BEFORE THE HEARING COMMISSIONERS
NAPIER

IN THE MATTER	of the Resource Management Act 1991 (the Act)
AND	
IN THE MATTER	of applications by Port of Napier Limited to undertake wharf expansion, associated capital and maintenance dredging, disposal of dredged material within the coastal marine area, and occupation of the coastal marine area for existing port activities and the proposed new wharf

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STATEMENT OF EVIDENCE OF IAN ROSS SNEDDON

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INTRODUCTION

Qualifications and experience

1. My name is Ian Ross Sneddon.

2. I hold a Master of Science in water pollution control from Middlesex University, London and a Bachelor's degree in chemical and materials engineering from Auckland University. I am a member of the New Zealand Coastal Society, a technical group associated with the Institution of Professional Engineers New Zealand (IPENZ).

3. I am currently an Environmental Scientist at the Cawthron Institute (*Cawthron*), in Nelson. I have held this position for 15 years and have focused primarily on the assessment of ecological effects from physical and chemical stressors associated with discharges to, and developments within, the Coastal Marine Area. My work has included investigations into the effects on marine ecology from dredging and dredge spoil disposal for the ports of Nelson, Marlborough, Napier and Lyttelton.

1. I was lead author of the assessment report on marine ecology which was included in Port of Napier Limited's (*PONL*) application for resource consents to undertake wharf expansion, associated capital and maintenance dredging, and disposal of dredged material (*Applications*).

2. The marine ecology report is entitled Assessment of Effects on Benthic Ecology and Fisheries Resources from Proposed Dredging and Dredge Spoil Disposal for Napier Port and it was Appendix H (Volume 3) to the Applications (Marine Ecology Report).

Involvement in project

3. My involvement with the project goes back to 2004-2005 when the first field investigations for an earlier version of the No.6 Berth Project were conducted. I was further involved in collection and interpretation of hydrodynamic and water quality data until 2009. I was lead investigator for renewed ecological fieldwork for the project conducted in April 2016, primarily focussing on Pania Reef. In addition, I have conducted investigations monitoring the effects of dredged material disposal off Westshore Beach in 2004 and 2018. The most recent assessment involved the analysis of a five-survey

ecological and sediment texture data-set covering the period 1997 to 2018.

Expert Witness Code of Conduct

4. I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note dated 1 December 2014. I have read and agree to comply with that Code. 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 that I express.

Purpose and scope of evidence

5. This evidence is divided into two parts. Part 1 consists of a summary of the approach and findings of the Marine Ecology Report, and Part 2 comprises responses to issues of marine ecology and fisheries raised by submitters on the Applications and the section 42A report.

6. The Marine Ecology Report covered:

   (a) The characterisation of the marine receiving environment and benthic ecology in the vicinity of the proposed project from our own field surveys and instrument deployments, and a range of other data sources;

   (b) Description of the fisheries resources occurring within the inshore and nearshore waters of Hawke Bay from the fisheries and scientific literature and catch data held by the Ministry for Primary Industries (MPI);

   (c) Consideration of the principal physical and chemical stressors potentially associated with the Project and assessment of the relative sensitivity of ecological receptors to them;

   (d) Interpretation of the sediment plume and sediment dynamics modelling reports produced by Advisian Pty Ltd (Advisian 2017a,b)[1] with regard to potential marine ecological effects;

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[1] Advisian 2017a. Napier Port Proposed Wharf and Dredging Project: Dredge Plume Modelling, 1st June 2017. Report No 301015--03651--003. 55p.

(e) Assessment of the likely and potential effects from the Project on marine ecological receptors including soft-sediment benthos, reef communities and fisheries resources;

(f) Considerations and recommendations for monitoring and management of effects before, during and following the Project.

Summary of conclusions

7. I summarise my key conclusions as follows:

(a) Dredging and spoil disposal activities will result in the effective loss of benthic communities within the spatial footprint of those activities, but ecological recovery of these areas following completion will be rapid.

(b) The principal mechanism by which far-field ecological receptors may potentially be impacted is via the propagation of turbidity plumes associated with dredging and spoil disposal but these will not exceed the tolerance of benthic communities beyond a short distance from the source.

(c) Plumes at the levels predicted by hydrodynamic modelling will not result in measurable ecological or sedimentation effects at Pania Reef. Any effects at shoreline reefs will also be within the natural range of conditions experienced at these locations.

(d) Effects on recreational or commercial fisheries species will be temporary and spatially limited to the immediate areas of physical disturbance. Any flow-on effects to stocks within the wider Bay will be minimal.

(e) I consider that the monitoring described in the Port's proposed conditions of consent and draft Water Quality Management Plan (WQMP) will enable detection of any significant unforeseen effects and allow timely and effective management response.

Advisian 2017b. Napier Port Proposed Wharf and Dredging Project: Post-disposal fate of dredged sediments 19 May 2017. Report No. 301015-03651-CS-004. 75p.

APPROACH AND METHODOLOGY

8. The field survey work upon which much of the assessment was based was conducted over two periods. The first was in 2004/2005, during which much of the investigation into soft-sediment benthic and shoreline reef habitats was completed. The second was in 2016, to validate the earlier survey data with limited further benthic sampling and to more comprehensively characterise the hard-substrate communities of Pania Reef.

9. The information from these field surveys was compiled with that from several other surveys conducted within the area over the past decade, including five-yearly surveys of the seabed off Westshore Beach conducted as part of the Port's maintenance dredging consent.

10. The principal aims were to:

    (a) Characterise the benthic substrate and ecology existing in the immediate vicinity of the areas proposed for capital dredging and offshore disposal of dredged material;

    (b) Characterise the far-field shoreline and offshore reef communities; and

    (c) Establish whether any benthic habitats or communities of special scientific or conservation interest exist in the vicinity of the proposed activities.

11. In establishing the information needs of our current assessment in 2016, careful consideration was given to the age of the extensive ecological data collected in 2004-2005. Benthic data from surveys of the Port's existing disposal areas indicated that temporal variability exceeded spatial variability over extensive areas of similar substrates. However, we considered it extremely unlikely that changes over time in such a dynamic benthic environment would comprise an increase in ecological value that was not at the same time reflected in the very large area of similar benthic habitats outside the footprint of the activity.

12. The use of the offshore disposal area was not part of PONL's proposal at the time this fieldwork was conducted, so was not included as a factor in the design of our survey work.

13. The continuing disturbance of the Fairway benthic habitat in the form of vessel traffic and episodic maintenance

dredging was also a factor in the decision to validate these assumptions with only limited additional sampling of the outer Fairway benthos in 2016. The emphasis in these more recent surveys was on expanding the survey data of Pania Reef as a key sensitive ecological receptor.

14. Overall, the surveys used the following methods:

(a) Samples of benthic sediments and sediment communities were collected by divers from an array of 90 pre-established seabed stations covering an area of approximately 650 ha in water depths from 4 m to 23 m[2]. Any direct observations of substratum and biota were also recorded.

(b) An epifaunal research dredge was used for 21 trawls to sample the epibiota[3] occurring over the same areas covered by the sample stations.

(c) Broad-scale imaging of the seabed near the Port and within the proposed offshore disposal area using side-scan sonar.

(d) Low-tide semi-quantitative surveys of conspicuous intertidal biota and communities on shoreline reef and introduced hard substrates.

(e) Diver photoquadrat[4], video and ecological data collection along eight transects at Pania Reef and in areas of mixed benthic substrates near the Port.

(f) Remote-operated underwater drop-video transects at Pania Reef.

(g) Collection and analysis of a series of surface and seabed water samples at the inshore and offshore limits of Pania Reef over a two-month period to gain an indication of suspended solids concentrations.

(h) Longer-term deployment of two telemetered buoy stations measuring continuous turbidity (NTU) and salinity in surface waters near Pania Reef.

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[2] Data from a further 47 sample stations was available from each of four five-yearly surveys conducted off Westshore Beach.

[3] Larger animals and plants occurring on the sediment surface.

[4] Photoquadrats allow the photographer to restrict the frame to a fixed area of seabed, facilitating the use of the images for later quantitative analysis.

15. In addition, a multi-beam echo-sounder survey was commissioned to provide a fine-scale bathymetric map of Pania Reef.

THE MARINE RECEIVING ENVIRONMENT AND SURVEY FINDINGS

16. Hydrodynamic data collected within the vicinity of Napier has indicated relatively weak tidal influences. There has been evidence of a generally south-east setting flow which is frequently over-ridden by wind-forcing. Consequently, the greatest surface current velocities are typically aligned with the direction of significant wind fields.

