Before the Taranaki VTM Expert Panel

under:	the Fast-track Approvals Act 2024 and Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
in the matter of:	an application by Trans-Tasman Resources Limited for marine consents to support a seabed mining operation in the South Taranaki Bight

Statement of evidence of **Peter John McComb** (Seabed Morphology) for Taranaki Offshore Partnership

Dated: 3 October 2025

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STATEMENT OF EVIDENCE OF PETER JOHN MCCOMB FOR TARANAKI OFFSHORE PARTNERSHIP

INTRODUCTION

1 My name is Peter John McComb.

2 I am an ocean scientist specialising in physical oceanography. My current role is Managing Director of Oceanum Ltd, an organisation that undertakes numerical modelling of ocean processes and applied environmental data sciences. This company has been in operation since 2019. Prior to that I was Founder, Senior Oceanographer and Managing Director of MetOcean Solutions Ltd, from 2005 until it was amalgamated into the Meteorological Service of New Zealand in July 2018. Since 2018, I have also held the role of independent science advisor and Steering Group Member for the New Zealand Antarctic Science Platform.

3 My qualifications include a Doctor of Philosophy from the University of Waikato and a Bachelor of Science and Post-Graduate Diploma in Marine Science from the University of Otago. I have more than 30 years' experience in applied ocean science, physical oceanography, coastal processes, and ocean engineering related topics.

4 My project experience includes oceanographic and geophysical survey, metocean[1] data collection, metocean design studies for oil/gas developments, subsea ocean cables, scour and pipeline stability studies, port development and dredging studies, coastal process investigations, and analysis and interpretation of environmental data and numerical modelling outcomes. As a junior oceanographer, I spent 6 months operating the rock dumping fall pipe ROV[2] for the Maui A to B pipeline construction project.

5 My professional outputs include 24 scientific publications and 300+ technical reports. My doctoral research topic was the sediment dynamics of black volcanic sand, with focus on entrainment equations and their practical application in sedimentation, channel infilling and dump mound dispersal at Port Taranaki. Since then I have contributed to many studies relating to coastal sediment transport and associated topics within the Taranaki region and beyond. That includes a study of sediment entrainment by waves and currents at the Kupe Wellhead Platform (*WHP*), which is adjacent to the Trans-Tasman Resources Limited (*TTRL*) proposal area.

6 I also led the development of the metocean design criteria for the Pohokura, Tui, Maari and Kupe offshore developments, including running onsite oceanographic data collection programs, installation

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[1] Metocean refers to the understanding of meteorological and oceanographic conditions in offshore coastal engineering or renewable energy projects.

[2] Remotely Operated Vehicle.

weather forecasting and seabed surveys. Accordingly, I have considerable practical experience of the weather conditions in the TTRL proposal area, and a detailed scientific understanding of the oceanographic processes in operation.

CODE OF CONDUCT

7 Although these proceedings are not before the Environment Court, I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (2023), and I agree to comply with it as if these proceedings were before the Court. My qualifications as an expert are set out above. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

8 I have been engaged by Taranaki Offshore Partnership (*TOP*) to provide expert evidence on sediment dynamics in relation to the application lodged by TTRL (*Application*) for marine consents under the Fast-track Approvals Act 2024 (*FTAA*) and Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (*EEZ Act*).

9 TTRL seeks marine consents to extract 50 million tonnes of seabed material per year, over 20 years, mechanically recover 5 million tonnes of heavy mineral sands concentrates containing iron ore, vanadium and titanium, and return the de-ored material to the seabed (*Proposal*).

10 In preparing this evidence I have reviewed the documents from the Application, from previous TTRL hearing processes and from other sources listed in **Appendix 1**.

11 I have also reviewed the statements of evidence from Mr Giacomo Caleffi, Mr James Perry, Mr Regan King and Mr Fraser Colegrave.

12 My evidence will address:

12.1 Sediment transport modeling;

12.2 Effects of the Proposal on seabed morphology – mound deflation and pit infilling;

12.3 Effects of the Proposal on waves and currents;

12.4 TTRL’s proposed conditions; and

12.5 My conclusions.

SUMMARY OF EVIDENCE

13 In my opinion, TTRL's assessment of the seabed morphology impacts of the Proposal is undermined by flaws in the governing assumptions. In particular, TTRL has failed to account for sediment "bulking" effects (where processed sediments occupy more volume than naturally compacted ones) and has applied a uniform ore recovery rate despite likely spatial variations. As a result, I consider TTRL has underestimated the likely impact of the Proposal on seabed morphology such that the mounds created by mining are likely to be larger than estimated by TTRL.

14 The likely impact of the Proposal on seabed morphology give rise to my concerns on the effects of the Proposal on waves and currents and the potential for long-term deformation of the seabed. It is probable that operational challenges due to the misalignment of waves, winds and currents will result in a non-uniform seabed, post-mining. This has the potential to alter wave patterns and create localised navigational hazards, particularly if wave focussing occurs along residual ridges.

15 The effects of the pits and mounds on currents have not been assessed in the Application and could be significant. For example, I estimate that mounds could locally increase the ocean current speeds by 25-30%. However this potential increase has not been quantified in any way nor considered as an effect by TTRL.

16 Mining will permanently alter the seabed's composition and its structural integrity. The reconstituted seabed substrate will likely be coarser (because fines have been removed) and less dense (because the heavy mineral sands have been removed).

17 The modelling that has informed TTRL's assessment of pit infilling and mound deflation rates contains several errors. I estimate that infilling and deflation rates for the parts of the Proposal area with shallower water depths will be at least 5 times longer than predicted by TTRL. In the deeper parts of the Proposal area, it is highly probable that natural remediation will not be effective, and changes to the morphology will be essentially permanent (i.e. persist beyond 1000 years).

