Technical assessment of Fast Track Application FTAA-2504-1048 (Taranaki VTM Project)

Prepared for

Horizons Regional Council

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PATTLE DELAMORE PARTNERS LTD
Level 2, 109 Fanshawe Street,
Auckland Central 1010
PO Box 9528, Auckland 1149, New Zealand

Tel +64 9 **523 6900**
Web www.pdp.co.nz

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DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE

Becky Shanahan

Reviewed and Approved by

SIGNATURE

Anna Madarasz-Smith

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Executive Summary

Under the Fast-track Approvals Act 2024, Trans-Tasman Resources Limited (TTR) have applied for a marine consent to extract iron sand. The proposed project site is 22-36 km offshore, beyond the 12 nautical miles (nm) Territorial Sea boundary adjacent to the Taranaki Regional Council Coastal Marine Area and covers an area of 65.76km^2 in water depths ranging from 20 to 50 m.

Horizons Regional Council lies to the south of the Taranaki region, with its northern most coastal boundary approximately 20km north of the Whanganui River.

Horizons Regional Council (HRC) engaged Pattle Delamore Partners Limited (PDP) to provide a brief technical memo building from previous work undertaken for Taranaki Regional Council (TRC), to outline the potential environmental effects of the proposed activity specific to the Horizons region to support the Council to provide informed feedback when sought for comment by the Environmental Protection Authority (EPA).

To undertake this review, PDP has used the aforementioned report as the basis, with reference to information on benthic habitats, and habitats of importance for marine mammals and seabirds in the Horizons Coastal Marine Area (CMA).

In reviewing the application and supporting evidence, it is important that the panel reflect on how current information gaps constrain confidence in determining the scale and significance of potential impacts. In particular, the following areas are noted where uncertainty may limit the strength of conclusions. These areas are:

Water Quality

- The increasing suspended sediment concentrations from mining activities appear to breach the water quality targets in HRC's One Plan. However, the data is presented at too coarse a scale to adequately assess those impacts.
- Data collected to calibrate the sediment model was collected at different times and sites potentially introducing model uncertainty.

Localised impacts

- It is uncertain whether the current application adequately addresses potential impacts on newly identified reefs.
- It is uncertain if TTR undertook an updated assessment of primary production impacts under the latest worst-case scenario testing for optical effects (Pinkerton, 2017).
- These uncertainties limit the confidence of conclusions regarding the scale and magnitude of potential impacts.

Sediment deposition

- Without knowing the size and extent of the depositional area, it’s not possible to assess the effects from mining on benthic species.

Benthic ecology

- There doesn’t appear to be adequate examples of species responses to an operation with the longevity of the proposed mining activity.

Seabirds

- There is a lack of sufficient information to assess the impacts on seabirds in the South Taranaki Bight (STB).
- This gap was highlighted in previous EPA processes and has yet to be filled.

Marine mammals

- There is limited data on marine mammal populations, particularly given their threat classification status, to determine potential impacts.
- Potential noise-related impacts on marine mammals are uncertain and lack empirical support to assess the effects.

Legislative Context

Notwithstanding the specific policies in each of the following documents that provides for extraction of minerals (outside of the current scope), the uncertainty outlined above should be taken into account when determining whether the proposed activity aligns with:

New Zealand Coastal Policy Statement (2010)

- Policy 11 – Indigenous biological diversity.
- Policy 13 – Preservation of natural character.
- Policy 15 – Natural features and natural landscapes.
- Policy 22 – Sedimentation.
- Policy 23 – Discharge of contaminants.

Horizons One Plan Regional Policy Statement (2014)

- Coastal Environment - Policy 1: Integrated management of the coastal environment
- Coastal Environment - Coastal Marine Area - Policy 2: Activities in the CMA must be managed using Zones
- Coastal Environment - Coastal Marine Area - Policy 6: Water* quality

Horizons Regional One Plan (2014)

- Coastal Marine Area - Policy 1: Regional rules for the CMA
- Coastal Marine Area - Modification, takes and uses - Policy 8: Consent decision-making for activities involving disturbance, removal or deposition
- Coastal Marine Area - Discharges – Policy 11: Consent decision-making for discharges* into the CMA
- Coastal Marine Area – Noise -Policy 13: Consent decision-making for any noise* and discharges* into air

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1.0 Introduction

Trans-Tasman Resources Limited (TTR) has submitted an application for marine consent under the Fast-track Approvals Act 2024 to undertake iron sand extraction activities. The proposed site is located 22 to 36 kilometres offshore, beyond the 12-nautical-mile Territorial Sea boundary, encompassing an area of 65.76 square kilometres with water depths between 20 and 50 meters.

Although the Environmental Protection Agency (EPA) initially granted consent for the project, the decision was appealed through the High Court, the Court of Appeal, and ultimately the Supreme Court. The Supreme Court overturned the consent and directed the EPA to reconsider the application.

The application was subsequently withdrawn from the EPA processes in 2024 and a new application submitted under the Fast-Track Approvals Act in 2024, with the substantive application submitted in 2025.

A panel was appointed to hear the application in August 2025, and Horizons Regional Council have been given the opportunity to provide comment on the project.

2.0 Scope

Horizons Regional Council (HRC) engaged Pattle Delamore Partners Limited (PDP) to provide a brief technical memo building from previous work undertaken for Taranaki Regional Council (TRC), to outline the potential environmental effects of the proposed activity specific to the Horizons region to support the Council to provide informed feedback when sought for comment by the Environmental Protection Authority (EPA). Specifically, HRC have asked PDP to focus on the projects direct and indirect effects and how these may affect the Council's objectives under planning documents in relation to the natural environment.

PDP was previously requested to provide a technical assessment for TRC (Shanahan et al., 2025). That evaluation included a targeted review of the technical information and assessments completed during the EPA application process and any intervening years that may be help clarify the environmental effects of the proposed activity.

The current review has been completed within the time and budget constraints agreed with HRC, basing information on the nature and potential impacts of the proposed project off information reviewed as part of the earlier report (Shanahan et al., 2025). Additionally, PDP has considered the information provided to support the application focusing on the key impacts in Horizons Regional Council Coastal Marine Area.

2.1 Structure

There is extensive literature that supports the TTR application. To assist HRC in understanding the relevant impacts from the literature reviewed, the following assessment has been structured to inform the following:

- What is the likely effect from the mining?
- Is the information provided to support the application sufficient to ascertain the effects of the activity?
- Are the conclusions reached supported by the data presented?
- Are there any areas outstanding?
- Are there any recommendations for the Panel to consider in its determination of effects?

2.2 Horizons Regional Council

Under the Resource Management Act (RMA) 1991, Horizons Regional Council (Horizons or HRC) is legally mandated to carry out specific functions, including the regulation of the Coastal Marine Area (CMA). The CMA extends from the mean high-water springs (MHWS) out to 12 nautical miles (nm) offshore, also referred to the as Territorial Sea. Beyond its regulatory duties, HRC also plays an important role advocating on matters of regional significance and concern.

To meet its obligations under the RMA, HRC prepared a Regional Coastal Plan that outlines the management of activities in the CMA to support the sustainable management of the area's natural and physical resources. HRC’s One Plan, including the Regional Coastal Plan, become operative in 2014, and has a key objective of managing the CMA to ensure that the natural character and ecosystem processes are maintained while still allowing activities and development (Horizons Regional Council, 2014).

The proposed mining area sits outside, but adjacent to TRC’s 12 nm territorial sea limit, within the exclusive economic zone (EEZ). TRC’s CMA is adjacent to the north of HRC’s CMA. The actual and/or potential adverse effects from mining may begin in the EEZ and be transported in a south-easterly direction into the HRC CMA due to movement of the sediment plume in currents and motile fauna within the STB.

2.3 The proposed activity

Trans-Tasman Resources (TTR) proposes to extract up to 50 million tonnes (Mt) of seabed material annually, of which approximately 10% (5 Mt) would be retained as iron concentrate for export (Trans-Tasman Resources Ltd, 2025). The remaining material would be redeposited approximately four metres above the seabed within the extraction zone. TTR is seeking a 35-year marine consent, an estimated 20 years of active extraction and 15 years allocated to pre-extraction preparation, environmental monitoring, and decommissioning activities. During operational years, the extraction vessel is expected to operate for up to 6,200 hours annually (equivalent to ~258 days, or 71% of each year).

Each designated extraction block will measure 300 by 300 metres. Up to six blocks may be extracted before the vessel's anchors are repositioned to access the next extraction area. On an annual basis, the total area directly impacted is approximately 5 km², achieved by working sequentially within multiple 900 by 600 metre blocks (0.54 km² each), with each block typically extracted over a 30-day period.

