fur seal is detected in the water within a 1,000 m radius around each individual pile driving location, pile driving operations must cease immediately. Note that fur seals ashore will not trigger a shutdown but will be subject to monitoring as pile driving must cease when they enter the waters of this Shutdown Zone during simultaneous pile driving.

For clarity, the extended MMOZ (as defined in **Section 3.2**) will also be implemented during simultaneous pile driving as will the Shutdown Zone for baleen whales and leopards seals (as defined in **Section 3.3**).

Note, when two piling units are operating concurrently but are striking at different times (i.e. are not simultaneous), the Standard Shutdown Zones (as defined in **Section 3.3**) will apply.

3.5 Marine Mammal Observer Duties

The function of MMOs is to oversee the required operational procedures to manage the effects of underwater noise on marine mammals during pile driving.

At least one MMO must be on duty at least 30 minutes prior to the commencement of pile driving, and at all times while pile driving is underway. The on-duty MMO must not be tasked with any other jobs while assigned to the role of MMO. Their sole function while on duty as an MMO will be to undertake the following tasks:

- Conduct visual observations for marine mammals within the relevant marine mammal observation zone/s by continually scanning the water surface for indicators of marine mammal presence;
- Observations will be undertaken using a combination of naked eye and high-quality binoculars from optimum vantage points to maximise visibility throughout the relevant marine mammal observation zone/s. Potential vantage points and considerations around vantage point selection are discussed further in **Section 3.6**;
- A MMO will be on duty to conduct ‘pre-start’, ‘stand-by’ and ‘normal’ observations as defined in **Sections 3.8**, **3.10**, and **3.11**;
- Whenever visibility and conditions allow, visual monitoring should extend beyond the 500 m radius of the primary MMOZ and into the Extended MMOZ. This will facilitate the detection of marine mammals before they enter the Shutdown Zones and will allow piling crews to be placed on stand-by for shut down.
- Determine distance of marine mammals from piling unit using fixed reference points or other appropriate tools (e.g. GPS, sextant, reticule binoculars, compass, measuring sticks, angle boards, laser range finders);
- Record all marine mammal sightings, including species, group size, behaviour, presence of calves, distance from piling unit when first detected, closest distance from piling unit, and direction of travel (see **Section 4.1**, and **Appendix A**);
- Record sighting conditions (Beaufort Sea State, visibility, fog/rain and glare) at the beginning and end of the observation period, and note when there is a significant change in weather condition;
- Maintain a record of MMO observations and pile driving (see **Section 4.2**);
- To the extent practicable, breaks for lunch, toilet etc. should be timed to coincide with breaks in pile driving (i.e. when observations for marine mammals are not mandatory). Alternatively, another trained MMO must cover breaks as needed;
- Receive and record third party marine mammal observations in accordance with **Section 3.7;**
- Implement appropriate mitigation actions (delayed starts, stand-by and shutdowns in accordance with **Section 3.12**) via direct communications with the piling crew manager/s;
- Record piling unit details (hammer size, power level), and any mitigation measure/s taken;
- Communicate with POTL Environmental Advisor to clarify any uncertainty or ambiguity in application of the MMMP; and
- Record any instances of non-compliance with the MMMP.

In situations when a single MMO is unable to cover the requisite observation zones of multiple piling units, then additional MMOs must be on-duty. It is recommended that as many construction crew members as possible are trained as MMOs so that a roster can be organised to rotate this position during the day and week. This will also allow for periods of staff absenteeism. The training requirements for MMOs are discussed in **Section 6.0**.

3.6 MMO Vantage Points

All reasonable efforts will be made to ensure that the selected vantage point from which MMO duties are undertaken maximises visibility throughout the relevant observation zone (as defined in **Section 3.2**). However, it is important to note that observations of the primary MMOZ should take precedence over the Extended MMOZ during active piling (i.e. if observations of both these zones from a single vantage point is unachievable), but whenever possible, the vantage point will also be selected to maintain a northerly field of view down the shipping channel towards the harbour entrance and will be elevated to maximise field of view.

Figure 1 provides two examples of how the 500 m MMOZ radius will be implemented around individual piling locations. The MMOZ will move relative to each individual pile location.

The on-duty MMO is responsible for selecting the most appropriate vantage point from which to undertake their MMO duties on a day-to-day basis. Noting that a location elevated above sea level will always be advantageous and that visibility will change depending on weather, glare/sunstrike, and the presence of moored vessels at the existing wharves, the following options to meet operational requirements are acceptable.