18 Pit migration has been mentioned by TTRLs experts as an expected outcome, which could have potential impacts extending beyond the Proposal area. No empirical, analytical or numerical evidence has been provided to support any assessment of pit migration.

EFFECTS OF THE PROPOSAL ON SEABED MORPHOLOGY

19 De-oring will extract a fraction of the sediments, mainly volcanic agglomerates with high density, which tend also to have a typical size range due to the weathering processes. When the remnant sediments are returned to the seabed, the dynamic plume will

preferentially separate fines from the mass of material. The net result will be a sediment character with less fines, lower overall density and larger proportion of interstitial cavities. None of this has been quantified in the Application, nor have the changes to structural integrity of the seabed been considered as an effect.

20 Seabed morphology refers to the physical shape, texture, and features of the seafloor. Changes to the morphology are relevant to wave climate, hydrodynamic regime, benthic ecology and other potential users of the marine environment, such as offshore wind farm developers.

21 TTRL's assessment[3] states that a mass of 50 million tonnes is to be extracted from the seabed per year, with 45 million tonnes of de-ored material being returned to the seabed.[4] TTRL estimates that:

21.1 10% of the mass is recoverable ore (which will retained onboard the Integrated Mining Vessel (*IMV*));[5] and

21.2 90% of the mass will be returned to backfill the excavated lanes, with a residual depth change of about 1 m deeper than the original depth, and remnant mounds (8-9 m high) and pits (9-10 m deep) at the start and end of each mining lane, respectively.[6]

My assessment

TTRL's assumptions are over-simplified

22 In my opinion, TTRL's assessment makes over-simplified assumptions.

Bulking and settling

23 A bulking factor is the volumetric difference between dredged and dumped sediments, typically expressed as a %. The Application does not consider the potentially significant volumetric effects of bulking, nor is any consideration given to understanding the rate of settling (i.e. compaction) of material over time. The latter is important because the seabed shape will change.

24 While the mass balance is conserved in a dredging / dumping operation, the volume is not because naturally compacted sediments occupy less volume than processed / dumped sediments.

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[3] Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015).

[4] Fast-track Application for Trans-Tasman Resources Limited Taranaki VTM Project (15 April 2025), section 2.3.4, p27.

[5] Ibid.

[6] Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015).

In a port setting for example, it is common to apply a 15-30% bulking factor to estimate the volumetric difference between dredged and dumped material.

Recoverable ore percentage

25 It can be expected that the percentage of recoverable ore will vary across the Proposal area, primarily due to the way that the iron sands were deposited there as shore-connected shoals during the Holocene post-glacial transgression period. While the sedimentology and estimates of recoverable ore are summarised in the Application, the potential effects of variability in % of recoverable ore are not. Instead, a uniform value of 10% has been applied, presumably to represent a spatial average, and this value has been globally used to inform the assessment of effects.

TTRL's assessment understates potential changes to seabed morphology

26 The above assumptions combine to influence the magnitude of potential changes to the seabed morphology that could arise from the Proposal (i.e. the post mining deformation).

27 Consider for example if only 5% of ore is recovered from a particular area and 95% of excavated sediment is returned to the seabed. With a 20% bulking factor the resultant mound height would be 11.4 m not 8-9 m high as predicted by TTRL. In water depths of 35 m, such a mound would occupy about 1/3 of the native water column. IMV operational inconsistencies due to weather, may further influence the formation of the mound, or indeed lead to localised peaks on the mound itself.

28 TTRL's assessment understates the changes to seabed morphology, and therefore are likely to substantially understate the related impacts of the Proposal.

TTRL's assessment does not adequately address the spatial extent of seabed morphology changes

29 In documentation for a previous application, TTRL identified that pit migration of 10 m per year was a potential outcome.[7] This estimate was based solely on a literature review, without any analytical or numerical evidence based on the local environment. Specifically, there is no account taken regarding cohesion of the adjacent substrate and it assumes that the direction of sediment transport is highly asymmetrical and directed toward the southeast.

30 The current Application provides no further empirical, analytical or numerical justification for this possibility, nor considers the potential effects of pit migration beyond the boundaries of the Proposal area. I do not see how a decision maker can reconcile this information when considering the potential effects of the Proposal.

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[7] Expert evidence of Dr Iain MacDonald on behalf of TTRL, 17 December 2017.

EFFECTS OF THE PROPOSAL ON WAVES AND CURRENTS

31 The seabed morphology has direct effects on swell waves that pass over the Proposal area, giving rise to both local and far field effects, and on the ocean currents (i.e. the hydrodynamics). It is relevant to understand the magnitude of these effects to assess any localised or downstream impact.

TTRL's assessment

32 TTRL considers the effect of pits and mounds on the regional wave climate, but not the local-scale impacts.

33 TTRL has not considered effects of pits and mounds on the local hydrodynamic regime.

My assessment - currents

34 The effects of pits and mounds on the local and regional currents have not been considered in sufficient detail by TTRL. The grid of the highest resolution model included in the Application (being 500 m),[8] is too large to capture even the existing dynamical effects of bathymetry, let alone quantify the influence of pits, mounds or an irregular seabed morphology post mining. This is a significant omission in my view.

35 In my opinion a higher resolution model (around 50 m) should have been developed for TTRL to first replicate the existing undulations in the mining area and then simulate the effects of pits, mounds and residual lanes on local and regional current flows. Without this information, I cannot see how a decision maker can adequately assess the hydrodynamical effects of the Proposal or its effects on existing and likely future users of the South Taranaki Bight.

36 Notably, a mound of 8-9 m height will have a profound effect on the local hydrodynamics in water of 30-40 m depth. Depending on shape and dimensions of a mound with respect to the axis of flow, a localised increase in current speed of 25-35% would be a reasonable expectation. Such effects have not been considered in the evidence presented by TTRL. In my opinion, this is an omission that brings into question the derivative uses of the hydrodynamics - such as mound deflation calculations, or the operating conditions for the mining plant.