17. The Port approach channel and adjacent waters lie offshore from a moderate- to high-energy shoreline with significant wave exposure a characteristic of the coast to the north and south.

Soft sediment benthic habitats

18. The majority of the shallow coastal seabed surrounding the Port comprises mobile sands that are subject to continual movement and redistribution through wave action. Sediments within the Port approaches are predominantly composed of fine and very fine sands with a smaller silt component. A slightly greater silt fraction was characteristic of the Fairway areas that have been subject to maintenance dredging.

19. Sediment macrofaunal communities are dominated by polychaete and nemertean worms, amphipods, cumaceans and ostracods. Several species of bivalve molluscs are also present but at low densities. Although differences in community structure are observable for areas that have been subject to maintenance dredging, these are mostly shifts in relative dominance with the same types of organisms represented, and predominantly the same species.

20. Areas offshore from Westshore Beach have been well-characterised by 5-yearly monitoring required by PONL's existing consent for disposal of dredged material. The seabed both within and outside of the established disposal grounds comprises sediments very similar to those within the Port approaches and supporting benthic communities of similar structure. Although the surveys required by the consent have been conducted following a range of recovery times (post deposition), they have consistently shown very little difference in communities compared to a

nearby control area. This demonstrates rapid recovery following disturbance as a result of the naturally dynamic nature of this environment.

21. The proposed offshore disposal area is located 3.3 km south-east of Pania Reef in an area comprised of homogeneous soft sediments; these again being predominantly fine and very fine silty sands. The bathymetry is relatively flat, gently sloping offshore in 20-23 m water depth and there are no significant high-relief features.

Reef habitats

22. The presence of the Port and breakwater confers some shelter to shoreline areas immediately to the west. In particular, the main Port reclamation has created a small semi-sheltered embayment. Much of the time it is subject to only limited wave action but experiences periodic flushing and disturbance from storm and swell events. Shoreline and shallow subtidal substrates of much of the area between the Port and Ahuriri Inlet comprise natural and introduced boulder and cobble material which may extend up to 100 m seawards in the west embayment.

23. Town and Pania reefs are disparate parts of a formerly continuous reef system that begins at the base of the main port breakwater and continues as a broken linear series of banks and pinnacles extending approximately 4 km offshore in a north-easterly direction. Pania Reef is the major seabed feature in southern Hawke Bay. Water depths over the Reef range from 3 m at Pania Rock to approximately 20 m where it meets the sand at its northern extremity. Its location makes it highly exposed to oceanic swells entering Hawke Bay as well as locally generated wind chop.

24. The eight survey transects along the length of Pania Reef showed that Reef communities varied along gradients of depth, water movement and sedimentation. Diver observations and the survey photographic record suggest that fine sediment deposition is a significant ongoing process on the Reef, with the inshore and deeper sections most affected.

THE HAWKE BAY INSHORE FISHERY

25. The inshore waters of Hawke Bay support a range of demersal and pelagic fish species, all of which are widespread in occurrence throughout the region and

nationally. The 50 m depth contour is approximately 21 km offshore from the Port of Napier, well beyond the expected range of significant turbidity plumes from the dredging and disposal operations. Hence, although species occurring across the entirety of Hawke Bay were considered, the assessment focussed on those whose major aggregations occur within the 30 m contour or where such shallower depths may be important to one or more life stages or migratory behaviours.

26. The principal inshore fisheries species for which shallower inshore habitats are likely to be important include flatfish, gurnard, tarakihi and snapper. However, some other species less prevalent in commercial catch data also occur in near-shore areas, including elephant fish, rig and school shark.

27. Trawling effort for flatfish appears to be concentrated in nearshore areas running south from Napier, whereas gurnard is targeted in depths ranging from the near shore out to the 100 m depth contour. In contrast, bottom trawl effort for tarakihi occurs mostly beyond the 100 m contour. The targeted snapper fishery is mainly north of East Cape, but within Hawke Bay, bottom trawling for this species occurs in an area of the southern Bay in around 50 m water depths from Napier to Cape Kidnappers. These ranges make flatfish and possibly gurnard the commercial finfish species of primary concern for possible effects from the Project.

28. A data extract from MPI's warehau fisheries database for the years 2012-2015 indicated that the flatfish catch was relatively concentrated within inshore waters of the south-western part of the Bay with a secondary catch concentration in the north near Wairoa. Approximately 70% of the total catch of flatfish for the Bay came from an area stretching from Cape Kidnappers to 7 Nm north of Napier port, most of this being from the coastal area south of Pania Reef and offshore from Hastings.

29. Catches aggregated for ten important commercial finfish species[5] for the same data extract showed that landed catch weight for the period was relatively evenly distributed across Hawke Bay. The data indicated that the waters within

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[5] Red cod, Tarakihi, Gurnard, Blue moki, Trevally, Snapper, School shark, Elephant fish, Rig and Rough skate.

six nautical miles of the Port are not relatively more important for catches of these species.

30. As well as finfish, locally important invertebrate fisheries species include paua, rock lobster and paddle crab. Paua and rock lobster are limited to reef habitats although Paua were not identified from our dive surveys of Pania Reef. Paddle crab are widespread over near-shore soft sediment habitats and have represented a significant if variable local fishery in the Napier area for several decades.

31. All seven of the surf clam species listed in the Quota Management System have been recorded from Hawke Bay but are as yet not commercially exploited. Data on their distribution within the Bay indicates that the only species which forms local concentrations in the Napier region is the triangle clam (*Spissula aequilatera*), although this occurs in a band which encompasses all of Southern Hawke Bay.

DIRECT IMPACTS OF DREDGING ACTIVITIES

32. The activities of dredging and disposal of dredged material have a direct impact upon the benthic areas where they are undertaken. The disturbance by these activities means that the temporary loss of all sessile[6] communities within their spatial footprint can be assumed. The environmental significance of this loss depends upon the relative size of the area affected, the ecological or other values with which it is associated and the ability of the habitat to recover.

33. Dredging will directly affect an area of 117 ha, although approximately half of this area is already affected by ongoing maintenance dredging. The size of the proposed disposal ground is approximately 342 ha. Neither of these areas supports communities that are unique or spatially limited within the wider region. I consider that the area of similar habitat throughout the inshore areas of the Bay is very extensive.

Recovery of directly impacted areas

34. Due to the high textural (and likely mineralogical) similarity of the dredged and underlying sediments to those currently making up the substrate in the Fairway and disposal ground, and the absence of ecologically significant levels of

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[6] Fixed in place on the seabed or otherwise non-mobile.

contamination, impediments to ecological recovery of these areas will be minimal. Recovery will be further aided by the already dynamic nature of these environments. However, in the case of both the dredged area and the disposal ground, the end-point of ecological recovery may differ somewhat from the original status.

35. For the extended Fairway channel, deeper water depths, finer sediment texture and ongoing disturbance from vessel traffic and maintenance dredging are likely to result in an altered benthic community, similar to that existing in the currently dredged portion of the Fairway.

36. For the disposal ground, I believe it likely that there will be textural changes associated with the deposition of stiff silt material in clump form and possibly from subsequent dispersive winnowing of fine material from the site by larger swell events. However, I consider that any changes in ecological productivity at the end-point of recovery are very unlikely to be negative and I do not consider that ecologically significant changes in community structure will persist over the longer term.

FAR-FIELD STRESSORS, WATER QUALITY AND PLUME PROPAGATION

37. The principal mechanism by which ecological receptors outside the immediate vicinity of dredging and disposal activities may be impacted is via the production of turbidity plumes and their subsequent movement with ambient currents. Such plumes may be associated with the following stressors:

(a) Increased suspended sediment in the water column

(b) Increased sedimentation (smothering)

(c) Decrease in light reaching the seabed.

Background suspended particulates and turbidity

38. Sampling of Pania Reef waters over November-December 2005 for suspended solids analysis (16 occasions, 2 locations, surface and seabed) yielded median total suspended solids (TSS) values for the southern end of the Reef of 15 mg/L at the seabed and 9 mg/L at the surface. Maximum values were 54 mg/L and 41 mg/L, respectively.

39. More recently, the Port of Napier has deployed two continuous turbidity monitoring stations to the west (inshore)

and east (offshore) of Pania Reef since April 2016 and April 2017, respectively. Ten surface samples collected adjacent to the Pania West buoy between April and October 2016 yielded median and maximum TSS values of 7.5 mg/L and 26 mg/L. This data was used to derive a relationship between naturally occurring turbidity and suspended solids.