- The Northern Breakwater of the Tauranga Bridge Marina (for pile driving operations along the southern part of both wharf extensions);
- The Mount Maunganui Bunker Wharf (for pile driving operations along the central part of the Mount Maunganui wharf extension); and
- The Northernmost Mooring Dolphin, Sulphur Point (for pile driving operations along the northern part of the Mount Maunganui wharf extension).

The selection of MMO vantage points must also consider any health and safety issues/requirements with the proposed location.

The use of elevated cameras may be used to assist with MMO duties; particularly for scanning the waters of the Extended MMOZ and the IHOZ. Noting that POTL has permission from Bay of Plenty Regional Council to mount a high resolution CCTV system on ‘Regional House’ at 1 Elizabeth Street, Tauranga to facilitate pre-start observations of the IHOZ. This is considered to be an acceptable option to meet IHOZ operational requirements as long as the following criteria are met:

- Any camera equipment used for this purpose must be regularly serviced and maintained to ensure continuous functionality during pile driving operations;
- The field of view required must include the main channel and surrounds from Harbour Bridge to Maungatapu Bridge as far as reasonably practicable (as indicated in **Figure 3**);
- Image resolution must be capable of detecting a single dolphin (c. 2.5 m long) at the surface when zoomed in).

3.7 Third Party Marine Mammal Observations

Opportunistic marine mammal sighting information from third parties will augment the capacity of the on-duty MMO. While this is relevant to all marine mammals, this is particularly the case for baleen whales and leopard seals, where sightings of these species in any waters inside Te Awanui / Tauranga Harbour will trigger a shutdown or delayed start of pile driving. An 'Alert System' will be established between POTL and other regular harbour uses to facilitate the prompt reporting of such sightings (see **Section 3.14**).

3.8 Pre-start Observations

Prior to the start of pile driving each day, the following observations shall be made:

<u>MMOZ observations:</u>

The MMO shall undertake at least 30 minutes of continuous visual observations within the primary MMOZ (and the Extended MMOZ where practicable) to assess whether any marine mammals are present:

- If no marine mammals are detected within the relevant Shutdown Zones, pile driving can commence using a soft start procedure (see **Section 3.9**); and
- If marine mammals are detected within the relevant Shutdown Zone, the commencement of pile driving must be delayed until the marine mammal moves beyond the shutdown zone, or 30 minutes has elapsed since the last detection.

<u>Inner harbour observations:</u>

- Prior to commencing pile driving each day 'inner harbour observations' to detect marine mammals up-harbour of Stella Passage will be made from a suitable vantage point to detect any marine mammals present in the 'Inner Harbour Observation Zone' (**IHOZ**). This zone is defined in **Figure 3** and includes the main channel and surrounds from Harbour Bridge to Maungatapu Bridge (which is the area from which most inner harbour sightings are made);
- Inner harbour observations will be made by a trained MMO, either in-person or using a suitable resolution camera system to allow cetacean detection over the required field of view (refer to **Section 3.6** above which describes the location of the camera and criteria of use);
- Pile driving shall only commence following the completion of 30 minutes of continuous 'inner harbour observations' during which no cetaceans are detected;
- If any cetacean (i.e. dolphin or whale)[4] is observed within or reported from the inner harbour whilst pile driving is underway, pile driving will immediately cease for the remainder of the day. The only exception to this would be if the animal/s are seen to depart through Stella Passage and are clear of the relevant shutdown zone, in which case piling could recommence. Monitoring of cetaceans in the inner harbour (during scheduled pile driving days) will occur to document their movements in an effort to support this control; and
- Prior to pile driving beginning on the morning after any inner harbour cetacean sightings were made, and in addition to the pre-start observations listed above, a boat search as far as Maungatapu Bridge will be made to check for the presence of

[4] This control does not apply to fur seals.

cetaceans. Pile driving will only commence once the search team reports that no cetaceans[4] have been detected within the inner harbour.

Extent of harbour

- Given the rarity of sightings of baleen whales and leopard seals in the harbour, pre-start observations of waters beyond the MMOZ and inner harbour (as described above) for these species are not necessary.

3.9 Soft Start

A 'soft start' is the process by which pile driving commences at the start of the day or after a break in operations. Soft starts consist of gradually increasing the power of the piling unit until full operational power is reached and concurrently increasing the strike rate over the initial operational period. This approach gives any marine mammals in the vicinity a chance to leave the area before significant effects can occur (e.g. hearing injury).