My assessment - waves

37 Regarding the wave modelling methods utilised by TTRL's experts in the Application[9] I am of the view they are fit for purpose, and the results are sensible for the far field coastal impact use case.

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8 Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015).

9 Ibid.

However, the modelling results remain entirely subject to the key assumptions regarding the size of pits and mounds, and the uniformity of the lanes.

38 If the magnitude of those features changes, so too will the modelling results and the concomitant effects on nearshore wave heights. TTRL has not accounted for any potential variation in the assessments included in the Application, nor has it undertaken any sensitivity analysis that would quantify this impact.[10] Consequently, there remains potential for larger effects on the coastal wave heights if the actual mining operation leads to a less uniform pattern.

39 Another potential concern is the localised effect of wave shoaling and refraction due to the mounds, potentially giving rise to larger and more confused sea states that could compromise the navigational safety to vessels operating in the area. While the effects will be dependent on the shape and size of mounds and pits, features with a horizontal scale of 300 m and magnitudes of around 25% of the water depth will significantly modify the local wave heights, wave directions and wave-wave interference patterns.

40 This has not been modelled. Notably, the spectral wave used by NIWA and eCoast (i.e. SWAN at 100 m resolution) will not replicate these localised shoaling effects over the mounds, nor the wave interaction patterns that can give rise to confused sea states in the immediate lee of the mounds. A different type of wave model at much higher resolution is required to quantify these effects.

41 The scientific literature is unanimous regarding wave interaction with the seabed and resultant effects on navigational safety. Specifically, in shallow to intermediate water depths (as determined by wavelength), bathymetric discontinuities can create wave conditions with increased overall height, greater chance of larger individual waves (including rogue waves) and a greater range of wave directions. [11]

42 Given the potential scale of the Proposal's residual features within the mining area, it is probable that Maritime New Zealand will need to issue a Notice to Mariners regarding localised wave states to manage the risks to navigation. This would be highly relevant, for example, to a fishing vessel or a wind farm operator running Crew Transfer Vessels (CTV), who may need to avoid such areas for seakeeping.[12]

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10 Ibid.

11 See the discussion in *Maritime New Zealand v Goodhew* [2024] NZDC 12301 at the High Court in Whangarei.

12 'Seakeeping' is a technical term used to describe a ship's ability to maintain normal functions at sea.

TTRL's assessment is based on a challenging mining methodology

43 It is my considered opinion that achieving a uniform post-mined surface, as was modelled, may prove to be an unrealistic expectation in the South Taranaki offshore environment. A defining feature of the region is the misalignment of weather forces, with swell waves, wind waves, winds and ocean currents often arriving from different directions, as was also presented in the evidence of Mr Christopher Carra.[13] To illustrate, the annual roses for the waves, winds and currents at the Kupe Platform are presented in **Appendix 2**. For currents, it is notable that in the Proposal area, the IMV can expect perpendicular currents as high as 1.5 kts and beam winds frequently exceeding 35 kts.

44 If during operations the weather effects are found to be influential, alternative mining orientations may need to be developed, and that will lead to a different pattern of pits, mounds and potentially ridges and striations between lanes. A non-uniform post-mined surface has the potential to influence the nearshore wave climate, particularly if residual ridges between lanes or elongated mounds are aligned with the swell wave directions. The eight situations modelled for the Application[14] all assume a uniform seabed with a regular shaped pit and mound at the end of each lane.

EFFECTS OF THE PROPOSAL ON MOUND DEFLATION AND PIT INFILLING

Review of NIWA sediment transport modelling

45 TTRL's assessment of mound deflation and pit infilling is based on NIWA sediment transport modelling.

46 Marine sediments become entrained when the particles are no longer supported by intergranular forces. The threshold for entrainment is highly dependent on (i) the grain size, (ii) the density difference between seawater and sediment, and (iii) the hydraulic roughness of the seabed. All three parameters need to be set in the model to ensure the local environment is correctly represented. They form the basis of the equations that underpin the volumetric bedload transport rates and wave-induced skin friction, thereby dominating the physics of entrainment and subsequent transport.

47 The NIWA modelling for pit infilling and mound deflation[15] has made significant and consequential errors in applying all three of these

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13 Carra, C., (24 January 2017). Expert evidence of Christopher John Carra for Origin Energy Resources Kupe NZ Ltd on behalf of the Kupe Joint Venture Parties.

14 Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015).

15 Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction

important parameters. In my opinion, these are fundamental limitations that undermine confidence in the model predictions. Each of these limitations is set out in further detail below.

Context

48 While TTRL has provided a spatial description of the surficial sediment characteristics in the proposed prospecting area, a key outcome of the mining operation is the redistribution of subsurface materials. Accordingly, a description of the expected vertical structure in terms of grain size and density should also be provided. Consideration should also be given to whether the de-ored sediment is expected to differ in density and size from the original surface sediments. TTRL has made more than 800 sediment cores while prospecting in the wider area but has not provided a summary of how the surficial sediments compare with subsurface sediments. This comparison is important because the Proposal involves exposing this subsurface material.

49 Mineralogy is also important because the heavy minerals are typically associated with finer particles, likely due to weathering of the volcanic source rocks.[16] The ratio of heavy (augite, opaques and horneblend) and light minerals (feldspar and composites) can inform an understanding of source and transport pathways.

50 The historical facies map provided in Report 11c[17] indicates that a wide range of sediment types exist within the Proposal area – gravelly muds, gravelly sands, dunes 3-12 m high and gravelly muds over relict dunes.