The proposed extraction methodology, as detailed in TTR's Fast-track application, is summarised below. Mining will commence with grade drilling, a single pass drilling system involving closely spaced seabed sampling to delineate the extraction area and characterise seabed conditions. This process requires a drill rig operated with air and water pressure to control the drill head.

Extraction of target sediments will then proceed using seawater jets to mobilise unconsolidated material in front of the subsea sediment extraction device / seabed crawler (SBC) (Figure 1). Sediment will be recovered to a maximum depth of 11 m (averaging 5 m), in a single pass, and transferred to the Integrated Mining Vessel (IMV), a large vessel with an overall length of 345m. The IMV, capable of continuous operation in wave heights up to four metres, will remain stationary throughout the extraction process.

Onboard the IMV, recovered material will undergo screening to remove particles larger than 3.5 mm, followed by magnetic separation to isolate iron ore. Oversized particles will be processed through a grinding circuit and subjected to a second round of magnetic separation. The residual (de-ored) sediment will then be discharged via a deposition pipe, releasing material approximately four metres above the seabed, in close proximity to the extraction site. Iron concentrate will be dewatered and transferred to the Floating Storage and Offshore Vessel (FSOV) for further processing and export.

Potential Environmental Effects

The primary potential direct environmental effects of the proposed activities are considered to be:

- Seabed removal: Extraction of the top 5 m of sediments on average (up to 11 m maximum), resulting in the loss and disturbance of benthic habitats and mortality of associated faunal communities.
- Sediment redeposition: Discharge of de-ored material ~4 m above the seabed, potentially causing smothering of benthic organisms in previously undisturbed areas, with adverse effects on feeding and respiratory structures.

- Sediment plumes: Generation of operational plumes with potential to alter optical water properties, thereby affecting photosynthetic and filter feeding organisms and predator foraging behaviour.
- Noise and light pollution, continual vessel presence: Continuous operation of the IMV and SBC may disturb marine fauna and seabirds, disrupting foraging, breeding, and migratory patterns.

In addition to direct habitat loss and modification, the extraction activities have potential to generate indirect ecological effects through persistent changes in the sedimentary regime and optical environment. Altered habitat structure and sediment composition may diminish suitability for recolonising invertebrates and fish species, thereby disrupting food-web dynamics beyond the extraction footprint. Adjacent habitats may also be impacted by the smothering of benthic communities through sediment redeposition.

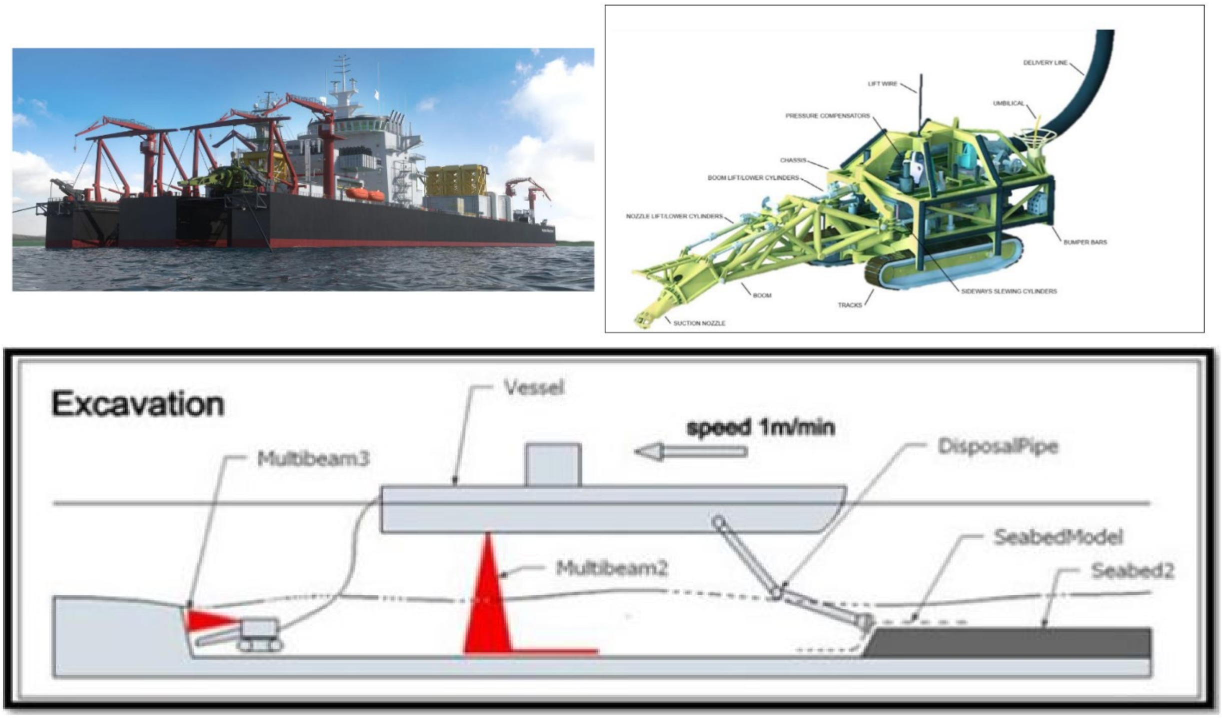

Figure 1. Seabed extraction vessels and process (taken from TTR's Fast-track application). Top left is the integrated mining vessel (IMV), top right is the seabed crawler (SBC), and the bottom shows the process for the sediment from extraction to re-deposition.

3.0 The Horizons CMA as a receiving environment

HRC's western CMA includes approximately 120 km of coastline from Waiinu Beach in the north of the Region, adjacent to Taranaki, and Waikawa Beach in the south, adjacent to the Greater Wellington Region. It is characterised by narrow sandy beaches backed by cliffs in the north, and sandy beaches backed by dynamic dune systems south from Whanganui southwards (Horizons Regional Council, 2014). HRC also has an eastern CMA area extending from north of Cape Turnagain to Aohanga.

HRC's western CMA is part of the South Taranaki Bight (STB), an area characterised by a shallow continental shelf that extends over 40 km offshore. Habitats within the STB, particularly offshore rocky reefs distant from the coastline, are relatively unique in New Zealand.

3.1 One Plan and scheduled areas

HRC's regional plan, the One Plan specifies water management areas for coastal management (Horizons Regional Council, 2014). Those areas are Estuary Water Management Sub-areas and the Seawater Management Area. The Seawater Management Area comprises the entire CMA other than the Estuary Water Management Sub-areas.

The One Plan's policies require that the characteristics and values for the management areas and natural character are protected. The Seawater Management Area includes a value to support healthy aquatic life/ecosystems. It also requires that water quality is maintained in areas that meet the water management values and enhanced in parts of the CMA where it does not.

The One Plan has several coastal water quality targets. Relevant targets to the mining operation include that visual clarity must be greater than 1.6 metres and no change greater than 10% in the euphotic depth in the estuary areas (Horizons Regional Council, 2014). The euphotic zone is the water depth that permits sufficient light for photosynthesis (algae growth).

3.2 HRC CMA benthic habitats and currents

While the habitats within the HRC CMA have not been formally mapped, some national datasets and reports from the community provide insight into habitats in the area (Jones et al., 2016; Thomas McElroy pers. comm., 7 July 2025). HRC has also commissioned several reports to characterise the CMA and determine management needs to meets its obligations under the One Plan (Bostock, 2018; Collins & Macdonald, 2019; Hale et al., 2021; MacDiarmid et al., 2018; O'Callaghan, 2020).

These reports highlight the diverse species and habitats in the region including insights from investigations specific to the seafloor habitats and associated flora and fauna identified in the report from Hale et al. (2021). This report noted:

- *"Twelve species of habitat forming macroalgae consisting of species of large brown seaweeds (e.g., kelps) in the CMA,*
- *Seven species of thicket forming bryozoans in the western CMA,*
- *Five species of garden forming sponges in the western CMA,*
- *One species of stony-coral, one species of gorgonian soft-coral and records of unknown coral habitats,*
- *Four bed-forming shellfish species with bed areas of these large bivalves identified in the western CMA,*
- *One species of aggregation-forming tubeworm in the western CMA, with evidence of tubeworm habitat presence in the broader South Taranaki Bight,*
- *One identified sea pen species and one order Pennatulacea species in the CMAs, and*
- *Three other 'At Risk' species present in the Horizon CMAs.[1]"*

Details of some of these habitats include habitat forming macroalgae such as kelp (*Ecklonia radiata*) and *Carpophyllum* spp. (Figure 2; Peterson et al., 2020). While these reports provide key insights into possible habitats, it's important to note that national datasets are sometimes limited in their ability to fully characterise species and habitats on a regional scale.