40. The record to date for surface turbidity at these stations gives respective median and 95th percentile values of 1.4 NTU and 6.6 NTU for west Pania and 1.3 NTU and 4.7 NTU for east Pania. The data record indicates that turbidity is generally lower at the seaward monitoring buoy location but also generally variable with periods of elevated turbidity associated with specific events.

41. The application of the empirically derived correlation between turbidity and TSS results in respective estimated values for median and 95th percentile TSS of 3.4 mg/L and 11.7 mg/L for west Pania and 3.2 mg/L and 8.7 mg/L for east Pania.

Key modelling predictions

42. The assessment of potential impacts to reef areas is highly reliant upon the outputs of hydrodynamic modelling by Advisian (2017a, b). The key features of plume modelling predictions relevant to the assessment were as follows:

(a) Taking into account resuspension from wave shear, no potential was identified for net deposition of fine silts or clays over the footprint of Pania Reef for the dredging campaigns modeled[7].

(b) There was no potential for Pania Reef to be affected by increases in total suspended sediment concentrations above 10 mg/L at any time.

(c) Time-series outputs of near-surface sediment concentrations, averaged over a 500 m grid area for points at the outer, middle and inner sections of Pania Reef, indicated only isolated peaks, exceeding 1 mg/L additional to background over periods on the order of 1-2 days during the one month simulation.

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[7] The model was run for simulations of campaigns 1 and 5, to capture high overall dredging volumes and relatively greater dredging of the outer Fairway, respectively.

(d) Sediment concentrations within plumes (from both dredging and deposition sources) will be spread relatively evenly throughout the water column at far-field receptors.

(e) The greatest plume concentrations at the Reef were predicted during dredging by trailer suction hopper dredge (TSHD) when the deposition rate at the disposal area was at a maximum[8].

(f) Currents at the proposed disposal area are almost exclusively southerly, with those directed towards Pania Reef (WNW to N) occurring approximately 10% of the time.

(g) Transport of sediments resuspended from the disposal area under extreme wave and wind conditions was predicted to have only limited potential to contribute to naturally elevated suspended sediments at Pania Reef during such events.

43. The compiled turbidity and suspended solids data for the Reef suggests that background concentrations on the order of 10 mg/L may occur reasonably frequently, but also that this level may be considerably exceeded during high swell or run-off events and remain elevated for several days. Hence the relatively brief and moderate peaks predicted by the model, are unlikely to lead to adverse ecological effects at the Reef.

44. The settled sediment observed on Reef surfaces during survey dives indicates deposition from existing sources, especially at deeper points of the inshore Reef. However, the accumulation of fine particulate material exists in an equilibrium with a countervailing process of episodic resuspension and dispersion via wave energy. Hence the extent of sediment accumulation is unlikely to be particularly sensitive to small increases in fine sediment supply.

45. Town Reef and the mixed boulder/cobble shoreline west of the Port are predicted to experience sediment plumes

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[8] The duration of TSHD dredging for an individual campaign is not expected to exceed 3 weeks.

slightly greater than those at Pania Reef[9], but given the greater natural exposure to shoreline resuspension processes at these locations, I consider that the relative increase is likely to be of the same order or less.

46. While hydrodynamic modelling is outside my specific areas of expertise, I would comment that the model predictions are not inconsistent with my experience of monitoring of maintenance dredge disposal for several ports, including Napier.

ECOLOGICAL EFFECTS FROM SEDIMENT PLUMES

Effects on soft sediment benthos

47. The fine seabed sediments that are characteristic of nearshore areas of southern Hawke Bay are subject to frequent resuspension by wave-induced shear. This produces a persistent near-bed layer of high turbidity over sediment substrates, resulting in the consistently very-limited to absent underwater visibility observed by divers. The benthic communities occurring in this environment must consequently be well-adapted to sustained conditions of high suspended-sediment loadings, including the increased deposition rates which this engenders. This is consistent with the assemblages of epifauna and sediment dwelling infauna[10] identified from our sampling surveys.

48. I acknowledge that the variable but frequently turbid near-shore waters of southern Hawke Bay do not necessarily mean that communities adapted to these conditions will be unaffected by further increases in suspended sediment concentrations. However, these assemblages are likely to be more tolerant, in absolute terms, of temporarily elevated turbidity than those established in clear-water environments.

49. Based on the sediment communities identified from the surveys and on my experience in monitoring ecological effects of deposition off Westshore Beach and at other disposal grounds nationally, it is my opinion that these communities will not be measurably affected by turbidity

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[9] Plumes predicted not to exceed 10 mg/L above background at Town Reef at the 98th percentile level; *i.e.* for less than 15 hours over the month-long simulations for Campaigns 1 and 5.

[10] Small animals living within the sediment matrix.

plumes more than a short distance from the source of suspension (~500 m).

Effects on reef communities

50. The modelling outputs indicate that, where local current conditions result in sediment plumes impinging upon reef areas, concentrations will not reach levels where reef communities will experience acute stress or be sustained for long enough for chronic effects to manifest. However, the principal mechanisms by which adverse impacts from unforeseen high-strength plumes may occur include the following:

    (a) Sedimentation by settlement from the water column. However, I consider that, due to persistent wave action, settled fine sediments are very unlikely to accumulate to an ecologically significant extent on exposed shallow reef habitats in the vicinity of the Project.

    (a) Attenuation of light reaching the seabed. A reduction in photosynthetically active radiation (*PAR*), if sustained, will eventually affect the viability of algae at their deepest current extent. However, the standing biomass of macroalgae is not constant, but already varies seasonally and inter-annually based on available light and climatic factors. Hence, they are generally resilient to the effects of reduced light levels on sub-seasonal time-scales.

    (b) At very high levels of suspended sediments, there may be adverse effects to the feeding modes of some classes of organisms, particularly the more sensitive filter feeders, but also grazers if sedimentation ensues. Nonetheless, I would class the dominant habitat-forming filter feeders on Pania Reef - such as green-lipped mussels, ascidians and sponges - as species relatively tolerant of elevated suspended sediment concentrations, especially over short durations.

    (c) Abrasive or scouring effects from suspended sediments can occur in areas of high water turbulence; however, the observed levels of turbidity and the existing proximity of reef habitats to shallow sediment substrates mean that reef communities will already be quite resilient to this effect.

Effects from construction of No.6 berth

51. The site of the proposed No.6 berth is already modified by the Port reclamation structure and subject to ongoing disturbance from Port operations. The construction of the berth will occur entirely within the footprint of capital dredging and will encompass activities for which I expect marine environmental effects to be highly localised. I believe that the only potentially significant risks for ecological receptors outside the immediate vicinity are from accidental spills and discharges, which will be appropriately covered by a construction environmental management plan.

Effects on fish and fisheries resources

52. With the possible exception of Pania Reef, no benthic habitats known or suspected to be of special importance to particular fisheries species, or any of their life stages, occur within the area potentially affected by the proposed project.

53. Landed-catch data suggests that particular spatial concentrations of fishing effort do not occur in areas potentially affected by the proposed Project. While able to avoid areas of direct disturbance, the habitats preferred by benthic foraging fish species also require them to be naturally tolerant of elevated turbidity. On this basis, I consider that the principal effect on flatfish, gurnard and other inshore species will be one of temporary displacement from the relatively small areas directly impacted by the Project.

54. The additional ~60 ha of benthic area requiring future maintenance dredging will undergo some habitat alteration which will affect the benthic communities supported. This may compromise its function as a forage habitat for some species, but the area is too small to result in a measurable effect on inshore fish stocks.

55. I make the conservative assumption that the 342 ha disposal area will be lost as a foraging habitat during and immediately following each dredging stage of the Project. However, the ecological data collected for the Westshore disposal areas monitoring programme indicates that recovery of the ecological productivity of this area will be rapid.

56. Although not identified from our reef surveys, paua may occur at some shoreline locations such as Town Reef. There is

good evidence that adult paua are relatively resilient to both periodic high turbidity and sedimentation events. While larval sensitivity to sediment deposition may limit recruitment success in some situations, I think it very unlikely that fine sediment accumulation will occur to an extent and duration that would compromise paua stocks in such a wave-exposed environment.

57. Spiny lobster are resilient to elevated turbidity and I consider that the stock established on reefs in the Napier area will not be adversely affected. The long pelagic larval phase of lobster means that recruitment of juveniles is very unlikely to be affected by plumes or sedimentation at the levels predicted.