51 The Proposal area is characterised by relict dunes and iron sand ridges that are remnant coastal features formed during times of lower sea level - analogous to the morphology of the present-day Farewell Spit. As sea level rose during the Holocene, the coastal dunes were submerged, and new features were formed at the new shorelines. Accordingly, many of the historical shoreline features remain today, but with relatively minor changes caused by modern day process, such as infilling and erosion. However, despite existing within a high energy wave climate with strong currents, these large-scale features have proved to be remarkably resilient to at least 7,000 years of oceanic processes.

52 Figure 1 in Appendix 2 to this statement of evidence presents the regional bathymetry at high resolution (defined in previous

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on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015).

16 Anthony J. Gow (1967) Petrographic studies of ironsands and associated sediments near Hawera, South Taranaki, New Zealand Journal of Geology and Geophysics, 10:3, 675-696, DOI: 10.1080/00288306.1967.10431086.

17 Report 11c – appendix C, '3.5 kHz seismic acoustic facies maps with sediment sample locations'.

studies[18]), along with the Kupe WHP and the TTRL permit polygon. Also shown is a dashed line where a depth profile has been extracted (Figure 2), illustrating the complex seabed morphology. Figure 3 is a histogram of depth within the Proposal area (range 23 to 48 m).

(i) Density difference between seawater and sediment

53 The governing sediment transport equations used by NIWA in their modelling to support the Application (i.e. bed load and suspended load) have adopted a standard quartz sand density of 2650 kg/m^3.[19]

54 This value does not represent heavy mineral sands. For example, Bartholomeusz (1985)[20] measured 4800 kg/m^3 at New Plymouth while the recent study of the Manukau Harbour entrance by MetOcean Solutions (2024)[21] used 3000 kg/m^3 in their numerical modelling of channel infilling. For well sorted medium sands, McComb (2001)[22] used 2850 kg/m^3 when tuning black volcanic sand entrainment equations against suspended sediment observations.

55 The use of a quartz sand density instead of a realistic black sand density is a bias that propagates through all the subsequent estimates of transport and the associated predictions of seabed remediation rates.

(ii) Grain size

56 The NIWA model relies on median grain sizes measured at just two sites within the Proposal area (sites 7 and 10 in 31 and 42 m depth, respectively). The third site used (site 6) is 6.5 km east of the Proposal area but was used as a proxy for 23 m depth.

57 The grain size analysis presented in Figure 3-3 on p36 of Report 5[23] suggests the area is dominated by fine to medium sand, which is a

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[18] Oceanum (2022). Metocean DataCube for the South Taranaki Bight, New Zealand. An open-access technical resource for offshore wind energy resource evaluation, facilities development, and environmental effects assessments. TN22-08 prepared by Guedes, Durrant, McComb Zynfogel and Ewans.

[19] Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015), p104.

[20] Bartholomeusz, W.G., 1985. Beach and nearshore sediment data for the New Plymouth beach restoration study. Central Laboratories Report 2-85/11. MWD, Lower Hutt. 59 p.

[21] MetOcean Solutions (2024). Manukau Harbour Numerical Modelling. Sediment Transport Report prepared for Tonkin & Taylor, June 2024.

[22] McComb, P. (2001). Coastal and sediment dynamics in a high-energy, rocky environment (Thesis, Doctor of Philosophy (PhD)). The University of Waikato, Hamilton, New Zealand.

[23] Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015). Report 39 - Mead. S., eCoast Marine. 2013. 'Potential Effects of Trans-Tasman Resources Mining Operations on Surfing Breaks in the Southern Taranaki Bight', 21 July 2013 (updated November 2015).

generic classification that extends from 0.125 to 0.50 mm. No evidence is presented to support using just 0.20 and 0.29 mm to represent median grain size over the entire Proposal area, and it is an open question as to the influence of local morphology on site specific grain size. For example, the site 7 seabed photo in Figure 3-56 of MacDonald[24] shows adjacent patches of coarse sand and fine sand.

58 I note that Report 11c details six archived seabed samples from immediately adjacent to and within the Proposal area (named as W97, J337, Z898, S1161, S1162, C181 in Report 11a). Three of these samples are described as medium sand (0.250-0.500 mm), two are fine sand (0.125-0.250 mm) and one is gravel. The spatial distribution of median grain size from this limited dataset does not exhibit systematic stratification by depth, suggesting texture is highly variable across the Proposal area - possibly reflecting the local-scale morphology and underlying substrata.

59 Regarding the latter, based on the evidence presented by TTRL, there is no way of knowing if the subsurface sediments dredged from up to 10 m below seabed will have the same textural and mineral characteristics as the present-day surface materials. The NIWA modelling assumes that grain size won't change, but no evidence or discussion to support this assumption is provided.

60 Because grain size has such an important influence on predictions of entrainment and transport, a more robust approach would be to either (i) make a statistically reliable survey of grain size that is stratified by depth and morphology or (ii) model the range of expected grain size distributions and present results as upper and lower bounds. Neither approach was taken, which reduces confidence in the model predictions.

61 ***(iii) Bedforms and the hydraulic roughness of the seabed***
Bedforms have an even greater effect on modelled sediment transport rates than grain size. Ripples that form on the seabed (due to stirring by waves and currents) create a hydraulic roughness that enhances sediment suspension by the waves and currents. Therefore, the amplitude of the ripples is an important parameter, and the NIWA model requires a manual setting of this.

62 Ripple estimates from within the Proposal area (sites 7 and 10) and 6.5 km to the east in 23 m depth (site 6) were used. At sites 6 and 10 the ripple height was 2 cm, while at site 7, a height of 12 cm was used.

63 In my opinion, 2 cm ripple heights for the model are reasonable, but the value of 12 cm is an anomalously high value to impose as a

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[24] Report 12 - MacDonald, I., Budd, R., Bremner, D., Edhouse, S. 2012. 'South Taranaki Bight Iron Sand Mining: Oceanographic measurements data report' NIWA Client Report No: HAM2012-147 (updated November 2015).

global setting. It appears biased to a single observation where a localised patch of coarse sand lies adjacent to finer material - per the seabed photo at site 7 (referenced at paragraph 33 above). Accordingly, in my opinion the model results for 35 m depth will be an overprediction and should not be considered representative of that depth.