If marine mammals have not been observed inside the MMOZ and cetaceans have not been observed in the inner harbour during pre-start observations, soft start may commence with piling impact energy and/or frequency gradually increased over a 10-minute time period (see **Appendix B** for Operational Soft Start Protocol). A soft start will also be used after breaks of more than 30 minutes in pile driving.

A soft start may commence after the MMO has assessed there are no marine mammals present within, or about to enter, the relevant Shutdown Zones.

3.10 Normal Observations

If marine mammals have not been observed inside the MMOZ during soft start, pile driving at full impact energy may commence. Visual observations will continue throughout the entire pile driving duration.

3.11 Stand-by Observations

If marine mammals are sighted beyond the relevant Shutdown Zone during the soft start or normal pile driving, the operator of the piling unit will be placed on stand-by to shut down, while visual monitoring of the animal continues. Pile driving can commence or continue while marine mammals are beyond the relevant Shutdown Zone.

3.12 Delayed Starts and Shutdowns

If a marine mammal is observed within, or is assessed as being about to enter, a relevant Shutdown Zone, pile driving must be stopped immediately.

In relation to the 500 m Shutdown Zone, if the animal(s) is observed to move outside the Shutdown Zone, or if 30 minutes have elapsed with no further sightings (despite continuous MMO observations), pile driving may commence with the soft start procedure. If a marine mammal is detected in a Shutdown Zone during a period of poor visibility, pile driving will stop until visibility improves.

If a baleen whale or leopard seal is reported to, or observed by, a MMO as present in the waters of Te Awanui / Tauranga Harbour, pile driving shall cease and shall not recommence until the animal(s) is observed to move outside of the relevant Shutdown Zone (see **Figure 2**) or has not been detected within the relevant Shutdown Zone for at least 24 hours.

3.13 Hours of Operation

Pile driving shall be limited to daylight hours only, where the period of daylight hours is defined following the DOC Code of Conduct for Seismic Operations (DOC, 2013) as the hours between sunrise and sunset and includes the twilight hours of dawn and dusk where there is sufficient light to make effective observations (in the opinion of the trained MMO).

Given the reliance of pile driving operations on visual observations for marine mammals, where the daylight hours are shorter than the operational hours proposed to minimise the annoyance from noise effects on suburban residents (Monday – Friday 7:30 am to 8 pm, and Saturday 9 am to 7 pm), the daylight hours restriction will take precedence.

3.14 Alert System for Marine Mammals in Te Awanui / Tauranga Harbour

An alert system has been developed to assist with the detection of marine mammals that occur inside Te Awanui / Tauranga Harbour. While this system will be applicable to all marine mammals, baleen whale and leopard seal detections are particularly important to support the management requirements relating to the relevant Shutdown Zone for these marine mammals (see **Section 3.2**). This system has been established to pro-actively request notifications of marine mammal presence from other third party sources that utilise or have an interest in Te Awanui / Tauranga Harbour. On this basis, POTL will establish protocols with the parties outlined in **Table 2** to immediately (or as soon as practical) notify POTL of any marine mammal detections during pile driving.

Table 2 Contact details for participants of the Marine Mammal Alert System

Participant	Key Contact	Mobile Phone
Harbour Master	Yet to be completed	Yet to be completed
Dredge Masters		
Tauranga Barge Company, Skookum Master		
Pilot Vessel Masters		
DOC Tauranga Office		
Tauranga Airport Control Tower		
Tauranga Bridge Marina Manager		
Eco-tourism operators with Marine Mammal Viewing Permits		
Members of POTL Marine Department to be listed, including:		
POTL CCTV Monitors		
POTL Customer Service Centre		
POTL Pilots		
POTL Pilot Launch Master		
POTL Tug Masters		
Tauranga Coastguard		
Etc.		

Marine mammal observations by participants of the alert system are to be accommodated through the following process:

1. Third party observer to immediately contact POTL Customer Service Centre (**CSC**);
2. POTL CSC to transfer call to on-duty MMO;
3. MMO to identify marine mammal from the description/photos provided[5] and estimate distance from construction site based on information provided;
4. MMO to instigate mitigation action if required (in accordance with **Section 3.12**); and
5. MMO to complete Marine Mammal Sightings Form (see **Section 4.1**, and **Appendix A**).

If the CSC receives an alert while pile driving is not occurring and no MMO is on-duty, the alert will be transferred to the POTL Environmental Advisor who will complete a Marine Mammal Sightings Form. At the start of each piling day the on-duty MMO must review the most recent sighting data to ensure their monitoring is compliant with this MMMP (i.e. if an inner harbour sighting was made the previous day, then a boat search may be required prior to piling commencing).