58. Both paddle crabs and juvenile sole have been routinely collected in epifaunal trawls through the near-shore disposal ground at Westshore Beach, paddle crabs also being commonly encountered by divers sampling sediments. The latest such sampling was conducted in January this year, just three months following cessation of deposition of dredged material. All of the monitoring evidence indicates that benthic communities within these areas recover very rapidly and that foragers such as flatfish and paddle crabs return quickly to the area. The disposal ground for the proposed project is deeper than the preferred foraging habitat for paddle crabs and the available information indicates that nearshore populations of this species will not be affected by the turbidity plumes predicted by modelling.

59. Similarly, I consider that surf clam populations along the shorelines of Marine Parade and Westshore beaches will not be measurably affected by turbidity plumes from the Project. Monitoring of the disposal areas off Westshore Beach shows that surf clams continue to recruit into areas at much greater proximity to the sources of such plumes than will be the case with the proposed dredging project.

MARINE BIOSECURITY

60. Although not covered by the Marine Ecology Report, issues of biosecurity were addressed in a response to a (section 92) request for further information dated 16 March 2018. For there to be a risk of transfer of Harmful Marine Organisms (HMOs) in dredged material, they would need to be present in the dredged material, but not the disposal area, and not only survive the transfer process but also establish self-

sustaining populations in the disposal area. The significance of this biosecurity risk furthermore relies on such transfer being the principal pathway by which HMO spread and establishment in the disposal area could occur. However, since the distance involved is small (~5 km), such transfer would not appreciably expedite such spread as would occur naturally. Hence, I consider that translocation of HMOs by dredging does not increase existing biosecurity risk associated with the Port.

61. I consider that the implementation of MPI's existing requirements for mitigation of biosecurity risk from ballast water and sediment (Import Health Standard – Ballast Water from All Countries [IHS]) and vessel fouling (Craft Risk Management Standard [CRMS] - mandatory from May 2018) will reduce the risk of introduction of HMOs via overseas vessels and equipment associated with the Project to an acceptable level.

MONITORING

62. The surveys, modelling and assessments conducted for the proposed Project have identified little potential for significant adverse ecological effects outside of the areas of direct disturbance. However, it is my view that the scale of the project and the inevitable areas of uncertainty in such assessments require that a robust program of environmental monitoring is established to validate the assessment findings and allow appropriate remedial action in the event of unforeseen outcomes. Practical constraints and the nature of ecological receptors dictate that such monitoring falls into two general categories:

(a) Collection of environmental data in actual or near real-time for use in adaptive management of the activity; and

(b) Direct or indirect monitoring of important receptors to provide assurance that significant adverse effects are not occurring.

Turbidity monitoring

63. As the principle mechanism by which far-field receptors may be impacted by the Project, the strength and propagation of sediment plumes are the most important effects to monitor in such a way as to allow for timely management responses during the project. Turbidity is a convenient proxy

for suspended sediments that can be measured *in situ* and the results recorded in real time. PONL's two telemetered instrument platforms continuously monitor turbidity and salinity in surface waters and this data can be compiled and analysed to better understand the nature and variability of background conditions.

64. The nature of turbidity data means that some form of smoothing must be employed to ensure that comparisons to established trigger levels remain ecologically relevant. The method most widely used for this purpose is an exponentially weighted moving average (EWMP).

65. The turbidity triggers proposed by the WQMP and the tiered response framework have been developed from the recommendations made in the Marine Ecology Report. The application of such triggers to an EWMA of the background turbidity record was presented in section 9.1.2 and Figure 47 of that report.

Ecological monitoring

66. Pania Reef has been recommended as the focus of ecological monitoring of reef communities for the following reasons:

(a) It is a unique feature of southern Hawke Bay and has high ecological, cultural and amenity value.

(b) It is located between the outer Fairway to be dredged and the disposal area and is the closest reef area to the disposal area boundary.

(c) Located offshore, it is not as frequently exposed to high turbidity from shoreline resuspension processes, so the relative elevation above background of Project sediment plumes is likely to be greater.

67. The response of reef communities to stressors such as those associated with turbidity plumes is not immediate. The time lag before observable change in these communities is manifest will be variable and confounded by the action of other drivers. Therefore, it is not practical for such monitoring to inform day to day operational decisions or to employ specific compliance triggers. However, the staged implementation proposed for the dredging project may allow management responses between stages based on the

findings of ecological monitoring where there is sufficient certainty around causality.

Disposal area benthic monitoring

68. The benthic monitoring of the disposal area proposed in the WQMP is based on the characterisation survey Cawthron conducted in 2005 and will establish the extent of recovery towards original habitat condition. However, due to the age of the (2005) survey data, I consider that it will be prudent to conduct a survey of this nature shortly prior to Stage 1 of the Project. Similarly, a repeat survey one year following cessation of (Stage 1) deposition will aid in the validation of benthic recovery time as assessed.

69. In view of the habitat conditions in the vicinity of the disposal area and the inherent tolerance to elevated suspended sediments of targeted near-shore fisheries species, I consider that the risks from Project-associated stressors to these fishery stocks are not high enough to warrant direct monitoring. The proposed benthic monitoring will establish the extent of recovery of benthic communities that constitute the principal food source of species such as gurnard and flatfish. I consider it extremely unlikely that benthic foraging fish species would not return quickly to an area where such recovery had occurred.

RESPONSES TO MATTERS RAISED IN SUBMISSIONS

70. I have read all of the submissions making reference to issues of marine ecology. I respond to a number of these issues where I feel additional explanation will be helpful in supporting the conclusions of the ecological and fisheries assessments.

71. **Chris Morris** (submission 4) claims that dredge spoil disposal near to Westshore kills off any shellfish trying to grow there.

72. Direct deposition of dredged material on the seabed will have a localized smothering effect on benthic communities and when the deposited sediment layer is large (greater than 10 cm), the loss of some species from these communities, within the disposal area boundaries, will result. However, there is no evidence that large scale effects will occur in the surrounding area well outside of these boundaries. Benthic sediments in the near-shore waters of Hawke Bay are constantly mobilized by wave shear and the silt component of these sediments results in persistent high

turbidity at the seabed in anything but very low-swell conditions. Communities living within these areas are naturally adapted to such conditions and will tolerate and/or recover from, temporary increases in suspended sediments.

73. The seabed monitoring offshore from Westshore Beach required by the Port's current disposal consent has not been designed to look specifically at edible shellfish resources. Rather it examines the sediment communities underpinning the nearshore ecosystem at a finer scale. Analysing the past 20 years of monitoring data, it can be seen that, even within disposal area boundaries, it is generally the same species (including bivalve shellfish) occurring as in the wider area. Recovery of disposal area communities has been observed to be rapid, with little difference in community structure between disposal and reference sites as early as three months following deposition.

74. Adult bivalve molluscs within the disposal areas may not survive direct deposition; however, juvenile recruits of the surf clam families veneridae and mactridae have remained a common occurrence in post-deposition samples. While there may have been changes in the shellfish resource along Westshore over time, I have seen nothing in the monitoring data to suggest deposition of dredged material as a direct cause.

75. Together with **Jamie Hunt** (submission 8), **Chris Morris** further claims that deposition of spoil in the proposed disposal area will effectively devastate sea life on Pania Reef. Both also contend that the Reef is currently significantly impacted by increased sedimentation.

76. The disposal of dredged material will result in the suspension within the water column of fine sediment material, but the strength of such plumes will reduce rapidly with distance from the source, as predicted by dispersion modelling.

77. The extensive turbidity record collected since April 2016 shows that during storm, high wave and flood events, Pania Reef already experiences levels of suspended sediments substantially higher than are predicted by modelling to reach the reef from dredging or deposition of dredged material.

78. Despite its accessibility and popularity, there was little in the way of ecological survey information for Pania Reef prior to our dive surveys in 2006 and 2016. However, a comparison of

the survey findings with two transects dived by Clinton Duffy[11] in 1991, does not suggest a clear change in reef ecology or a decrease in diversity over that time.

79. While currents may at times carry attenuated plumes from Project activities onto sections of Pania and Town reefs, it is my opinion that these will not be of a strength or duration that will result in measurable adverse effects on reef communities.

80. I consider that the proposed monitoring using continuously recording turbidity buoys is sufficient to protect against unforeseen conditions that may impact the Reef. If plume strength reaching the reef exceeds conservative trigger levels, the system will alert the Port and dredge operator, triggering an operational response to bring levels down before reef communities can be adversely affected.