64 This view is supported by the derivation by NIWA of *X* in Equation 6.23.[25] *X* is a slope correction term that attempts to account for flow acceleration over ripples. The empirically derived value of 0.02 at for site 7 is inconsistent with 12 cm bedforms. Note also the dominance of sediment density and grain size in Equation 6.23, which implies that that the values used for X are correcting for other bias.

Conclusion

65 The NIWA model estimates of pit infilling and mound deflation rates are highly dependent on the key assumptions made regarding grain size, sediment density and hydraulic roughness of the seabed. In my opinion the assumptions made by NIWA are not reasonable and will result in a significant overprediction of the rates of pit infilling and mound deflation.

TTRL's assessment

66 TTRL states in section 5.4.2.4 of the Fast-track Act Application that "*for a 10 m deep pit and a 9 m high mound, at 35 m water depth, it will take approximately 100 years for waves and currents to reduce the pit volume by 90% and 20 years for the mounds to be reduced by 90%.*"

My assessment

67 The marine sediments in the Proposal area were slowly deposited by the coastal and oceanic processes over thousands of years, which has led to certain grain size distributions and levels of compaction, forming a seabed with inherent structural integrity. This structural integrity is evidenced by the enduring relict coastal features that characterise the region, clearly shown in Figure 2 of Appendix 2.

68 The prediction of a 10 m pit in 35 m depth becoming 90% infilled after ~100 years is misaligned with the contemporary geological history. This region is known as The Rolling Ground and is characterised by bathymetric undulations that have endured 7,000 years of energetic oceanic conditions. If the magnitude of transport being predicted by NIWA was occurring, it would be reasonable to expect more of these features to have become smoothed out over time, rather than prevailing as they have.

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[25] Report 5 – Hume, T., Gorman, R., Green, M., MacDonald, I. 'Coastal stability in the South Taranaki Bight - Phase 2 Potential effects of offshore sand extraction on physical drivers and coastal stability'. NIWA Client Report No: HAM2013-082, October 2013 (updated November 2015), p109.

69 More specifically, for pit infilling to occur there needs to be a source of sediment, and the modelling assumes this will be from the adjacent seabed - without any supply limitation. For this to be realised, the adjacent surficial sediments need to be unconsolidated and available for active transport by waves and currents. Even under those circumstances, van Rijn (2005)[26] notes that for pits in >25 m water depth, infilling only occurs during super storms. I note that the proposed mining operational plan does not locate the mounds adjacent to the pits, with mounds positioned at the southwest end of the operational area and pits at the northeast end.[27] So, the unconsolidated de-ored sediments cannot be considered a direct source for pit infilling.

70 In my opinion the quantitative estimates of pit infilling derived from the NIWA model need to be considered with due caution because; (i) the bedform information used at 35 m depth is probably not representative, (ii) the sediment density is incorrect, (iii) sensitivity analysis for grain size has not been undertaken. Further, arbitrary scaling factors (i.e. X in paragraph 62) may have been applied to correct for inherent bias. Also, it has been assumed, without evidence, that the seabed adjacent to the pits is unconsolidated and provides an unlimited sediment supply. Such errors and assumptions ultimately undermine confidence in the model predictions.

71 Similar conclusions can be made regarding the use of the model to predict mound deflation. Of consequence too is the assumption that grain size will be conserved, so that a mound of redistributed material from up to 10 m below seabed will have the same textural character as the present-day surface. Also, in my opinion it is inappropriate to globally impose 12 cm bedforms on a future mound without strong supporting evidence.

72 The NIWA model predictions are not consistent with decades of bathymetric survey data from the offshore disposal ground at Port Taranaki. Here, a persistent disposal mound of fine to medium sand has been present since the 1960s, despite exposure to an energetic wave climate and strong coastal currents. Recent analytical and numerical studies undertaken by Oceanum (2024)[28] confirm that dredged coastal marine sediments of volcanic origin are very stable when placed in this ground in water depths exceeding 25 m. In 30 m depth, the threshold for entrainment of 0.225 mm black volcanic sand is only ever exceeded during the largest of storms.

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[26] van Rijn, L.C., Soulsby, R.L., Hoekstra, P., Davies, A.G. (2005) SANDPIT. Sand transport and morphology of offshore sand mining pits. *Process knowledge and guidelines for coastal management*. Aqua Publications, The Netherlands: 716.

[27] Fast-track Application for Trans-Tasman Resources Limited Taranaki VTM Project (15 April 2025), section 5.4.2.2, p158.

[28] Oceanum (2024). Port Taranaki Dredging Consent Renewal Studies. Report One - Disposal Ground Selection. A report prepared for Port Taranaki Ltd (currently under review by Taranaki Regional Council).

73 It is informative to compare loss rates at Port Taranaki with the NIWA predictions for 20 m depth. At Port Taranaki a relict mound in 15-20 m depth showed net deflation equivalent to ~10,000 m^3/year over a 20-year monitoring period. The mounds modelled by NIWA were 300 x 300 x 10 m, which is a volume of 900,000 m^3. To deflate by 90% over 22 years is equivalent to an annualised loss rate of 37,000 m^3/year – nearly four times faster than that measured at Port Taranaki.

74 Note that the Port Taranaki site is in shallower water (15-20 m compared with 20 m) and has a slightly less energetic wave climate (i.e. the 99^{th} percentile significant wave height in July is 4.38 m at Port Taranaki compared with 4.63 m the TTRL 20 m site, see Figure 5 in Appendix 2). For the same wave climate, a shallower location will have a much higher deflation rate, so the two sites are broadly comparable.