[1] The three at risk species are hydrozoan *Nemertesia elongata*, the octopus *Octopus kaharoa*, and the bivalve *Purpurocardia reinga*

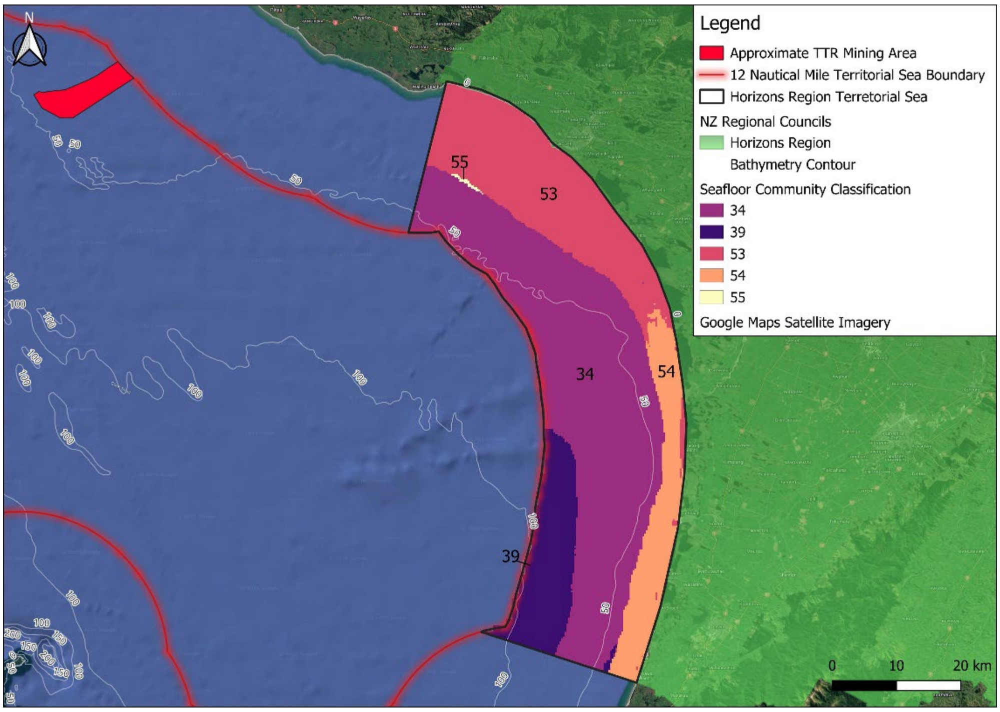

Figure 2. Seafloor community compositions from Peterson et al. (2020). Group numbers are based on predominantly physical factors, but dominant algal species for each group is: (34) *Codium convolutum*, (39) *Ecklonia radiata*, (53) *Ecklonia radiata*, (54) *Carpophyllum flexuosum*, (55) *Carpophyllum machalocarpum*. Detailed descriptions of each number can be found in Appendix A.

Alongside national datasets, Jones et al., (2016) recognised the value of Local Ecological Knowledge (LEK) to complement known biophysical data. They interviewed trawlers around New Zealand to document their knowledge of benthic habitats, biogenic habitats in particular, and record spatial information regarding those habitats on charts. In the South Taranaki Bight, Jones et al., (2016) interviewed 14 fishers. These interviews revealed areas of habitat forming sponges and soft corals as well as key shellfish species including horse mussels, scallops, and dog cockles (Figure 3).

In addition to those mapping efforts, TRC worked with NIWA and a local citizen science team to map previously uncharted reefs in the TRC CMA. That mapping effort revealed a 'mosaic' of rocky reefs with high biodiversity (Morrison et al., 2022). The results also showed that, "rocky reef habitat is more widespread on Pātea Banks than documented in the scientific literature."

Although those efforts focused on TRC CMA, the patchy distribution of reefs and evidence that they can form "extensive, linear features several kilometres long" suggest reefs may also be likely to occur in HRC CMA. This is particularly plausible given that the shallow continental shelf in the HRC CMA extends up to

15 km offshore in places, providing opportunities for habitats such as macroalgae at distances from shore less influenced by riverine sediment inputs. The presence of possible reefs is evidenced by areas such as the Waitotara Reefs that are on either side of the border of the TRC and HRC CMA boundaries that are not officially mapped (Thomas McElroy pers. comm., 7 July 2025). There are also other uncharted frequented fishing spots reported by the community (Thomas McElroy pers. comm., 7 July 2025).

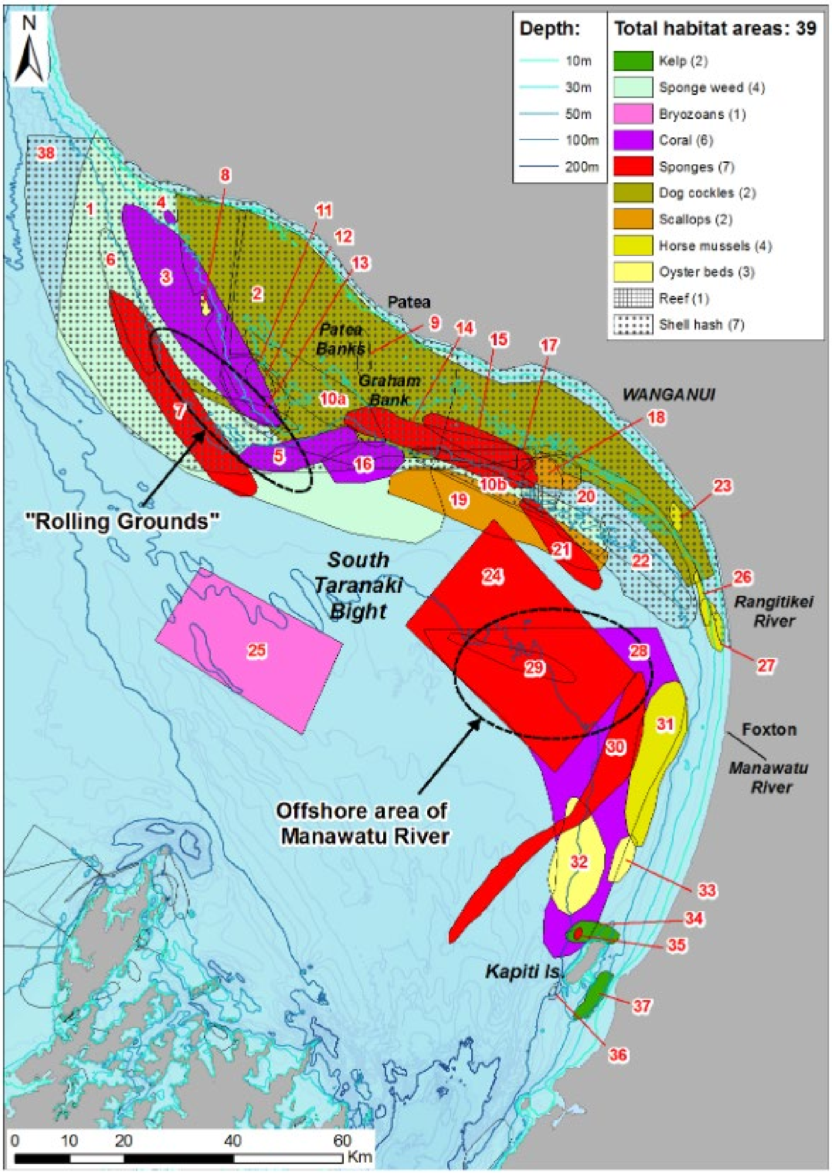

Figure 3. South Taranaki Bight and Kapiti Island LEK map. Each fisher-drawn area has been assigned a unique number, specific to this regional section (red). Some key sites are circled and labelled as black text on white background. From Jones et al. (2016).

The relative influence of river plumes and major ocean currents on the HRC CMA has been assessed in several studies (Collins & Macdonald, 2019; O'Callaghan, 2020). Collins & Macdonald, (2019) concluded that suspended sediment loads predominantly derived from riverine inputs have a greater impact on the CMA rather than offshore sources. This reflects the influence of the D'Urville Current, which flows west to east across Cook Strait and drives the movement of offshore waters through the CMA. In addition, O'Callaghan, (2020) found that freshwater plumes from rivers can extend up to 11km out into the CMA.

It should be noted that the oceanographic data used in MacDiarmid et al., (2018) was collected and modelled as part of TTR's information gathering for the previous applications to the EPA for sand mining. Therefore, most of the sites where data was collected are within the TRC CMA rather than the HRC CMA. Additionally, figures presenting background suspended sediment concentrations (SSCs) are over the scale of the Sediment Modelled Domain (SMD) for the sediment plume model (i.e., a large area from Cape Egmont to Kapiti (13,000 km^2) and are difficult to interpret at a scale relevant to the HRC CMA.