81. Surveys of the Reef will occur under assurance monitoring to establish whether ecological effects are occurring even where turbidity limits imposed for continuous monitoring are not exceeded. Although direct Reef monitoring will not allow adaptive management from the dredging operation on a day-to-day basis, it will provide assurance between successive dredging stages that significant ecological effects attributable to the project are not occurring.

82. Among other submitters, **Aaron Duncan** (submission 7) expresses concerns about the importance of Pania Reef and Town Reef as recreational and kai-moana gathering areas and their importance for juvenile fish and crustaceans.

83. Town Reef was specifically included in the assessment report (section 7.4.4) but was not part of the dive surveys. The modelling outputs were examined to assess the relative increase in suspended sediments which may occur at Town Reef in relation to the background turbidity it is expected to experience in its near-shore location. It is my opinion that the proposed continuous turbidity monitoring and the assurance monitoring proposed for eight locations along the length of Pania Reef will serve to validate the veracity of the modelling

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[11] Duffy C. 1992. Shallow rocky reef habitats in Hawke's Bay: Site descriptions and rotenone collections. Prepared for Marine Reserves Workshop: Towards achieving a marine reserve network using a scientific base.

and will thereby be protective also of other reef areas within the modelling domain.

84. I am not aware of any documented information concerning the specific importance of these reef systems as breeding or nursery areas for fisheries species. In the assessment for this Project, the life cycles of a range of important inshore fisheries species were considered, including crustaceans such as rock lobster and paddle crabs. Although reef habitats may be used by the juveniles of some species such as blue moki, there is little to suggest that any of the important fisheries species has a critical reliance on the Pania / Town Reef system.

85. Unlike mixed substrate seabed areas such as the Wairoa Hard (~300 km^2), Pania Reef (less than 5 km^2) is not large enough to function as a critical nursery area for fisheries species that have a Bay-wide distribution as adults. While I acknowledge that the young of some species may utilize these reef environments, I have found no reference in the literature or online for the occurrence of juvenile aggregations at the levels required.

86. Based on the modelling results and the ecological data, it is my assessment that the Pania and Town Reef systems will not experience sediment plumes at a level that would have significant or lasting deleterious effects on reef communities. This assessment includes the juvenile life stages of fisheries species that may utilize these areas. The protection of these areas against unforeseen plume behaviour afforded by the proposed monitoring will similarly cover any nursery function associated with these habitats.

87. **Mr Duncan** questions what monitoring will take place along Pania Reef during disposal activities and contends that too little consideration was given to monitoring in the Benthic Ecology Report.

88. The proposed monitoring is set out in the WQMP included as Appendix R of the application documentation. It covers continuous turbidity monitoring on both sides of the reef during disposal operations. Since turbidity plumes are the principal mechanism by which deposition of dredged material could affect far-field ecological resources, this is the best method to monitor the effect of the activity and potentially establish a causal link with any ecological effects subsequently identified by the proposed dive surveys.

89. Section 9 of Appendix H to the application documentation (the Marine Ecology Report) sets out considerations for monitoring and management. It draws upon all of the assessments and habitat characterisation detailed in the rest of the report to make informed recommendations as to an effective monitoring approach. Discussions following submission of the Report to PONL led to the development of the WQMP.

90. Ecological monitoring of Pania Reef was established as a precise methodology outlined in section 4.5.2 of the same report and a summary of the recorded ecological baseline laid out in section 6.5. To my knowledge, the compiled ecological data summarized in the report represent the most detailed and extensive scientific surveys of the Reef to date.

91. An extensive programme of repeat surveys of the Reef is proposed in the WQMP as dredging stages of the Project are completed. As noted in section 9.2 of Appendix H, the time lag between the application of the stressor (turbidity) and the manifestation of ecological effects (e.g. die-back of macro-algae or change in depth zonation of key species) means that little would be achieved by conducting ecological monitoring during the relatively short dredging stages.

92. **Karl Warr** (submission 10) expresses concerns regarding the impact on the ecology of fisheries from disposal of dredged material. He contends that the current maintenance dredge disposal operation has decimated the yellow-belly flounder population.

93. It is my opinion that there will be very little environmental impact on the ecology of fisheries species from the proposed disposal of dredged material. This is primarily because effects to the benthic communities outside the boundaries of the proposed disposal area will be very localised to the margins of the site and temporary in nature. As well as consideration of the seabed habitat and communities, this conclusion is based on my professional experience of other disposal sites in New Zealand and my recent analysis of a 5-survey sediment and benthic community data-set, covering the Westshore disposal grounds and one control site, spanning the last 20 years.

94. The area of the proposed disposal ground (approximately 342 ha) is small relative to a much larger area of similar

substrate in similar depths in Hawke Bay. As an indicator of flatfish occurrence and productivity, it is useful to re-examine the catch data presented in the Marine Ecology Report in terms of landed catch per unit of seabed area. The area of inshore southern Hawke Bay representing approximately 70% of the Hawke Bay flatfish catch for the period 2012-2015 is shown in Figure 1 below, with catch weight and proportional symbols[12] normalised to seabed area.

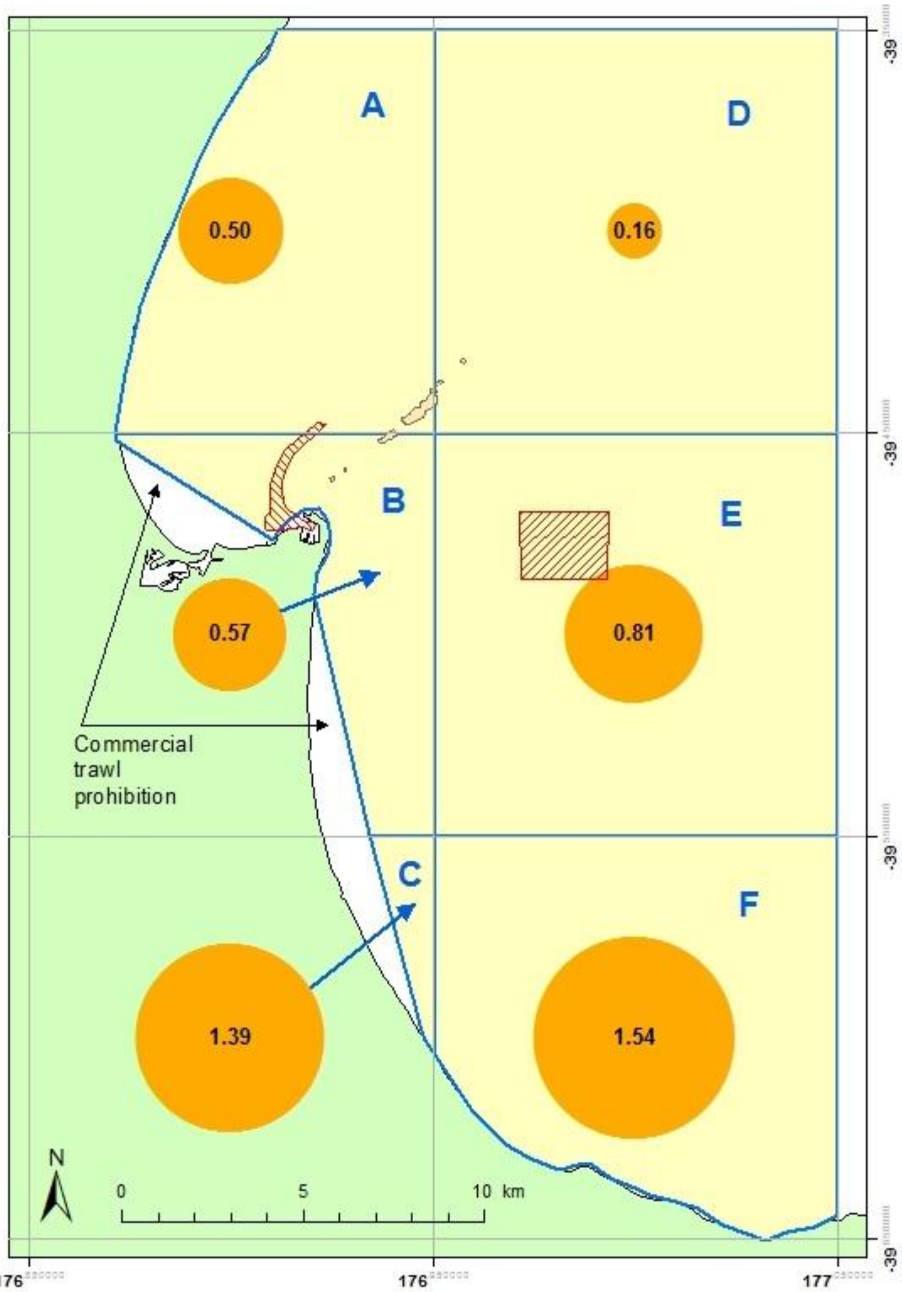

Figure 1 Recorded commercial catch weight (tonnes per 100 ha) for aggregated flatfish species in near-shore southern Hawke Bay (1 Oct 2012 to 1 Oct

[12] Adjusted for viewer perception with Flannery compensation.