75 The scientific literature accepts that even well-tuned sediment transport model predictions can be wrong in either over-prediction or under-prediction by a factor of 5 or more.[29] In my opinion, the NIWA model provides results that are inconsistent with regional observations and produce unrealistic over prediction of the rates of mound deflation and pit infilling. Consequently, natural remediation will take much longer than TTRL asserts.

76 I estimate that infilling and deflation for the shallow parts of the Proposal area will be at least 5 times longer than predicted by the NIWA modelling. In the deeper parts of the Proposal area, it is highly probable that natural remediation will not be effective, and changes to the morphology will be essentially permanent (i.e. persist beyond 1000 years).

CONCLUSIONS

77 The Proposal will have adverse impacts on seabed morphology, waves and currents. The post-mining morphology of the seabed remains uncertain, which leads to uncertainty in the predicted wave and current effects. TTRL has understated length of time required to naturally remediate the pits and mounds created by mining. Relying on natural processes to remediate these deformations has the potential to lock in many centuries of impact.

Peter McComb
3 October 2025

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[29] van Rijn, L.C., Soulsby, R.L., Hoekstra, P., Davies, A.G. (2005) SANDPIT. Sand transport and morphology of offshore sand mining pits. Process knowledge and guidelines for coastal management. Aqua Publications, The Netherlands: 716.

APPENDIX 1 – DOCUMENTS REVIEWED

1 From the Application:

1.1 The parts of the Application relating to sedimentation and ocean dynamics.

1.2 The proposed marine consent conditions relating to sedimentation and ocean dynamics.

1.3 Report 12 – MacDonald, I.T., Budd, R., Bremner, D., Edhouse, S. 2012. 'South Bight Iron Sand Mining: Oceanographic Measurements Data Report'. NIWA Client Report HAM2012–147, August 2012 (updated November 2015).

1.4 Report 11 – Orpin A.R, 2013. 'Geological Desktop Summary Active Permit areas 50753 (55581), 54068 and 54272, South Taranaki Bight'. NIWA Client Report No: WLG2013-44, August 2013 (updated November 2015).

1.5 Report 39 - Mead. S. 2013. 'Potential Effects of Trans-Tasman Resources Mining Operations on Surfing Breaks in the Southern Taranaki Bight'. eCoast, October 2013 (updated November 2015).

2 Other documents from previous TTRL hearing processes:

2.1 Expert evidence of Dr Iain MacDonald on behalf of TTRL, 17 December 2017.

2.2 Macdonald, H. Hadfield, M. 2017. South Taranaki Bight Sediment Plume Modelling: Worst Case Scenario. NIWA client report 2017049WN for Trans-Tasman Resources.

2.3 Joint Statement of Experts in the Field of Sediment Plume Modelling. Dated 13 February 2017.

2.4 Joint Statement of Experts in the Fields of Sediment Plume Modelling and Effects on Benthic Ecology. Dated 23 February 2024.

2.5 Joint Statement of Experts in the Field of Sediment Plume Modelling – Setting Worst Case Parameter. Dated 23rd February 2017.

2.6 Hadfield, M. and Macdonald, H. 2015. Sediment Plume Modelling. Prepared for Trans-Tasman Resources Ltd. NIWA Client Report No: WLG2015-22.

2.7 Hume, T., Gorman, R., Green, M. & MacDonald, I. 2015. Coastal stability in the South Taranaki Bight- Phase 2 – Potential effects of offshore sand extraction on physical

drivers and coastal stability. NIWA Client report: HAM2013-083. Updated November 2015.

2.8 HR Wallingford, 2015. Support to Trans-Tasman Resources – Source terms and sediment properties for plume dispersion modelling, October 2015.

2.9 HR Wallingford, 2017. Support to Trans-Tasman Resources – Worst case scenario sediment plume modelling, October 2015.

APPENDIX 2 – ENVIRONMENTAL STATISTICS

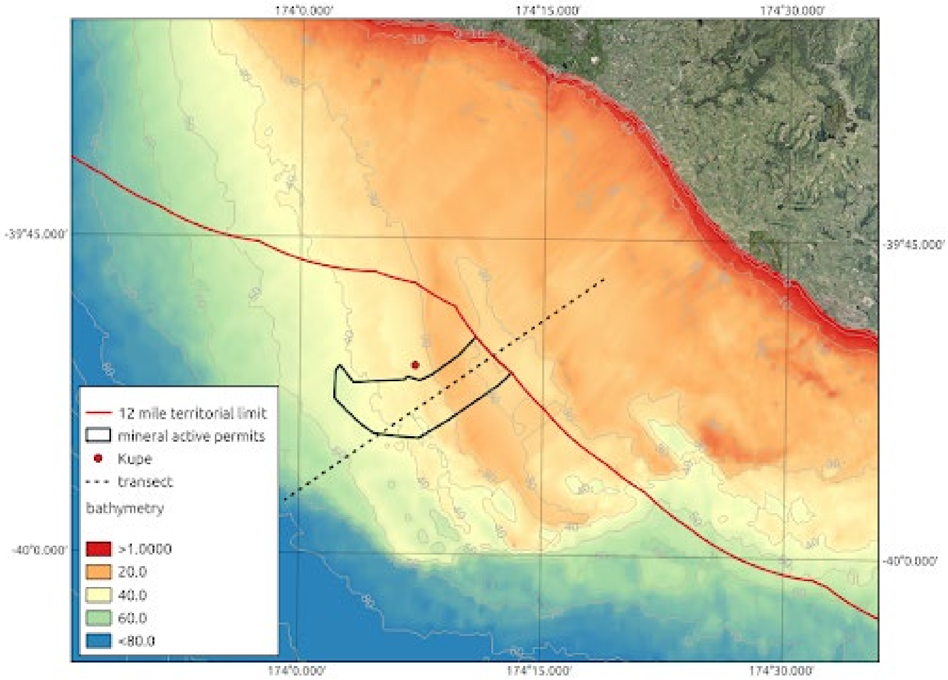

Figure 1 Bathymetric map showing the Kupe WHP (red dot) and the TTRL Proposal area (black outline). The dashed line is the location of a bathymetry transect.