4.0 Assessment of information to determine effects

4.1 Water quality

The activities associated with the TTR mining operation has been shown to create a sediment plume from the discharge of the tailings back into the water post-extraction. As part of its application, TTR modelled the potential sediment plume from the sand mining operation including its concentration (in mg/L), distance and direction of travel given different scenarios (environmental conditions, extraction practices, and sediment properties (Hadfield & Macdonald, 2015; Macdonald & Hadfield, 2017) and optical effects (Cahoon, et al., 2015; Pinkerton, 2017; Pinkerton & Gall, 2015). The sediment model has considered the <63 µm sediments coming from both the hydro-cyclone overflow and the de-ored sand discharge.

While the model is a necessary tool for assessing potential sediment plume effects, the actual dimensions, scale, and resulting impacts cannot be confirmed until mining activity begins. Additionally, models are inherently uncertain due to limitations in input data, underlying assumptions, and model structure. When one model informs another (e.g., outputs serving as inputs), uncertainties are not only carried forward but may compound, as biases, errors, or simplifications propagate through subsequent models. This can increase both the scale and complexity of uncertainty. It is therefore essential that assumptions and uncertainties (e.g., sensitivity analyses) are clearly communicated when models are used to support decision-making.

Modelling of potential effects on optical properties was based on simulating mining activities at two primary plume-dispersion sites within the project area: Site A, adjacent to the TRC's CMA boundary at a depth of 31 m, and Site B, on the seaward side of the mining project area at a depth of 42 m.

The Horizons One Plan has a water quality target for changes in the euphotic zone (i.e., no change greater than 10%) applied to the Estuarine Water Quality zones. While this target is not specified to apply to the Seawater Management Area, it provides a reasonable guideline for interpreting impacts from the mining operation sediment plume on the coast. Water clarity is generally higher on the open coast than in estuaries, as has been recorded in New Zealand coastal water quality (Fraser et al., 2021). Estuaries receive fine sediments from land that settle slowly and increase turbidity, while the open coast is more frequently flushed by tides and currents. Therefore, a 10% reduction in the euphotic zone on the open coast represents a considerable change in water clarity.

Figure 2-3a from Pinkerton, (2017) shows that the euphotic zone may be reduced by up to 50% in the HRC CMA due to the mining activity (Figure 4). Additionally, the One Plan states that water clarity must equal or exceed 1.6 metres (horizontal visibility). According to Pinkerton, (2017) Figure 2-6b (Figure 4), horizontal visibility could reduce by 10m in the HRC CMA. In that report, some modelled optical effects were directly calculated for sites potentially impacted from mining. However, none of those sites are within the HRC CMA and the maps in Figure 4 are at the scale of the SMD and too coarse to interpret at a regional scale. Therefore, it appears that TTR's mining activities may exceed the water quality targets set out in HRC's One Plan. Without further analysis at a resolution that is appropriate for analysing the effects within the Horizons CMA, this is not possible determine outright.

Figure 2-3a

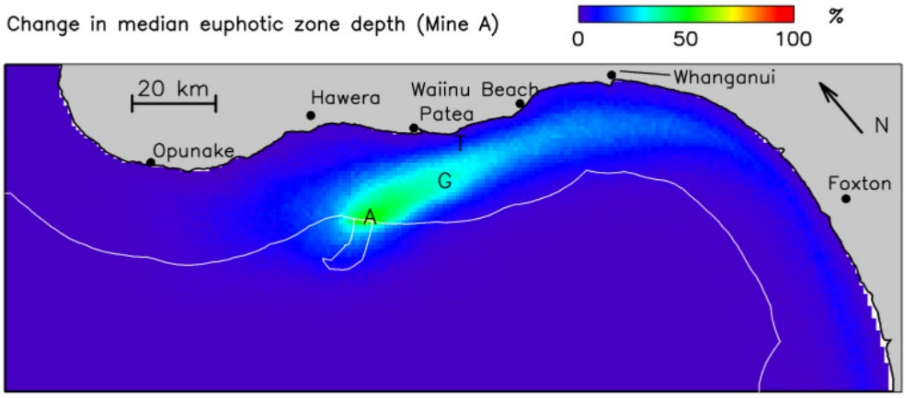

Figure 2-6a

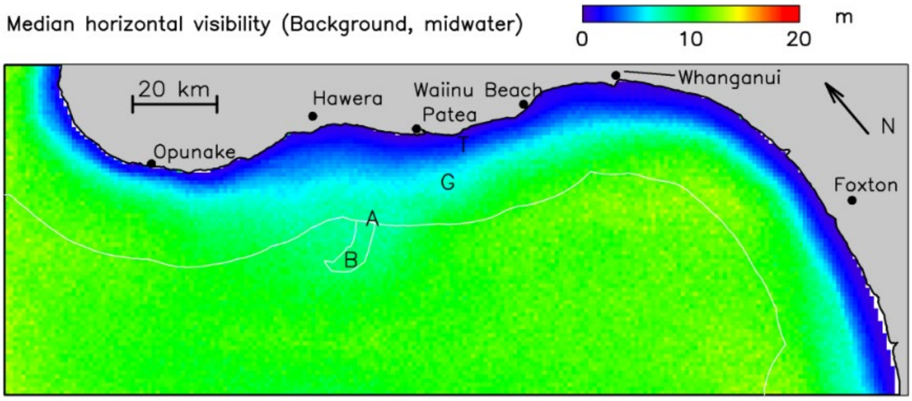

Figure 2-6b

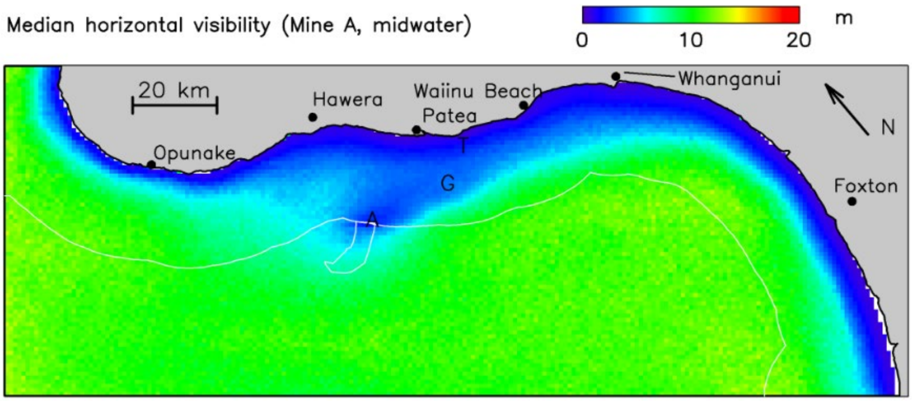

Figure 4. Figures 2-3a, 2-6a, and 2-6b from Pinkerton (2017). Figure 2-3a shows that the euphotic zone may be reduced by up to 50% in the HRC CMA, Figures 2-6a and 2-6b show the comparison between background SSCs and mining induced SSCs indicating that horizontal visibility could reduce by 10m in the HRC CMA.

As discussed in (Shanahan et al., 2025), the model used to provide information on the potential effects of the proposed mining on the seabed and coastal waters is complex and includes a variety of data sources. The oceanographic data was collected at 16 sites including 10 in and around the mining site (MacDonald, Budd, et al., 2015) and 6 additional nearshore sites along the coast (MacDonald, Gall, et al., 2015). Data was collected at the initial 10 sites from September 2011 to July 2012 with uneven coverage across seasons and sites (MacDonald, Budd, et al., 2015). Data was also collected at the 6 inshore sites from February to May 2013 with uneven coverage across months (MacDonald, Gall, et al., 2015). The difference in timing of data collection suggests the sediment plume modelling is calibrated to different conditions across sites. Additionally, since only 2 inshore sites of the 16 sites fall within the HRC CMA, it's difficult to determine how well the model is calibrated to conditions in the HRC CMA.

4.2 Localised impacts on receiving environment

The composition of the receiving environment is an integral component of determining the potential effects of an activity. Dependant on an area's physical and biological make-up, it may be more sensitive or have higher vulnerability to certain stressors. Therefore, an understanding of the species and habitats that occur within the Horizons CMA is an important consideration when assessing potential effects of the proposed activity.

Despite patchy information on the specific benthic habitats and species of the Horizons CMA, there is anecdotal evidence and studies (section 3.2) that demonstrate that benthic habitats similar to those in the Taranaki area may exist within this area. TTR acknowledged possible reef habitat through its evidence stating, "it is highly likely that other areas of rocky reef occur in this area inshore of the PPA and may be known to the local fishing and diving community but remain to be formally mapped." High sediment loads can significantly affect the growth, survival, and photosynthetic activity of rocky reef species, leading to altered morphology or life history traits, weakened species interactions, or direct smothering (Airoldi, 2003). To understand the effects of the proposed activity on those habitats, an assessment of localised impacts on species present in the HRC CMA would be required.