3.15 Acoustic Monitoring

Acoustic monitoring shall commence immediately once impact driving of steel piles to founding layer begins. Underwater noise measurements shall be made to ensure the size of the MMOZ and the Shutdown Zones are appropriate to protect marine mammals from auditory injury.

These measurements must be made by a suitably qualified and experienced person and shall occur during normal operating conditions for each of the different pile diameters used in the operation (for a minimum of three days each).

These measurements must include the one hour and twenty four hour cumulative Sound Exposure level ($SEL_{cum(1h)}$; $SEL_{cum(24h)}$); where the SEL_{cum} shall be derived from the maximum combined noise at all water depths at each of the following distances: 300 m, 500 m, 1,000 m, 1,500 m, 2,000 m, 2,500 m, 3,000 m down-harbour of the construction site, and out to 1,500 m up-harbour of Stella Passage.

The results of this acoustic monitoring shall be reported within two weeks of the completion of field measurements to the Bay of Plenty Regional Council and DOC. Each report shall detail the acoustic monitoring methodology utilised and the results of the monitoring undertaken.

3.16 Methodology for Revising the Requirements and Radius of the MMOZ and Shutdown Zones

On the basis that the Vallarta & Eickmeier (2025) model predictions did not account for the use of cushion blocks and/or bubble curtains and assumed the worst case scenario, e.g., that the impact hammer will run at 100% power during all operations and that all piles will be driven with the 14 tonne hammer. MMOZ and shutdown zone reductions may be appropriate.

Following the commencement of piling activities, the POTL may revise the requirements and radius of the MMOZ and Shutdown Zones outlined in **Section 3.2** by the introduction of

[5] Where species identification is uncertain, a precautionary approach should be adopted until confirmation is possible.

mitigation measures to manage the underwater noise generated by pile driving. Revisions to the radius of these zones may be proposed following results from acoustic monitoring.

To achieve this, POTL shall provide to the Bay of Plenty Regional Council a report from a suitably qualified and experienced marine mammal specialist identifying the results of acoustic monitoring and providing justification for a change in the requirements and radius of the MMOZ and Shutdown Zones. The Bay of Plenty Regional Council may peer review the report. No change to these zones shall be undertaken unless certified by the Bay of Plenty Regional Council, that the updated measures and / or radius changes are consistent with the purpose of the MMMP.

4.0 Recording and Reporting Requirements

4.1 Log of Marine Mammal Sightings

Records of marine mammal sightings collected over the duration of the project may provide valuable baseline information about marine mammal presence/absence in and around Te Awanui / Tauranga Harbour. Accordingly, high priority is placed on the recording of such sightings. All POTL employees and contractors involved with the project will be required to report any sightings of marine mammals during the project.

All marine mammal sightings during the project are to be logged by the following personnel:

- MMO's are responsible for completing individual sightings records for 1) each of the sightings that they make whilst on-duty; and 2) any third party sightings relayed to them whilst on duty; and
- Reports from third parties conveyed to the POTL CSC when no pile driving is occurring shall be recorded by the POTL Environmental Advisor.

<u>Marine Mammal Sightings Protocol</u>

On each occasion that a marine mammal sighting is made/received the following actions will occur:

1 For every observation a photo will be taken (where practicable);

2 For every observation a 'Marine Mammal Sightings Form' will be completed (**Appendix A**). Note, if an individual marine mammal is seen numerous times in a day, then only one sighting form needs to be completed per day for that individual animal; and

3 All completed 'Marine Mammal Sightings Forms' and photos will be scanned and emailed to POTL's Environmental Advisor on a monthly basis.

Any injured or dead marine mammals in the vicinity of Stella Passage or any near misses between the vessels associated with the project and marine mammals, must be reported immediately to the Bay of Plenty Regional Council and DOC including details of the incident and any mitigation measures employed.

4.2 Record of MMO Observations and Pile Driving

A record of MMO observational duties and pile driving will be maintained for each day pile driving occurs in accordance with the 'MMO Duties Register' (**Appendix C**). The purpose of this form is to collect data to demonstrate compliance with the resource consent conditions. Data fields on this register include the location, date, name of MMO, start and end time of observational periods (pre-start, soft start, normal pile driving operations), specifics of pile driving (hammer weight, power level), completion time of pile driving, visibility, and records of any mitigation measures employed (e.g., delayed starts, shutdowns).