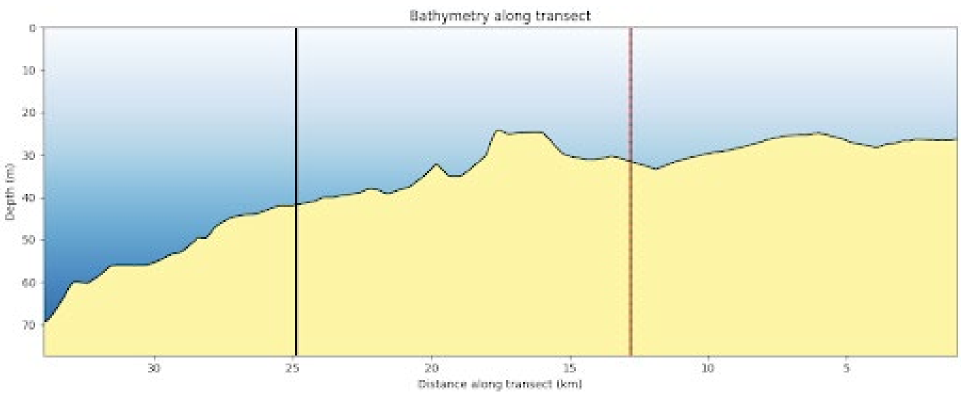

Figure 2 Depth profile along the dashed transect in Figure 1, denoting the 12 nm limit (red vertical line) and edge of the Proposal area (black vertical line).

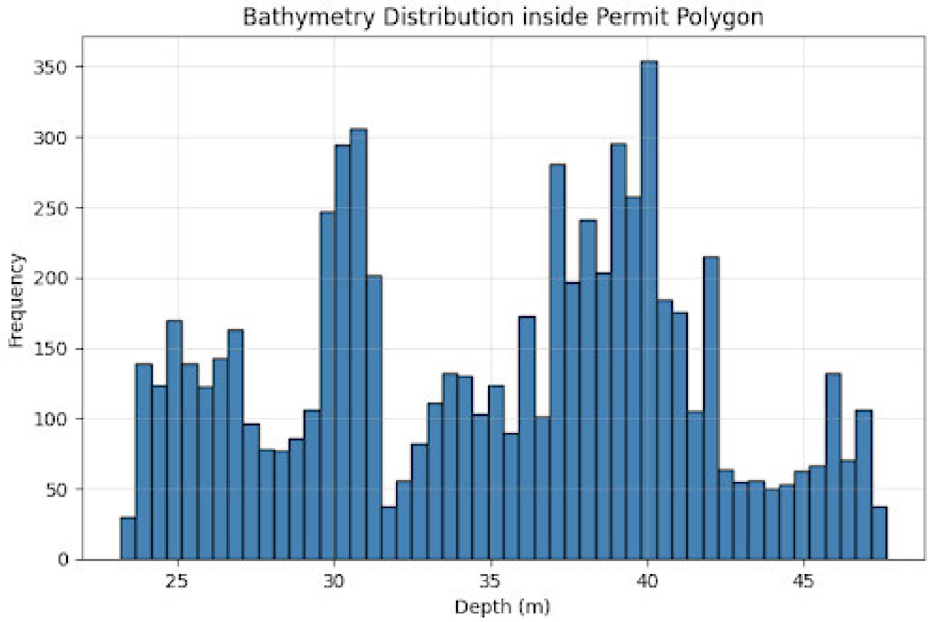

Figure 3 Histogram of bathymetry within the Proposal area. The mean depth is 35.07 m and the standard deviation is 6.28 m. The bathymetry ranges from 23.20 m to 47.62 m.

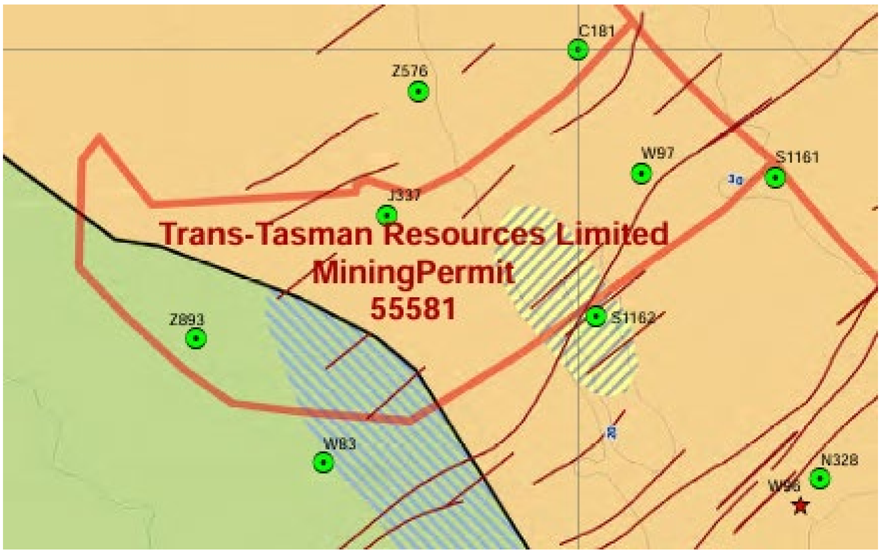

Figure 4 Subset of the facies map from Report 11c, showing the archived sediment samples within and adjacent to the Proposal area.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
p99	3.74	3.67	3.88	3.99	4.48	4.54	4.63	4.37	4.53	4.34	4.10	3.63
p95	2.97	2.80	2.98	3.12	3.67	3.58	3.68	3.46	3.61	3.56	3.28	2.96
p90	2.56	2.35	2.59	2.71	3.22	3.13	3.20	3.04	3.16	3.13	2.88	2.57
p50	1.41	1.32	1.40	1.49	1.69	1.76	1.78	1.79	1.87	1.84	1.67	1.47
p10	0.74	0.71	0.76	0.83	0.92	1.00	0.95	1.04	1.05	0.97	0.87	0.81
mean	1.55	1.45	1.56	1.65	1.90	1.94	1.95	1.93	2.01	1.97	1.79	1.60