4.3 Optical properties and suspended sediments

Peterson et al., (2020) and Jones et al., (2016) highlighted that some key, habitat forming, algal species are likely to be present in the HRC CMA including kelp (*Ecklonia radiata*). TTR suggests that optical effects from mining will only have minor effects on macroalgal production (Aquatic Environmental Sciences Ltd, 2016). However, increasing turbidity reduces productivity of kelp, with a 63% decrease in light resulting in a 25% decline in productivity and most of the carbon storage being allocated to growth and then eroded away (Blain et al., 2021). In previous applications TTR did assess the impact of optical effects on primary productivity (Cahoon, et al., 2015), but the same assessment was not completed following updated worst-case scenario optical effects modelling report (Pinkerton, 2017).

Collins & Macdonald, (2019) and O'Callaghan, (2020) highlighted the influence of riverine inputs, containing land-based sediment loads, on the HRC CMA. TTR's sediment plume modelling emphasizes the heavy sediment load from the Whanganui River asserting that because the 99th percentile suspended sediment concentrations (SSCs) at the coast is higher than the modelled additional sediment concentration from mining, particularly southward from Pātea toward Kapiti, the additional sediment from mining is insignificant. Additionally, TTR states that mining will add to the seabed sedimentation in the near-shore environment in the area of Pātea and Whanganui. While the high riverine sediment load is acknowledged, offshore benthic habitats are likely to exist between the mining site and the near-shore environment. Those offshore habitats are less likely to have been influenced by riverine sediment loads (Collins & Macdonald, 2019; O'Callaghan, 2020) and could be quite susceptible to impacts from the sediment plume. This is particularly relevant to consider given that the mining operation is proposed to be continuous for 24 hours a day, 7 days a week, 258 days per year for 20 years. The sediment load from a semi-continuous operation is likely to have a different level of impact to storm based episodic events that have periods of recovery between.

The presence of filter-feeding species that for habitats in the HRC CMA also underscores the need for more detailed information regarding the area impacted by deposited sediment. Increasing suspended sediment and deposition can clog the gills of the filter feeding species resulting in decreased growth or mortality (Airoldi, 2003).

Jones et al., (2016) found that the HRC CMA included filter feeding, shellfish habitats offshore (horse mussels, scallops, and dog cockles). Shellfish beds provide several key ecosystem services including stabilising seafloor sediments, create vertical relief above sediment/water interface, rework surface sediments, provide hard structure for other sessile animals to grow, influence how substances move between the sediment and the water, and increase water clarity through filter (or suspension feeding; Lohrer, 2024). Increasing suspended sediment and deposition can clog the gills of these filter feeders (Airoldi, 2003). TTR's application includes recent research on dog cockles, *Tucetona laticostata* where individuals were exposed to high SSCs (up to approximately 700mg/L) and had high survival rates with no observable effect on oxygen consumption. Dog cockles tend to prefer coarse sediment habitat and fast-flowing water suggesting an persistent increase of fine sediment could impact the survival of this species (Anderson et al., 2020). An experimental time of 4 weeks is unlikely to adequately reflect the actual durations of higher suspended sediments (operation extending for 37 weeks of the year). Therefore, it is unlikely that this adequately reflects the impact of the sand mining operation. Other shellfish species weren't assessed as part of TTR's application.

Other key filter feeding habitats in the HRC CMA include bryozoan beds. The bryozoan beds studied by TTR were mainly offshore of the mining site and supported diverse benthic assemblages. However, the bryozoan beds in HRC's CMA have not been assessed. In general, bryozoan beds increase diversity, provide nursery habitats for fisheries species (e.g., blue cod, tarakihi, snapper, etc.), and stabilise bottom sediments (Morrison, 2024). A known stressor of bryozoans is suspended sediment and has been regarded as the cause of the disappearance of fields in other parts of New Zealand (Morrison, 2024). However, because TTR determined the effects of mining on the offshore bryozoan habitats would be minor, studies weren't included assessing the impact of increasing suspended sediment concentrations on those habitats.

4.4 Sediment deposition

The Assessment of Effects supporting documentation provided in the Trans-Tasman Resources Limited application describes sediment deposition effects resulting from the activity as being "virtually indistinguishable from naturally occurring background levels and will have negligible, if any, effects on benthic communities outside the excavation pit and immediate surrounding area" (Aquatic Environmental Sciences Ltd, 2016). However, there is recognition in the application that "attachment of [macroalgal] germlings can be impacted by a light dusting of sediment (Schiel, 2006)."

Wernberg et al., (2019) found that although adult kelp (*E. radiata*) can survive under a range of sediment loads, the attachment and survival of microscopic stages are constrained by sediment deposition and competition from more sediment-tolerant, but less habitat-forming, turf algae (Connell, 2007). Consequently, even depositional layers thinner than 0.05 mm over large areas could reduce algal recruitment and cover over time, diminishing biodiversity on subtidal reefs.

The size of the depositional area is not provided within the application documents or supplementary information. Given the importance of this factor in influencing the successful recruitment of macroalgae and survival of filter feeding species that provide habitat, this is considered a key gap in determine the potential impacts of the mining operation.

4.5 Benthic ecology

Despite limited data on the benthic ecology of the HRC CMA, corals, bryozoans, shellfish, sea pens, and tubeworms (including *Euchone* recorded at the mining site) have been recorded in the western HRC CMA (Hale et al., 2021; Jones et al., 2016). Green lipped mussels (*Perna canaliculus*) have also been recorded along the coast (Hale et al., 2021). Habitat suitability models for corals suggest that more species could also be present in the CMA (Hale et al., 2021). Impacts on some of the key habitat forming species are discussed above (section 4.2).

TTR's application does include an assessment of increasing sediment load on several filter (or suspension) feeding species. They found that while mussel and oyster condition reduced with SSCs over 26 mg/L (Schwarz et al., 2006), studies have also found that increasing sediment loads on suspension feeding animals aids in their processing of food and can be beneficial (Clarke et al., 2000; Hawkins et al., 1999; Hewitt & Norkko, 2007). For some species like green-lipped mussels, recent studies do support that conclusion (Biggar et al., 2025). However, the studies mentioned in the TTR application were on species in shallow environments adapted to turbid conditions. Other species like horse mussels were more sensitive to increasing sediment with their condition impacted by suspended sediment concentrations over 80 mg/L. Despite the mention of scallops in the application, there doesn't appear to be an assessment of relevant studies to determine the impacts of sedimentation on that species.

The Assessment of Effects, (2016) supporting documentation provided in the TTR application addresses the impact of sediment on corals. The study referenced on sedimentation impacts on corals are for tropical, hard corals rather than the soft corals found in the HRC CMA limiting the ability determine the impacts of seabed mining on soft corals. In addition, there doesn't appear to be studies included TTR's application and supporting documents assessing the effects of elevated SSCs on sea pens that are present in the HRC CMA.

TTR's application and supporting documents suggest that sponge responses to suspended sediment vary. Schwarz et al., (2006) found decreased condition in sponges with SSCs of 15 mg/L. More recently Cummings et al., (2020) measured the response of a common cushion sponge (*Crella incrustans*) to SSCs of up to 700mg/L for four weeks. They found that the sponge had high survival rates and no change in oxygen consumption. The sponges had, however, accumulated sediments internally with only a third of the sponges clearing the sediment two weeks after elevated SSCs ceased. As mentioned in section 4.2, the sponges weren't tested for the length of time the mining operation is proposed to run making it difficult to interpret the effects. Additionally, there are no documented *C. incrustans* in the HRC CMA as most of the described sponges protrude from the benthos and may respond to increasing SSC levels differently.

In general, species responses to sediment, where documented, are not consistent making it difficult to determine effects of sand mining relevant to the Horizons CMA. Additionally, many of the species discussed in TTR's application and supplementary documentation are not present in the HRC CMA. Without assessments of species present in the HRC CMA, species responses to increasing sediment are difficult to resolve.

4.6 Seabirds

As part of TTR application, the potential impact of mining on seabirds was addressed in multiple reports and evidence addressing artificial lights, ecological impacts (Thompson (2013; updated 2015), MacDiarmid et al. (2015), Thompson (2023)).

The potential impacts outlined for TRC are also relevant to HRC as the important areas for bird occurrence, nesting and foraging extend between the Cook Straight and just south of Ōpunake in Taranaki.