2015). Proposed disposal ground and dredging extent shown as red-hashed areas. Adapted from Figure 7 of the Marine Ecology Report, with catch weight normalised to 100 ha area for the data cells in the vicinity of the Project.

95. Figure 1 indicates clear gradients for flatfish catch, increasing from north to south and towards the shoreline. The disposal ground represents less than 1% of the nominally 'trawlable' (yellow-shaded) area of Figure 1 and is located in the northern sector of a cell (E) that appears to be around half as productive as the adjacent cell (F) to the south.

96. During dredging campaigns, it is likely that fish will avoid the disposal ground as a forage area. Following cessation of deposition, it is my opinion that benthic communities within it will recover, over a time-scale of months to one year, to a level of ecological diversity similar to the surrounding area. Even during this recovery phase, its successional communities will form the base of a food web supporting fisheries species in the wider area.

97. I am not aware of factors linking the current disposal of material from maintenance dredging to a decrease in the occurrence of yellow-belly flounder. The most recent survey of the seabed ecology of the disposal areas off Westshore Beach was conducted three months after the completion of dredging in November 2017. From comparisons with previous survey data and a 1997-8 baseline, we found no evidence for a change or decline in benthic communities at these sites. While we did not observe or catch yellow-belly flounder, a series of epifaunal trawls (which are not designed to sample fish) suggested that juvenile sole and paddle crabs were common within the shallow near-shore disposal area.

98. As a species, yellow-belly flounder have a number of attributes that make it unlikely that they will be particularly sensitive to deposition of dredged material or elevated suspended sediments:

(a) In contrast to sand flounder, they appear to favour siltier inshore areas and thrive in conditions turbid enough to categorise them as a non-visual predator.

(b) They are free-ranging and not territorial, so they will respond to stress by avoidance of the area.

(c) They move offshore to spawn during the winter to spring months and the eggs and larvae are pelagic as part of the upper water column plankton.

(d) Nursery habitats appear to be exclusively limited to sheltered harbours and estuaries rather than open coastal environments.

99. In a recent review of dredging activities on fish, Harvey et al. (2016)[13] collated relevant research information for the suspended sediment sensitivity of 20 species. Despite an information bias towards reef-associated fish rather than soft sediment foragers (such as flounder and gurnard), their meta-analysis of this data indicated that 50% of species would be protected by a trigger level set at 80 mg/L and 25% at 166 mg/L. Based on what is known of its habitat preferences, I consider it highly unlikely that yellow-belly flounder would not be included in the least sensitive 25% of species.

100. It is my experience that yellow-belly flounder do not appear to be significantly affected by suspended sediment from deposition of dredged material. Landed catch of this species in inshore Pegasus Bay over the years 2011-2014 was concentrated on a small area off Godley Head adjacent to an area receiving over 400,000 m^3 of fine silt annually from Lyttelton Port's maintenance dredging program (see Figure 2).

[13] Harvey E, Wenger A, Saunders B, Newman S, Wilson S, Travers M, Browne N, Rawson C, Clarke D, Hobbs JP, Mcilwain J, Evans R, Erftemeijer P, Mclean D, Depczynski M. 2016. Effects of dredging-related pressures on critical ecological processes for finfish: a review and possible management strategies. Report of Theme 8 –Projects 8.1 & 8.2 prepared for the Dredging Science Node, Western Australian Marine Science Institution, Perth, Western Australia, 91 pp.

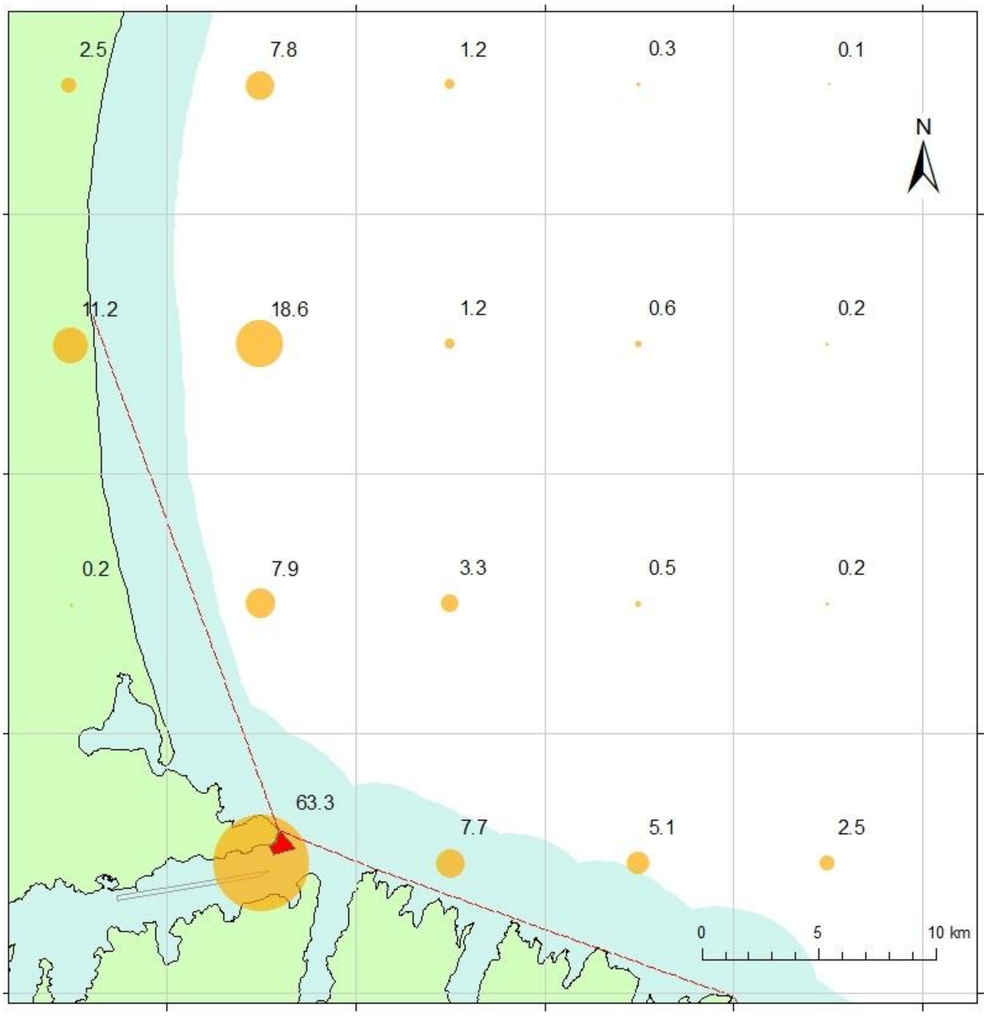

Figure 2 Recorded commercial catch weight (tonnes) for aggregated flatfish species in Pegasus Bay (1 Oct 2011 to 14 Aug 2014) for 0.1 degree grid squares. Blue-shaded area designates 2 Nm trawl height restriction. Red line designates inshore trawl prohibition boundary. The disposal area marked as a red polygon (area 52 ha) had been in use for more than 20 years and received an average of 485,000 m^3 per annum[14] over the period covered by the flatfish catch record. Due to inshore prohibitions around trawl use, only 21% of the grid square to which the Godley Head catch weight of 63.3 tonnes applies was available to flatfish trawls. The principal species targeted and caught in this area was yellow-belly flounder.

101. The benthic monitoring proposed in the WQMP for the disposal area vicinity uses an approach similar to that for the current dredging disposal operation and will provide data on the effects of deposition at this site and the extent of recovery following project completion. This will in turn allow assessment of any changes to the area as a foraging ground for fisheries species.

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[14] Calculated from a mean specific gravity of 1.68 tonnes/m^3.

102. **Mr Warr** refers also to a potential for light pollution as a basis for "massive predation" on fisheries species (moth effect).

103. Light pollution is a comparatively little-studied source of stress to marine communities, but I consider this would affect only those areas in close proximity to light sources (tens to several hundred meters). The submitter did not make clear the specific light source referred to, but it is my opinion that the reach of Port lighting associated with a new No.6 berth would not extend far enough offshore to have a discernible effect on inshore Hawke Bay fisheries stocks.