4.3 Data Management

A standardised datasheet (the 'Marine Mammal Sightings Form', **Appendix A**) will be used to record all marine mammal sightings. POTL's Environmental Advisor will collate all data records and marine mammal photos to ensure they are securely stored in an electronic format such that they can be compiled on an annual basis for the purpose of reporting (see **Section 4.4**).

4.4 Reporting Procedure

In accordance with consent conditions, POTL is required to submit a copy of all marine mammal sightings records and an annual summary report of marine mammal sightings and mitigation measures undertaken to Bay of Plenty Regional Council and DOC at the end of each calendar year (or as requested). The information that will be recorded in the annual summary report shall include:

- A summary table that collates the data from each Marine Mammal Sightings Form (see **Appendix E** for template); and
- A detailed description of all measures taken to manage the potential effects on marine mammals (i.e. shutdowns and delayed starts).

5.0 Waste Management

This section outlines management measures to be employed during the construction of the project to minimise the potential for the entanglement of marine mammals with marine debris, or their ingestion of waste material.

The primary waste management control is compliance with the Resource Management (Marine Pollution) Regulations 1998. These regulations require that all non-biodegradable waste must be collected, retained and disposed of at an approved solid waste facility onshore.

6.0 Staff Training

6.1 All relevant staff

Training in the implementation of this MMMP will be provided to all relevant employees and contractors by POTL during project inductions, and meetings as required. It is, however, noted that the Marine Mammal Sightings Form has been specifically developed to be accurately and efficiently completed by someone possessing little familiarity with marine mammals. In particular, the form provides identification notes for the species predicted to be present in and around Te Awanui / Tauranga Harbour. It also describes the different behaviours that marine mammals commonly engage in.

6.2 Vessel Masters

In addition to the training of all relevant employees and contractors, vessel masters shall receive additional training in the following management measures:

- Alert system for marine mammals (particularly with regard to baleen whales and leopard seals);
- Compliance with Marine Mammal Protection Regulations 1992; and
- Waste management.

6.3 Environmental Monitoring Teams

In addition to the training of all relevant employees and contractors, environmental monitoring personnel shall receive additional training regarding:

- Resource consent conditions;
- Recording and reporting requirements;
- Required actions in response to non-compliance; and
- Reviewing the MMO roster (as provided by the contractor).

6.4 Marine Mammal Observers

Specialised training by an approved MMO provider[6] will be required of, and provided to, MMOs. This training will focus on the requisite MMO duties as listed in **Section 3.5**. MMOs will need to be physically fit and have good eyesight and hearing. A minimum of five MMOs should be trained before pile driving activities commence.

7.0 Process for MMMP Certification and Review

7.1 Certification Process

The MMMP shall be submitted for certification in accordance with the consent conditions.

7.2 Review Process for Operative MMMP

See **Section 3.16**.

8.0 References

DOC 2013. 2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations. http://www.doc.govt.nz/documents/conservation/native-animals/marine-mammals/seismic-survey-code-of-conduct.pdf.

Li, B., Lewis, D. 2021. Underwater piling noise modelling: Stella Passage Development. Report prepared by SLR Consulting for Port of Tauranga. Dated August 2021. SLR Ref: 740.30010.00000-R02-v1.0.

SLR, 2025. Assessment of Effects - Marine Mammals: Stella Passage Fast track Approval Application. Report prepared for Port of Tauranga Limited by SLR Consulting NZ Ltd. Report No. 840.030138.00001. Revision 05. Dated April 2025.

[6] As listed by DOC at www.doc.govt.nz/our-work/seismic-surveys-code-of-conduct/observer-standards-and-training

Appendix A Marine Mammal Sighting Form

Marine Mammal Management Plan

Stella Passage Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Marine Mammal Sightings Form

OBSERVER'S NAME			
Observation Location			
Piling operations	Hammer Size: Power Level:		
Date of sighting			
Time of sighting/s			
Sighting Location/s	Distance from construction site when first seen: Closest approach to construction site: Direction of travel: Location/s of subsequent sightings:		
Sea Condition (Beaufort scale, swell)			
Photos/video taken	Yes No		
Species ID (circle one) PTO for descriptions	Bottlenose dolphin Orca/Killer whale Fur seal Other Southern right whale Humpback whale Leopard seal		
Certainty of species ID (circle one)	Definite Probable Unsure		
Number of animals (total)		**Number of calves** (if present)	
Length of adult (m)		**Length of calves** (m)	
Description colour, dorsal fin, blow shape etc			
Behaviour (circle one) PTO for descriptions	Travelling Milling Feeding Socialising Resting Other		
Description of mitigation actions (shutdown, delayed start etc)			