There is broad agreement that the STB lies within the Cook Strait Important Bird and Biodiversity Area and is therefore of international importance for seabird conservation. The region supports numerous 'threatened' and 'at risk' species, as defined by the New Zealand Threat Classification System, with at least ten and 24 taxa, respectively, present either year-round or seasonally. Forty-five seabirds and 11 shorebirds are likely to occur in or adjacent to the South Taranaki Bight (STB; Thompson 2023). Eleven of those seabirds and two shorebirds are classified as 'Threatened', and 24 birds and seven shorebirds as 'At Risk' (Robertson, et al., 2021). The list contains seven species classified as 'Endangered' and eight as 'Vulnerable' by the IUCN Red List[2] which fall in the IUCN 'Threatened categories'[3].

Experts noted that no systematic seabird surveys had been carried out and that relevant information was absent from the 2017 evidence. Since then, however, the unique importance of this area as a key seabird habitat has become more widely recognised.

Potential effects on seabirds include displacement, the effect of the sediment plume on foraging, noise, lighting and potential oil/fuel spills. However, to date experts have not been able to agree on the magnitude of the effects.

Additionally, the Integrated Mining Vessel (IMV) will measure >300 m length becoming a permanent feature in the STB over approximately 20 years. It is likely to attract migratory and local seabirds, functioning as an artificial island that draws birds, particularly at night or during poor weather, which could result in increased mortality. However, some of those effects may be able to be reduced with appropriate mitigations (e.g., downward facing and specific tones).

Adverse effects on these species must be avoided, consistent with Policy 11 of the New Zealand Coastal Policy Statement (NZCPS, 2010). How the proposed activity is avoiding effects should be considered given that the experts agreed that "large numbers of seabirds may be present in the STB at night, including the proposed mining area, and that there is potential for significant mortality of

[2] https://www.iucnredlist.org/
[3] https://www.iucnredlist.org/about/faqs

seabirds attracted to mining vessel lights" in the Joint Statement of Effects in 2017 and 2024.

There does not appear to be sufficient information to assess the impacts of the mining activity on seabirds in the South Taranaki Bight (STB) based on the information provided. Site-specific data on seabird presence, distribution, foraging areas, and behavioural patterns remain limited, which makes it difficult to quantify potential population-level or long-term impacts.

4.7 Marine mammals

Similarly to seabirds, the assessment of the information provided of relevance to TRC is also relevant to HRC given the large migratory and foraging pathways of marine mammals in this area.

Several aerial surveys, scientific reports, and evidence have been used to inform the assessment of potential effects on marine mammals associated with the proposed activity (Martin Cawthron Associates, 2013, DOC 2023, MacDiarmid et al., 2013, Torres et al., 2013; Derville et al., 2016, MacKenzie et al., 2016, Stephens, 2020a; 2020b, Joint statement of experts in the field of "effects on marine mammals" 2014, 2017, and 2024). The main effects considered to have an impact on marine mammals include noise, vessel strike, and the effects of the sediment plume on foraging and wider food web disturbance. Sediment can also have indirect effects, such as reducing a predator's ability to detect its prey (Airoldi, 2003).

A total of 11 marine mammal species have been sighted recorded in the HRC CMA within the Department of Conservation sighting and stranding database (Figure 5). This includes several 'Threatened' and 'At Risk' species including, Hector's dolphin, Maui dolphin, leopard seal, killer whale (orca) and southern right whale. On the whole, the STB is an area of hight marine mammal diversity with some parts considered important habitat and foraging areas (Childerhouse 2023).

To assess the effect of noise on marine mammals TTR modelled noise from of the Integrated Mining Vessel (IMV) and seabed crawler operations. However, in situ measurements were not used and compliance benchmarks suggested have limited empirical data to inform their appropriateness.

Determining the magnitude and scale of effects of an activity on species, especially those that are close to extinction, requires careful consideration. Given the limited data, there is some uncertainty about the potential effects of the mining operation on marine mammals, particularly for sensitive or endangered species such as blue whales, Hector's and Maui dolphins.

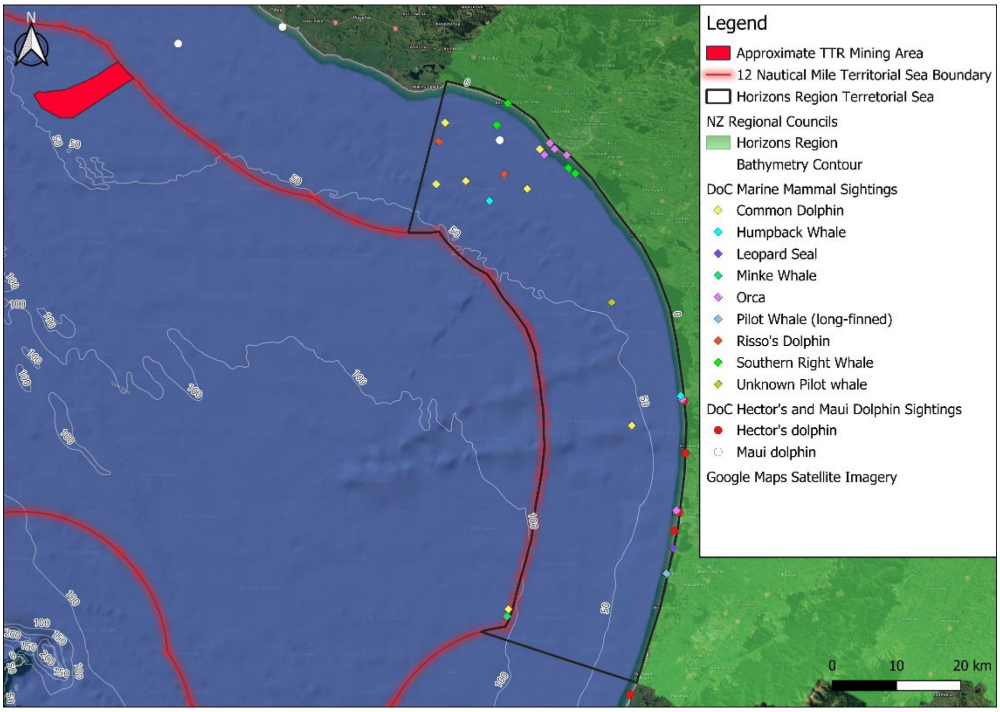

Figure 5. DOC marine mammal sightings and strandings database in the HRC CMA.

4.8 Recommendations for Panel consideration

Gaps in current information limit the ability to confidently assess the scale and significance of potential impacts within the Horizons CMA. These include:

4.8.1 Water quality

- The increasing suspended sediment concentrations appear to have the potential to result in breaches the water quality targets in HRC's One Plan relative to changes in the euphotic zone and visual clarity (horizontal visibility). However, the data is unable to be interpreted at the scale it's presented in. The panel may need to reflect on the weighting of these potential breaches to the HRC One Plan.
- The development of the sediment plume model using data collected different years and timeframes introduces potential uncertainty. The panel may need to weigh how this affects confidence in whether the model accurately reflects conditions in the HRC CMA.

4.8.2 Localised impacts on the receiving environment

- There is uncertainty without a localised assessment of impacts on likely reef habitats in the HRC CMA. The panel may wish to consider this in its evaluation of ecological effects.

4.8.3 Optical properties and suspended sediments

- Without an updated primary production assessment based on the updated worst-case optical effects modelling, there isn't enough information to assess the magnitude of effects on kelp found in the HRC CMA.
- The panel may wish to consider how the uncertainty regarding reef locations and the absence of updated primary production assessment impacts the confidence in conclusions about potential effects on reef ecosystems.

4.8.4 Sediment deposition

- Without knowing the size and extent of the depositional area, it's not possible to assess the magnitude of sedimentation effects on the receiving environment. The panel may wish to consider that this necessary information is missing.

4.8.5 Benthic ecology

- Based on the evidence, there doesn't appear to be adequate examples of species responses, particularly filter feeders, to the longevity of the proposed operation. The panel may wish to consider the limitations of the supplied information versus the proposed activity.

4.8.6 Seabirds

- The panel may which to consider the lack of sufficient information to assess the impacts on the mining activity of seabirds in the South Taranaki Bight (STB).
- A lack of knowledge regarding seabird presence, foraging areas, and behavioural patterns has remained a knowledge gap. The panel may wish to consider that knowledge gap was noted in the previous EPA process and has yet to be substantively filled.

4.8.7 Marine mammals

- The panel may wish to consider whether the existing limited data on marine mammal populations, particularly given their threat classification status, are sufficient to evaluate the potential impacts of the proposed mining activities.
- The panel may wish to take into account that the potential noise-related impacts on marine mammals from mining is uncertain and lacks empirical data support to fully assess the magnitude and significance of effects.