104. **The Napier Fisherman's Association (NFA)** (submission 21) contends that the disposal of dredged material is too risky to guarantee no impact on the ecological environments of Pania Reef and Town Reef.

105. Based on my assessment of dispersion modelling outputs and the range of local background turbidity, together with my experience of disposal ground usage and monitoring by several ports nationally, I consider that the risk to the Pania/Town reef system is low. This risk is further mitigated by the proposed continuous monitoring of turbidity, which will serve to validate the model and allow timely response should unforeseen conditions arise. I consider that, if measurable effects to reef ecology were to occur despite the use of an adaptive management approach based on continuous monitoring, these effects would be within those experienced by the area as a result of normal weather and sea-state events.

106. In their submission, **NFA** further equates the 3.2 million m^3 of dredged material to sediment that is carried into Hawke Bay with riverine discharges and run-off (quoted estimate of 11.5 million tonnes). They appear to see these volumes as simply cumulative in terms of potential impact. I do not consider this approach to be correct for two reasons:

    (a) The bulk of dredged sediments released over the disposal area will descend directly to the seabed where they will largely stay. Only a small proportion of the silt component will be stripped from the descending mass of sediments and conveyed from the area by ambient currents as a turbidity plume. In contrast, a very high proportion of fine sediments entrained in riverine outflows will stay in suspension long enough to settle over very large seabed areas.

(b) The nature of the dredged sediments will match the native sediments of the disposal area and wider benthic area much more closely than those in freshwater inputs from land. Recovery times for benthic communities are shortest when deposition is 'like on like.' Studies of the deleterious effects of increased sedimentation within estuaries (e.g. Gibbs & Hewitt. 2004)[15], have focussed mainly on terrigenous[16] sources where marked differences can exist in the physical nature of introduced versus natural bed sediments.

107. I disagree with the contention or implication of several submitters (e.g. 21, 25, 29, 40) that deposition of dredged material at sites with water depth greater than 500 m will have no effect on benthic ecology and/or fisheries resources. Benthic areas at these depths are less disturbed by natural events and are therefore able to attain a higher level of stability and structure. It follows that their ability to recover from disturbance would likely be weaker than in more dynamic inshore areas. It is also worth noting that the ability to monitor impacts and recovery at these depths is very limited.

108. **Ngaio Tiuka** (submission 30) claims that the application does not appear to adequately consider the possible constituents of the dredged sediment with regard to the "wide range of substances that pass through the port of Napier including Hazardous substance".

109. There is a reasonable amount of data available from Port consent investigations, consent monitoring requirements and field surveys to characterise the chemical nature of the sediments to be dredged. This was addressed in section 6.1.2 of Appendix H.

110. **Legasea Hawkes Bay** (submission 25) claim that they have observed that the inshore dumping site has had a "dramatic and long-term effect" on the benthic environment and

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[15] Gibbs M, Hewitt J. 2004. Effects of sedimentation on macrofaunal communities: a synthesis of research studies. Report prepared for Auckland Regional Council. NIWA Client Report: HAM2004-060. National Institute of Water & Atmospheric Research Ltd. May 2004.

[16] Terrigenous sediment refers to that derived from the land, generally through erosion and entrainment within run-off.

fishing and expect this to be mirrored and probably more dramatic at the proposed site (because of volume).

111. Although I am aware of concerns regarding a decline in the inshore fishery of Hawke Bay, I have not seen any documented evidence (beyond the Haggit & Wade 2016 review)[17] of a "dramatic and long-term effect" on the benthic environment; nor am I aware of an established causal link with disposal of dredged material. While any activity of this scale and nature is not without immediate impact, the monitoring data collected over the last 20 years suggests that effects from disposal in the near-shore environment of Westshore Beach are transient, leaving benthic communities indistinguishable from those in the wider area after a period of months. The monitoring data has not indicated a persistent change in the seabed or its communities, nor even elevated variability at these sites consistent with successional recovery.

112. I agree though, that the less dynamic conditions in the 20 m water depths of the proposed disposal area, combined with the relatively greater volume of deposited material, will likely result in a longer period of recovery. It is part of the proposed monitoring programme that the benthic effects of deposition be monitored in the vicinity of the site.

113. **NZ Angling and Casting Association** (submission 40) expresses concern about impacts of deposition on "microbial sea life" and draws a link between the deposition of maintenance dredge material (along with overfishing and riverine silt) and the creation of a "dead zone" along the Westshore and Whirinaki beaches.

114. While I am unsure what is meant by "microbial life" in this instance, I appreciate that the submitter refers generally to ecosystem level effects. While I agree that such effects accrue from the sum of all stressors present, the apportioning of a particular weighting to individual stressors is more difficult when faced with a decline, either perceived or measured.

115. As I have noted above, data on the effects of deposition off Westshore has been examined, spanning a 20-year period.

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[17] Haggitt T, Wade O. 2016. Hawke's Bay Marine Information: Review and Research Strategy. Report prepared for Hawke's Bay Regional Council. eCoast marine consulting and research. 110p plus appendices.

Along with sediment characteristics, the basis of this data is the macrofauna inhabiting the sediment matrix and surface and these communities are the basis of habitat productivity and the food source of foraging fisheries species. While I cannot comment on trends which may have preceded 1997 when the first baseline surveys were conducted, I am satisfied that this currently represents a relatively healthy, if dynamic, sediment environment and there has been no significant decline in the communities it supports since that time.

116. I agree with the submitter that high-wave events can move huge amounts of sediment in a short time and this is an episodic occurrence in inshore Hawke Bay. This is what makes the sediment environment so dynamic and leads to a high capacity for rapid community recovery following disturbance. I further agree that a small amount of siltation can result in an adverse ecological effect, but only if such sediment differs appreciably from the native sediments of the seabed. Where deposited and native sediments are closely matched in such dynamic environments, rapid recovery from the deposition of even quite heavy layers will ensue.

117. **Fisheries Inshore NZ (FINZ)** (submission 41) suggests that the potential for adverse effects on the marine environment has not been adequately recognised and that further work is required to assess this potential at specific times of the year.

118. I assume that the focus of concern here is the potential for impacts to fisheries species and I disagree that this has not been adequately explored. In section 8 of Appendix H, the current knowledge of the life cycles of the key fisheries species (including spawning, nursery habitats and migration) was considered in the context of the modelling outputs and assessed benthic effects. Although it is generally accepted that there are numerous gaps in this knowledge, we identified none that represented a significantly heightened risk in the context of the proposal.

119. The submission quotes section 8.1.1 of Appendix H that "The proposed location of the disposal area is within an area of inshore southern Hawke Bay representing around 60% of the total commercial flatfish catch." While the quote is correct, and I do not wish to downplay the concerns expressed, it is important to note that the proposed 342 ha disposal area

represents only around 1% of the productive flatfish area referred to by this sentence.

RESPONSE TO MATTERS RAISED IN THE SECTION 42A REPORT

120. In regard to marine ecological issues, the s42A report relies primarily on the advice of **Dr Shane Kelly**, the evidence of whom is included in its appendices. Dr Kelly expresses three primary concerns I wish to respond to:

(a) The age of much of the benthic sampling data contributing to the assessment.

(b) The coverage or sampling intensity of epifauna within the proposed offshore disposal area.

(c) Uncertainty over the fisheries importance of the proposed disposal area and the potential effects of the Project on the flatfish fishery.

121. I agree with Dr Kelly that, ideally, all of the data contributing to the assessment should be as recent as possible. However, the considerable quantity of survey data available from an earlier version of the current proposal was supported by a substantial quantity of more recent data from nearby seabed areas of similar character. Another factor was the dredging of the Fairway that had occurred over the intervening years. After careful consideration of the possible implications, it was concluded that only limited validation sampling of the sediments and benthos of the outer Fairway was required.

122. The timing of the inclusion of the offshore disposal area in the current Project proposal did not provide an opportunity to revalidate the characterisation of the area during the 2016 fieldwork. However, a similar weight of evidence process was applied in deciding not to pursue a further standalone survey.

123. While I stand by the decisions made concerning the limited benefits of repeat sampling to the assessments undertaken, and do not wish to repeat here my earlier response to the section 92 request on this issue, I acknowledge that the age of the survey data for the proposed disposal area is potentially problematic for interpretation of the benthic monitoring of this area proposed in the WQMP. Hence, I have recommended that a re-survey of this area should

precede Project commencement to confirm current benthic condition (paragraph 68 above).