Species of Relevance to Tauranga Harbour - Identification Guide

Bottlenose dolphin <4m  Robust body. Distinctive beak. Rounded forehead. Grey upper body, paler underside	**Killer whale** <9m  Black upper, white belly and patch around eye. Male dorsal fin very tall and sharp. Flippers rounded
Common dolphin <2.3m  Sleek body. Prominent beak. Dark upper and dorsal fin. Tan or yellow sides, "hourglass" pattern. Cream or white belly	**NZ fur seal** (*Arctocephalus forsteri*)  Pointed nose. Dark brown fur. Males: up to 2.5m, 150kg. Females: up to 1.5m, 30-60kg. Widely distributed
Humpback whale <16m  Blackish body. White underside, esp under tail and flippers. Knobbly head. Long flippers. Dorsal fin on hump	**Leopard seal** (*Hydrurga leptonyx*)  Big, snake-like head. Grey fur, black spots. Sharp, tri-lobed teeth. Males: up to 3m, 270kg. Females: up to 3.5, 300kg. Regular visitor to NZ
Southern right whale <18m  Blackish body, white patches on head & jaws. V-shaped blow. Arched jaw. Callosities on head. No dorsal fin	

Adapted from DOC Marine Mammal Sighting Form, https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/marine-mammals/whale-dolphin-sighting-report.pdf

DESCRIPTIONS OF COMMON BEHAVIOURS
Resting The animals stay close to the surface, surface at regular intervals and in a coordinated fashion, either not propelling themselves at all, or very slowly.
Travelling Animals propel themselves at a sustained speed, all swimming in the same direction and making noticeable headway.
Milling Animals frequently change direction, pre-venting them from making headway in any one direction and they remain in the same area. Often different individuals will be swimming in different directions, but frequent directional changes keep them together in a group.
Feeding Animal chases or captures prey items close to the surface
Socialising Physical interactions among animals (except mothers and calves), ranging from chasing to body contact, or copulation.

Source: Neumann, D. 2001. The activity budget of free-ranging common dolphins (Delphinus delphis) in the northwestern Bay of Plenty, New Zealand. Aquatic Mammals 27(2): 121-136.

COMMON INDICATORS OF MARINE MAMMAL PRESENCE
• Dorsal fins visible when individual whales or dolphins' surface to breathe;
• Flippers visible when seals are active or resting on the surface;
• Splashes and aerial behaviours which are indicative of seal or dolphin presence; and
• Blows (exhalation vapours) of larger baleen whales.

Appendix B Operational Soft Start Protocol

Marine Mammal Management Plan

Stella Passage Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

Operational Soft Start Protocol

A soft start is the process by which pile driving energy and/or frequency gradually increases. For impact piling the duration of the soft start should be no less than 10 minutes. For vibratory piling the duration of the soft start should be no less than three minutes. A soft start gives any marine mammals in the vicinity a chance to leave the area before full power is reached and hearing injury could occur.

The following options to meet operational requirements are acceptable.

Impact Hammers:

Soft starts should consist of five hammer blows at low energy, separated by 2- and then 1-minute breaks, followed by 5 minutes during which hammer energy will be limited to 50%.

Soft starts consist of five strokes of the hammer at low energy separated by 5, 3, 2 and then 1 min, followed by a slow increase in the hammer energy over a period of 20 min. Full blow impact pile driving then continued until the pile was installed (following Bailey et al 2010).

Strike rate was slowly increased from about 1 strike per minute to 1 strike per second over 5 minutes (following Brandt et al 2011).

Soft start commenced with a 100-200 mm drop (the first “bar” on the control unit) for 2 mins, then 25 % power for one min., then power as required. Drop height increases as the pile meets further resistance (following Leunissen, 2017).

Vibratory Hammers:

For each pile, vibratory hammers should be activated at low power for 15 s, followed by a 1-min waiting period (i.e., at a duty cycle of 20%, repeated at least three times) before full power is achieved (i.e., a "soft start") (adapted from Wang et al 2014).

References:

Bailey, H., Senior, B., Simmons, D., Rusin, J., Picken, G. & Thompson, P.M. 2010. Assessing underwater noise levels during pile-driving at an offshore windfarm and its potential effects on marine mammals. Marine Pollution Bulletin, 60, 888–897.