5.0 Conclusions

To support its applications for consent, TTR has commissioned a broad suite of technical investigations and modelling. The current application has also been strengthened by additional work undertaken in response to requests and questions from the DMC. However, further consideration and information are needed to accurately assess the impacts of the proposed activity on the coastal marine area of the Horizons region, particularly on sensitive benthic habitats. The review has found that in several areas, the available information lacks sufficient resolution or scale to determine the magnitude of effects.

6.0 Application documents reviewed

Anderson. T.J., MacDiarmid, A., Stewart, R., 2013. “Benthic habitats, macrobenthos and surficial sediments of the nearshore South Taranaki Bight” NIWA Client Report No: NEL2013-012. June 2013. 44 pp. Updated November 2015.

Aquatic Environmental Sciences Ltd. (2016). *Trans-Tasman Resources Ltd consent application: Ecological assessments*. Prepared for Trans-Tasman Resources Ltd.

Beaumont, J., Anderson, T.J., MacDiarmid, A.B. (2013). Benthic flora and fauna of the Pātea Shoals Region, South Taranaki Bight. NIWA Client Report No: WLG2012-55. October 2013. 183 pp. Updated November 2015.

Cahoon, L. B., Pinkerton, M., & Hawes, I. (2015). Effects on primary production of proposed iron-sand mining in the South Taranaki Bight region. NIWA (Prepared for Trans-Tasman Resources, Ltd.).

Cahoon, L.B. (2016). Expert evidence of Dr. Lawrence Cahoon on behalf of Trans-Tasman Resources Limited: Hearing before the Environmental Protection Authority (2016).

Cahoon, L.B. (2017). Supplementary Expert evidence of Dr. Lawrence Cahoon on behalf of Trans-Tasman Resources Limited: Hearing before the Environmental Protection Authority (2016).

Chiffings, T. (2016). Lodgement review of the effects on plankton, fish and marine mammals. DHI report prepared for the Environmental Protection Agency In the matter of Applications by Trans-Tasman Resources Ltd marine consent application.

Childerhouse, S. (2023) Expert evidence of Dr Simon John Childerhouse on behalf of Trans-Tasman Resources Limited, para 16. 19 May 2023.

Dearnaley, M. (2024). Expert rebuttal evidence of Dr Michael Dearnaley on behalf of Trans-Tasman Resources Limited. January.

Hadfield, M., & Macdonald, H. (2015). Sediment Plume Modelling—Prepared for Trans-Tasman Resources Ltd (Nos. WLG2015-22). National Institute of Water and Atmospheric Research Ltd.

Joint statement of experts in the field of effects on benthic ecology. (2017, Feb 20). In the matter of Trans-Tasman Resources Ltd marine consent application. NZ Environmental Protection Authority hearing document.

Joint statement of experts in the field of sediment plume modelling; and effects on benthic ecology. (2024, Feb 23). In the matter of a Reconsideration of Applications by Trans-Tasman Resources Ltd marine consent application. NZ Environmental Protection Authority hearing document.

Joint statement of experts in the field of effects of sediment plume on primary production. (2017, Feb 14). In the matter of Trans-Tasman Resources Ltd marine consent application. NZ Environmental Protection Authority hearing document.

Mead, S.T. (2017). Supplementary statement of evidence by Shaw Travor Mead on behalf of Kiwis against seabed mining incorporated. May 19.

McClary, C. (2014). Statement of Evidence in Chief of Dr Dan McClary on behalf of Trans-Tasman Resources Ltd. Before the EPA: Trans-Tasman Resources Ltd Ironsands Extraction Project.

MacDiarmid, A. (2014). Expert evidence of Dr Alison MacDiarmid on behalf of Trans-Tasman Resources Limited. December.

MacDiarmid, A. (2023). Expert evidence of Dr Alison MacDiarmid on behalf of Trans-Tasman Resources Limited. December 19.

MacDiarmid, A. (2024). Expert rebuttal evidence of Dr Alison MacDiarmid on behalf of Trans-Tasman Resources Limited. January 23.

MacDiarmid, A., Anderson, O., Sturman, J., (2013). South Taranaki Bight Fish and Fisheries. NIWA Client Report No: WLG2012-13. October 2013. 70 pp. Updated November 2015b.

MacDiarmid, A.; Thompson, D.; Grieve, J. (2015). Assessment of the scale of marine ecological effects of seabed mining in the South Taranaki Bight: Zooplankton, fish, kai, moana, sea birds, and marine mammals. NIWA Client Report: WLG2015-13. Report prepared for Trans-Tasman Resources Ltd. September 2015.

Macdonald, H.S. & Hadfield, M.G. (2017). Draft: South Taranaki Bight Sediment Plume Modelling: Worst Case Scenario. NIWA Client Report 2017049WN for Trans-Tasman Resources Ltd, March 2017.

Macdonald, I., Budd, R., Bremner, D., & Edhouse, S. (2015). South Taranaki Bight Iron Sand Mining: Oceanographic measurements data report. Prepared for Trans-Tasman Resources Ltd.

MacDonald, I., Gall, M., & Bremner, D. (2015). *Nearshore Optical Water Quality in the South Taranaki Bight* (No. NIWA Client Report No: HAM2013-040; p. 88). NIWA (Prepared for Trans-Tasman Resources, Ltd.).

Macdonald, H., & Hadfield, M. (2017). *South Taranaki Bight Sediment Plume Modelling Worst Case Scenario—Prepared for Trans-Tasman Resources Ltd*.

Martin Cawthorn Associates Ltd. (2013). Cetacean Monitoring Report. Document No: TTR071013. October 2013. 35pp. Updated November 2015.

Pinkerton, M. (2017). Optical effects of proposed ironsand mining in the South Taranaki Bight region—Worst case update (No. 2017089WNrev1). NIWA (Prepared for Trans-Tasman Resources, Ltd.).

Pinkerton, M., & Gall, M. (2015). Optical effects of proposed ironsand mining in the South Taranaki Bight region (Nos. WLG2015-26). NIWA (Prepared for Trans-Tasman Resources, Ltd.).

Taranaki Regional Council (2014). Submission of Trans-Tasman Resources marine consent application. Submission made by Taranaki Regional Council to the Environmental Protection Agency.

Taranaki Regional Council (2016). Submission of Trans-Tasman Resources marine consent application. Submission made by Taranaki Regional Council to the Environmental Protection Agency.

Thompson, D. (2013). Seabirds of the South Taranaki Bight. (WLG2013-15). NIWA (Prepared for Trans-Tasman Resources, Ltd.), updated March 2015.

Trans-Tasman Resources Ltd (2025) Trans-Tasman Resources Ltd Taranaki VTM Project Fast-Track Act Application.

7.0 Further references

Airoldi, L. (2003). The Effects of Sedimentation on Rocky Coast Assemblages. *Oceanography and Marine Biology*, *41*, 161–236.

Anderson, T., Stewart, R., D'Archino, R., Stead, J., & Eton, N. (2020). *Life on the seafloor in Queen Charlotte Sound, Tory Channel and adjacent Cook Strait Life on the Seafloor* (No. NIWA CLIENT REPORT No: 2019081WN).

Biggar, B. S., Jeffs, A., & Hillman, J. R. (2025). Effects of suspended sediment on survival, growth, and nutritional condition of green-lipped mussel spat (*Perna canaliculus*, Gmelin, 1791). *Journal of Experimental Marine*

Biology and Ecology, *582*, 152074. https://doi.org/10.1016/j.jembe.2024.152074

Blain, C. O., Hansen, S. C., & Shears, N. T. (2021). Coastal darkening substantially limits the contribution of kelp to coastal carbon cycles. *Global Change Biology*, *27*(21), Article 21. https://doi.org/10.1111/gcb.15837

Bostock, H. (2018). *Offshore substrate characterisation for Horizons CMA* (No. Horizons Report 2018/EXT/1573). Horizons Regional Council.

Clarke, D., Engler, R. M., & Wilber, D. H. (2000). *Assessment of Potential Impacts of Dredging Operations Due to Sediment Resuspension.:* Defense Technical Information Center. https://doi.org/10.21236/ADA377325

Collins, C., & Macdonald, H. (2019). *Oceanic flow patterns and their influence on receiving and transmitting material on the west coast of the Manawatu-Whanganui Region—Ocean flow and its influence on transporting material* (No. NIWA CLIENT REPORT No: 2019169WN). NIWA (Prepared for Horizons Regional Council).

Connell, S. (2007). *Connell SD (2007) Water quality and the loss of coral reefs and kelp forests: Alternative states and the influence of fishing. In: Connell SD, Gillanders BM (eds) Marine Ecology. Oxford University Press, Melbourne, pp 556-568* (pp. 556–568).