124. In paragraph 4.5 of his evidence, Dr Kelly cites "substantial differences in epifaunal species recorded among samples from: the dredged channel area; an area around the inshore disposal site (area CS); and the offshore disposal site" as inconsistent with a conclusion of relative ubiquity for soft sediment habitats in the wider area.

125. Observing no differences in epifaunal communities sampled from such a range of depths and shore-proximity in such wave-exposed environments, not to mention areas subject to periodic dredging disturbance, would be very unusual. Sections 6.1.4 and 7.1.1 of Appendix H presented and discussed the differences between dredged and non-dredged areas in the vicinity of the Fairway.

126. While no direct comparisons of epifaunal data from the non-contiguous survey sites were made, the species represented were not substantially different. However, for the most part, their occurrence was entirely consistent with accepted depth-ranges for these organisms. Shallow water species such as the sand dollar (*Fellaster zelandiae*) and the wedge clam (*Myadora striata*) tailed off in their occurrence at water depths of 11 m or greater. In contrast, the gastropod snail *Struthiolaria papulosa* was collected only from the deeper waters of the disposal area. Apart from this, all other species collected from the disposal area except the sea cucumber *Heteromolpadia marenzelleri* have also been present at sites off Westshore Beach.

127. I conclude that both the epifaunal and infaunal data represent a logical continuum of highly over-lapping species distributions with depth and distance from shore. As such they support the relative ubiquity of soft sediment habitats and community assemblages (within the constraints of water depth) in the vicinity of Napier.

128. Dr Kelly expresses concerns in paragraph 4.1 of his evidence that four epifaunal dredge samples were insufficient to adequately characterise the epifauna of the disposal area and singled out the high densities of the sea cucumber *Heterothyone ocnoides*. While conceding that high numbers of this species appear to occur south of Pania Reef, he expresses concern over its broader distribution and the

potential ecological implications of impacts at the disposal area.

129. I share Dr Kelly's lack of understanding of the specific ecological significance to benthic communities of *H. ocnoides* but I note from the data that the infaunal assemblages do not change markedly in its presence. I can furthermore confirm that it occurred in similar densities in two epifaunal trawls north of Pania Reef (CDT8 and CDT10; section 6.1.4 of Appendix H). It was furthermore one of the dominant organisms in infaunal cores collected from both the current disposal area (Site Ia; mean 2.33 individuals per 133 cm^2 core) and the reference site (Site CIa; 2.47 per core) off Westshore Beach three months after cessation of deposition at Site Ia (Sneddon & Atalah 2018)[18], providing solid evidence that it is resilient to sediment inundation.

130. While I agree that epifauna can be patchily distributed, the dredge tows at the offshore disposal area represent a sampling of almost two linear kilometres spread over the area. I believe that a greater sampling intensity would be justified only where there were indications of substrate heterogeneity or if the assessment was not also supported by infaunal cores, diver observations and side-scan sonar imaging. These other survey methods provide substantial support for the conclusions reached. If significant shellfish beds or sponge aggregations were present in the area, it is highly unlikely that these would not be noted by divers, even with the very limited visibility conditions encountered at the seabed.

131. It is my opinion that the location of the proposed disposal area within an area relatively productive for flatfish is also consistent with the absence of significant habitat-forming epifauna since it is unlikely that frequent bottom trawl activity would allow the establishment of significant emergent biogenic features such as sponge gardens or horse mussel beds. The existence of such ongoing disturbance is also likely to have effectively prevented an increase in diversity or ecological value in the years since the survey of the disposal area was conducted.

[18] Sneddon R, Atalah J. 2018. Monitoring of benthic effects from dredge spoil disposal at sites offshore from Napier Port: 2018 survey. Prepared for Port of Napier Ltd. Cawthron Report No. 3141. 62 p. plus appendices.

132. Dr Kelly states in paragraph 4.6 of his evidence that "questions remain about: what will be lost (from the disposal area); the local importance of that loss; what it will be replaced by and how quickly; and whether indirect effects could extend the local footprint of ecological impacts".

133. While I agree that there is no way to accurately determine how quickly the disposal area will recover following deposition and that significant knowledge gaps concerning the resilience, life cycles and response to disturbance of many benthic organisms are always faced by assessments of this nature, a substantial quantity of locally relevant data has been used to answer these questions as far as is possible. In particular, the information available for the Port's current disposal area (including a non-impacted reference site) gives valuable insights into impacts and recovery of similar habitats locally (Sneddon & Atalah 2018). I consider the assessments made are suitable and appropriate to this purpose.

134. In paragraph 4.9 of his evidence, Dr Kelly notes that the spatial resolution of the MPI catch data does not allow the contribution of the proposed disposal area to be determined relative to the surrounding area.

135. The spatial resolution of the data extract was driven by MPI's 3-client/3-vessel rule whereby data is withheld (for reasons of commercial sensitivity) if less than 3 vessels have fished a particular cell for the period specified. By using a 0.1 degree spatial resolution, I was able to access all of the catch data for the 3-year period.

136. To assist with interpretation of the flatfish catch data in this regard, I have normalised the data relative to seabed area for the cells in the vicinity of the Project (Figure 1) for my response to the submission of Karl Warr (paragraph 94 above). While the fisheries productivity of the disposal area cannot be determined exactly, Figure 1 indicates that it is likely to be significantly lower than areas of the Bay to the south.

CONCLUSIONS

137. Most of the seabed area in the vicinity of the dredging and dredged material disposal activities is comprised of relatively flat soft sediment habitat with a fine silt fraction that is subject to resuspension by wave action.

138. While I acknowledge that the age of some of the survey data is less than ideal, this was carefully considered in the design of the most recent surveys and some revalidation sampling was completed. The timing of the inclusion of the offshore disposal area in the proposal did not afford an opportunity for revalidation sampling in the most recent 2016 survey. However, I consider that our conclusions regarding the ecological status of this area are well-supported by data compiled for other inshore areas where very similar benthic assemblages occur and that a further standalone survey was not warranted.

139. Reef habitats in the wider area are frequently exposed to elevated turbidity from a variety of sources. However, reef surfaces are kept relatively clear of accumulated sediment by persistent wave action.

140. The results of sampling surveys indicate that the dredged material generated by the Project will be similar in texture and composition to the native sediments of the offshore disposal area and will carry negligible levels of contamination.

141. While dredging and disposal activities will result in the effective loss of benthic communities within the spatial footprint of those activities, dredging campaigns are not anticipated to exceed a few months duration and the nature and composition of these communities indicate that they will recover rapidly.

142. The principal mechanism by which far-field ecological receptors may potentially be impacted by Project activities is via the transport with ambient currents of suspended sediment in turbidity plumes. However, suspended sediment concentration would need to persistently exceed the natural background turbidity to which communities are adapted before adverse effects would occur.

143. Soft sediment benthic communities in the wider area will be resilient to high suspended sediment exposures. Furthermore, modelling predictions indicate that high-strength plumes from Project activities will be limited to within hundreds of meters of the source and will not impinge upon reef habitats at concentrations that may lead to adverse ecological effects.

144. While the flatfish fishery is concentrated within the near-shore waters of the southern part of Hawke Bay, catch data

indicate no concentration of landed catch within the specific vicinity of the proposed dredging or disposal activities.

145. No habitats have been identified within the areas potentially affected by high-strength plumes that may be important to critical life stages of targeted commercial species. The mobility of inshore fish species and the relative uniformity of benthic substrates facilitate the avoidance by fish of the areas directly impacted during the Project.

146. The natural habitat preferences of yellow-belly flounder indicate that this species will be resilient to both elevated suspended sediments and sedimentation from turbidity plumes. I therefore consider that flounder displaced during the project will return to areas of deposition as soon as the benthic communities that are their food source re-establish.

147. Based on their observed habitat range and life histories and the very limited potential for high-strength plumes to impinge on reef environments, I consider that the risk to paua and lobster stocks is very low. Similarly, populations of paddle crabs and surf clams are very unlikely to be affected more than negligibly by project activities.

148. Effects from the construction of the proposed No.6 berth will be spatially limited to the immediate area and will not have longer-term consequences for habitats outside of those subsequently maintained by dredging.

149. Although my assessment concludes that significant adverse effects to marine ecological receptors are very unlikely, the scale of the project and a level of uncertainty associated with some elements means that a precautionary approach to monitoring is warranted. I consider that the monitoring described in the Port's proposed conditions of consent and WQMP effectively addresses this need.

Ian Ross Sneddon

6 August 2018