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
p99	3.23	3.16	3.19	3.50	3.88	4.18	4.38	4.00	4.08	3.90	3.63	3.15
p95	2.42	2.26	2.43	2.64	3.23	3.20	3.38	3.24	3.24	3.12	2.71	2.46
p90	2.02	1.87	2.06	2.25	2.81	2.79	2.87	2.80	2.79	2.69	2.37	2.14
p50	1.02	0.95	1.03	1.17	1.40	1.46	1.48	1.55	1.55	1.52	1.27	1.16
p10	0.57	0.56	0.59	0.64	0.72	0.75	0.74	0.81	0.83	0.78	0.65	0.64
mean	1.19	1.11	1.20	1.34	1.59	1.64	1.66	1.70	1.71	1.64	1.42	1.29

Figure 5 Significant wave height statistics (m) for 23 m depth in the Proposal area (upper) and at the 20 m depth contour in the Port Taranaki offshore disposal ground (lower).

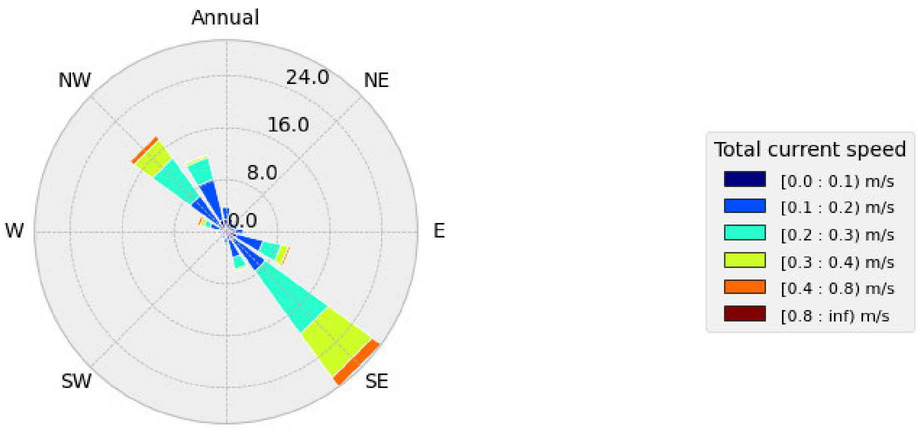

Figure 6 Depth-averaged current roses for the seasonal and annual conditions (combined tidal and non-tidal flow) at the Kupe WHP. Note, directions are shown in the 'going to' convention.

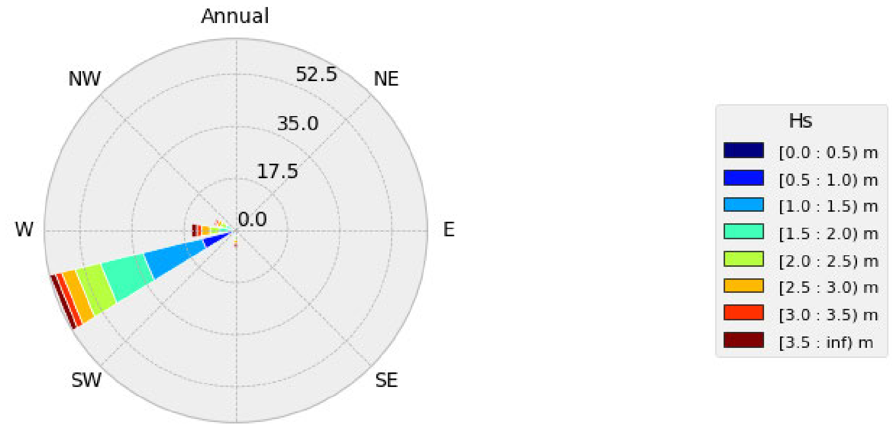

Figure 7 Wave roses for the seasonal and annual conditions at the Kupe WHP.

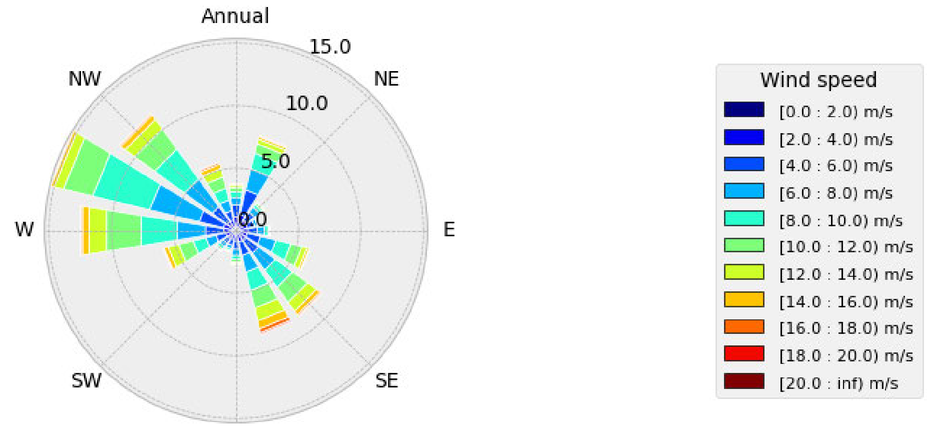

Figure 8 Wind roses for the seasonal and annual conditions at the Kupe WHP.