Cummings, V. J., Beaumont, J., Mobilia, V., Bell, J. J., Tracey, D., Clark, M. R., & Barr, N. (2020). Responses of a common New Zealand coastal sponge to elevated suspended sediments: Indications of resilience. *Marine Environmental Research*, *155*, 104886. https://doi.org/10.1016/j.marenvres.2020.104886

Fraser, C., White, R., Snelder, T., & Stoffels, R. (2021). *New Zealand Coastal Water Quality Assessment 2021*. Prepared for Ministry for the Environment.

Hale, R., Wadhwa, S., Anderson, T., Anderson, O., Hupman, K., Stephenson, F., Lundquist, C., Schnabel, K., & Neill, K. (2021). *Seafloor habitats and fish, invertebrate and marine mammal diversity in the Horizons Region coastal marine area* (No. NIWA CLIENT REPORT No: 2021069NE). NIWA (Prepared for Horizons Regional Council).

Hawkins, A. J. S., James, M. R., Hickman, R. W., Hatton, S., & Weatherhead, M. (1999). Modelling of suspension-feeding and growth in the green-lipped mussel Perna canaliculus exposed to natural and experimental variations of seston availability in the Marlborough Sounds, New Zealand. *Marine Ecology Progress Series*, *191*, 217–232.

Hewitt, J. E., & Norkko, J. (2007). Incorporating temporal variability of stressors into studies: An example using suspension-feeding bivalves and elevated suspended sediment concentrations. *Journal of Experimental Marine*

Biology and Ecology, *341*(1), 131–141. https://doi.org/10.1016/j.jembe.2006.09.021

Horizons Regional Council. (2014). *One plan: The consolidated Regional policy statement, Regional plan and Regional coastal plan for the Manawatu-Wanganui Region*. Horizons Regional Council.

Jones, E. G., M.A. Morrison, N. Davey, B.W. Hartill, & C. Sutton. (2016). *Biogenic habitats on New Zealand's continental shelf. Part 1: Local Ecological Knowledge*. https://doi.org/10.13140/RG.2.2.35539.58404

Lohrer, D. (2024). *Shellfish bed extent and quality. In: Lohrer, D., et al. Information Stocktakes of Fifty-Five Environmental Attributes across Air, Soil, Terrestrial, Freshwater, Estuaries and Coastal Waters Domains.* (No. NIWA report no. 2024216HN (project MFE24203, June 2024).). Prepared by NIWA, Manaaki Whenua Landare Research, Cawthron Institute, and Environet Limited for the Ministry for the Environment. https://environment.govt.nz/publications/information-stocktakes-of-fifty-five-environmental-attributes

MacDiarmid, A., Milne, J. R., MacDonald, I., & Rickard, G. (2018). *A review of available information for the open coastal waters of the Manawatū-Wanganui region*. Horizons Regional Council.

Morrison, M. (2024). *Bryozoan thickets extent and quality. In: Lohrer, D., et al. Information Stocktakes of Fifty-Five Environmental Attributes across Air, Soil, Terrestrial, Freshwater, Estuaries and Coastal Waters Domains* (No. NIWA report no. 2024216HN (project MFE24203, June 2024)). Prepared by NIWA, Manaaki Whenua Landare Research, Cawthron Institute, and Environet Limited for the Ministry for the Environment. https://environment.govt.nz/publications/information-stocktakes-of-fifty-five-environmentalattributes

Morrison, M., Seaward, K., Bodie, C., Madden, B., Evans, O., Smale, P., Pratt, K., Boyd, B., Richardson, J., Guy, R., McElroy, T., Williams, S., Pallentin, A., & Mackay, K. (2022). *Offshore subtidal rocky reef habitats on Pātea Bank, South Taranaki* (No. 2022229AK). NIWA (Prepared for Taranaki Regional Council).

O'Callaghan, J. (2020). *River plume dynamics in the coastal marine area* (No. NIWA CLIENT REPORT No: 2020033WN). NIWA (Prepared for Horizons Regional Council).

Peterson, G., Stephenson, F., Brough, T., & Rowden, A. (2020). *Seafloor Community Classification: Group descriptions* (No. NIWA CLIENT REPORT No: 2020230HN).

Schiel, D. R. (2006). Rivets or bolts? When single species count in the function of temperate rocky reef communities. *Journal of Experimental Marine Biology and Ecology*, *338*(2), Article 2. https://doi.org/10.1016/j.jembe.2006.06.023

Schwarz, A., Taylor, R., Hewitt, J., Phillips, N., Shima, J., Cole, R., & Budd, R. (2006). *Impacts of terrestrial runoff on the biodiversity of rocky reefs* (No. 7).

Shanahan, B., Westcott, W., & Madarasz-Smith, A. (2025). *Technical assessment of Fast Track Application (FTAA-2504-1048 Taranaki VTM Project)* (No. JOB REFERENCE HB011420001). PDP Paddle Delamore Partners Ltd on behalf of Taranaki Regional Council.

Wernberg, T., Coleman, M. A., Babcock, R. C., Bell, S. Y., Bolton, J. J., Connell, S. D., Hurd, C. L., Johnson, C. R., Marzinelli, E. M., Shears, N. T., Steinberg, P. D., Thomsen, M. S., Vanderklift, M. A., Vergés, A., & Wright, J. T. (2019). Biology and Ecology of the Globally Significant Kelp Ecklonia radiata. In S. J. Hawkins, A. L. Allcock, A. E. Bates, L. B. Firth, I. P. Smith, S. E. Swearer, & P. A. Todd (Eds.), *Oceanography and Marine Biology* (1st ed., pp. 265–323). CRC Press. https://doi.org/10.1201/9780429026379-6

Appendix A: Description of Seafloor Community Classification (SCC; adapted from Peterson et al. (2020))

Table 1. Detailed SCC habitat descriptions in HRC CMA

SCC Group	Description
34	• Moderate concentrations of oxygen, low levels of dissolved nitrate, and high temperatures associated with elevated productivity. • Benthic invertebrate assemblages are primarily characterised by sponges and brittle stars. • Demersal fish assemblages are characterised by very high frequency occurrence of the barracouta, gurnard and dogfish, and reef fish assemblages are characterised by wrasse and triplefin. • Kelp and a single green algae characterise macroalgal assemblages. • Confidence in modelled relationships is moderate to high.
39	• Characterised by high productivity, high salinity at depth, moderate oxygen concentrations and strong tidal currents. • Benthic invertebrate assemblages are characterised by brachiopods with crab, coral and urchin present in lower frequencies. • Demersal fish assemblages are characterised by the very high frequency occurrence of barracouta, mackerel, dogfish and tarakihi. Reef fish assemblages are diverse and characterised by blue cod, butterfly perch and several species of reef dwelling triplefins, wrasse and moki. • Macroalgal assemblages are also diverse and are characterised by several species of red, brown and green algae, including kelp. • Confidence in modelled relationships is moderate to high.

Table 1. Detailed SCC habitat descriptions in HRC CMA

SCC Group	Description
53	• These high temperature waters have low concentrations of nitrate and silicate associated with elevated productivity and have large seasonal differences in bottom temperature. • Benthic invertebrate assemblages are characterised by high frequency cephalopods and hydrozoans, and low frequency brachiopods. • Demersal fish assemblages are characterised by very high frequency occurrence of demersal cod, tarakihi and gurnard, and reef fish assemblages are characterised by high frequency occurrence of triplefins and wrasse. • Macroalgal assemblages are diverse, characterised by several species of brown algae including kelp. • Confidence in modelled relationships is moderate.
54	• High temperature waters have low concentrations of nitrate and silicate associated with elevated productivity and have large seasonal differences in bottom temperature. • Benthic invertebrate assemblages are characterised by high frequency occurrence of brittle star and isopods, moderate frequency occurrence of bivalves, and low frequency occurrence of brachiopods and amphipods. • Demersal fish assemblages are characterised by high frequency occurrence of blue cod, and reef fish assemblages are characterised by high frequency of triplefins and wrasse. • Macroalgal assemblages are very diverse and are characterised by several species of brown and red algae. • Confidence in modelled relationships is moderate to high.

Table 1. Detailed SCC habitat descriptions in HRC CMA

SCC Group	Description
55	• High temperature waters have low concentrations of nitrate and silicate associated with elevated productivity and have large seasonal differences in bottom temperature and high seabed disturbance and moderate to high tidal currents. • Benthic invertebrate assemblages are characterised by high frequency occurrence *sea urchin*, hydrozoan and crab, with low frequency bivalve occurrence. • Demersal fish assemblages are characterised by high frequency occurrence of gurnard, barracouta and flounder and reef fish assemblages are characterised by high frequency occurrence of triplefin and wrasse. • Macroalgal assemblages are diverse and are characterised by several species of brown and red algae. • Confidence in modelled relationships is moderate to high.