Brandt MJ, Diederichs A, Betke K, Nehls G. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. Marine Ecology Progress Series 421: 205–216.

Leunissen, E. 2017. Underwater noise from pile-driving and its impact on Hector’s dolphins in Lyttelton Harbour, New Zealand. MSc Thesis, University of Otago, Dunedin, New Zealand.

Wang, C., Lyons, S. B., Corbett, J. J., and Firestone, J. 2007. Using ship Speed and Mass do Describe Potential Collision Severity with Whales: an Application of the Ship Traffic, Energy and Environment Model (STEEM) [Report by the University of Delaware]. Available online at: https://tethys.pnnl.gov/publications/using-ship-speed-and-mass-describe-potential-collision-severity-whales.

Appendix C MMO Duties Register

Marine Mammal Management Plan

Stella Passage Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025

MMO Duties Register

The purpose of this form is to collect data on a pile by pile basis to demonstrate compliance with consent conditions relating to marine mammal mitigation measures for underwater piling noise.

[The data contained within is simply an example of how the fields would be completed]

<table>
<tr><td>DATE</td><td colspan="3">01/07/22</td><td colspan="2">NAME OF MMO</td><td>JOE BLOGGS</td></tr>
<tr><td>Observation Location</td><td colspan="6">Northernmost mooring dolphin, Sulphur Point</td></tr>
<tr><td>Piling details</td><td>Pile No/s:
S37</td><td>Hammer:
10T</td><td colspan="3">Wharf</td><td>Mt Maunganui</td></tr>
<tr><td rowspan="9">Operations / Observations Log</td><td colspan="2">Task
Pre-start observations (PSO)
Soft start (SS)
Piling 100% power (100%)
Piling 50% power (50%)
Shutdown
Delayed Start</td><td colspan="2">Start time</td><td>End time</td><td>Comments
Nil = no marine mammals
Delayed start – marine mammal
Shutdown – marine mammal</td></tr>
<tr><td colspan="2">PSO</td><td colspan="2">0735</td><td>0805</td><td>Nil</td></tr>
<tr><td colspan="2">SS</td><td colspan="2">0806</td><td>0816</td><td>Nil</td></tr>
<tr><td colspan="2">100%</td><td colspan="2">0816</td><td>0935</td><td>Nil</td></tr>
<tr><td colspan="2">50%</td><td colspan="2">0935</td><td>1123</td><td>Shutdown – group of orca entered 500 m zone</td></tr>
<tr><td colspan="2">Shutdown</td><td colspan="2">1123</td><td>1131</td><td>Observed to leave 500 m zone and head up Otumoetai Channel</td></tr>
<tr><td colspan="2">SS</td><td colspan="2">1131</td><td>1141</td><td></td></tr>
<tr><td colspan="2">50%</td><td colspan="2">1141</td><td>1305</td><td>S37 fully driven - complete</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td><td></td></tr>
<tr><td>Visibility</td><td colspan="6">Generally good, ~ 2 km all morning, cloud cover increased from mid-morning which was helpful to reduce glare</td></tr>
<tr><td>Any Instances of Non-Compliance?</td><td colspan="6">No
(If yes, please immediately notify POTL Environmental Monitoring Team)</td></tr>
</table>

Appendix D Simple Rules for Boaties when Interaction with Whales & Dolphins

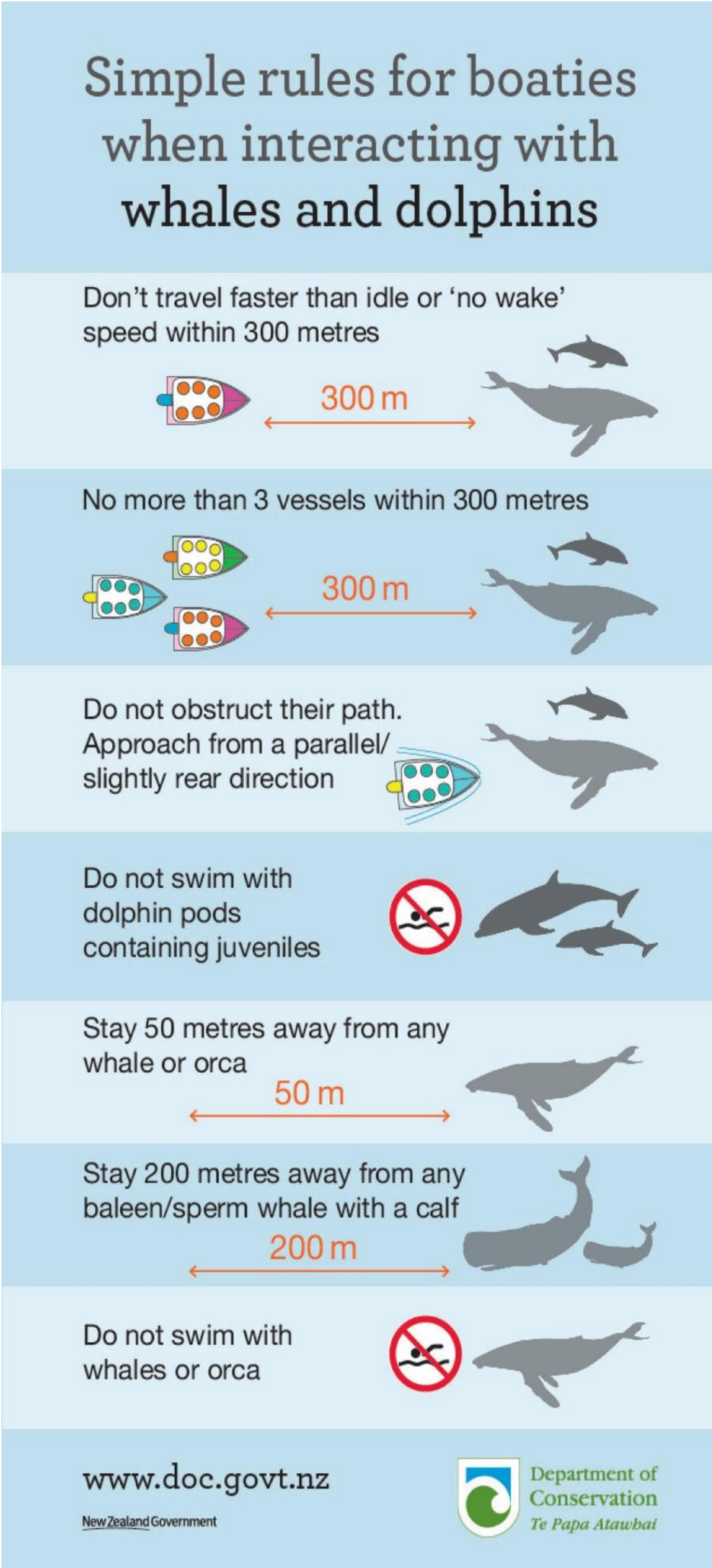
Marine Mammal Management Plan

Stella Passage Fast Track Approval Application

Port of Tauranga Limited

SLR Project No.: 840.030138.00001

10 April 2025


Simple rules for boaties when interacting with whales and dolphins
Don't travel faster than idle or 'no wake' speed within 300 metres
300 m
No more than 3 vessels within 300 metres
300 m
Do not obstruct their path. Approach from a parallel/ slightly rear direction
Do not swim with dolphin pods containing juveniles
Stay 50 metres away from any whale or orca
50 m
Stay 200 metres away from any baleen/sperm whale with a calf
200 m
Do not swim with whales or orca
www.doc.govt.nz
New Zealand Government
Department of Conservation
Te Papa Atawhai

Appendix E Marine Mammals Sightings Summary Log: Template

Marine Mammal Management Plan

Stella Passage Fast Track Approval Application

Port of Tauranga Limited

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10 April 2025

Marine Mammal Sightings Summary Log

The template below provides a platform on which marine mammal sightings made during the Stella Passage Development can be collated and summarised.

[The data contained within is simply an example of how the fields would be completed]

	Total number of individuals												
Observation date	- Bottlenose dolphin	- Orca/Killer whale	- Fur seal	- Common dolphin	- Southern right whale	- Humpback whale	- Leopard seal	- Other	Calves present	Inside or Outside Harbour?	Behaviour and location	Mitigation Actions	Operations (hammer size & power level)
20/3/22	7								1	Inside	Travelling up shipping channel	Shutdown when animals entered 500 m zone	Piling at 50% power, 14 tonne hammer
4/6/22		3							0	Inside	Feeding near harbour entrance	None required, animals didn't enter shutdown zone	Piling at full power, 10 tonne hammer
11/7/22			1						0	Inside	Milling near Sulphur Point Marina before hauling out onto marina boardwalk	Delayed start	Pre-start observations
15/7/22				~25					?	Outside	Travelling to east, 1 km off Rabbit Is	None	Dredge spoil disposal
ETC													

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