

**IN THE MATTER** of the Resource Management Act 1991

**AND**

**IN THE MATTER** of Applications by **PORT OTAGO LIMITED** to the **OTAGO REGIONAL COUNCIL** for resource consents in respect of applications to dispose of capital and maintenance dredge spoil nearshore in the vicinity of two Nationally Significant Surfing Breaks.

## **STATEMENT OF EVIDENCE OF DR. SHAW TREVOR MEAD**

### **QUALIFICATIONS AND EXPERIENCE**

~~1.~~ I hold BSc and MSc (Hons) degrees from the University of Auckland (School of Biological Sciences), and a PhD degree from the University of Waikato (Earth Sciences). I am currently an environmental scientist and Managing Director at eCoast, which is a marine consulting and research organisation. I have 18 years of experience in marine research and consulting, have 44 peer-reviewed scientific papers, and have solely or jointly produced over 200 technical reports pertaining to coastal oceanography, marine ecology and aquaculture. I have undertaken over a thousand research and consulting SCUBA dives around the coast of New Zealand and overseas, and have led many comprehensive field investigations that have addressed physical, biological and chemical components of the coastal environment. I am affiliated to the New Zealand Marine Science Society and the New Zealand Coastal Society (IPENZ), and am on the editorial board of the Journal of Coastal Conservation, Planning and Management. I am also technical advisor for the Surfbreak Protection Society (NZ) and Save the Waves Coalition, which mostly entails considering the impacts of developments and the impacts they will, or have, had on high-quality surfing breaks (e.g. the development of a breakwater boat dock in Doolin, Ireland; the impact of marina development at Whangamata, New Zealand; the impact on greatly increasing nearshore disposal volumes on Nationally Significant Surfing Breaks in Otago – Aramoana and Whareakeake).

~~2.~~ I have a background in coastal oceanography, numerical modelling, marine ecology and aquaculture. I studied for my MSc degree at the University of Auckland's Leigh Marine Laboratory, undertaking subtidal research there from 1994 to 1996 directed at the fertilisation success of sea urchins as a basis for the sustainable management and development of the commercial market. My MSc in Environmental Science, Marine Ecology and

Aquaculture included 4<sup>th</sup> year Environmental Law and a dissertation on the Quota Management System (QMS) legislative review. My PhD was primarily in coastal oceanography, with the marine ecological components of my Doctorate directed towards subtidal habitat enhancement of marine structures. The physical oceanography component was focussed on understanding the effects of coastal bathymetry on surfing wave breaking characteristics using field measurements (bathymetry surveys, aerial photography and GPS positioning of in situ data collection) and hydrodynamic numerical modelling. My PhD thesis is comprised of 6 peer-reviewed Journal Papers that describe the meso-scale components that combine to create high-quality surfing breaks and empirical methods of determining wave breaking intensity of high-quality surfing waves. More recently, I have been involved in a wide range of coastal consulting and research projects that have included the design of coastal structures and developments, and assessments and monitoring of physical and ecological effects of marine construction, coastal erosion control, marine reserves, dredging, outfalls, oil industry, aquaculture ventures and various other coastal and estuarine projects that have included hydrodynamic (waves and currents), sediment transport and dispersion modelling (including contaminants, suspended sediments, freshwater, hypersaline water, nutrients and petro-chemicals).

3.——Further to this, with direct relevance to the present case, is that the focus of my PhD and subsequent consulting and research work has been on wave/structure interactions and the impacts of seabed morphology and coastal structures on waves, currents and sediment transport. For instance, during my PhD I interpreted the morphologies of 44 bathymetries from high quality surfing breaks around the world to consider how different components of the morphology impacted on wave transmission. I have produced several peer-reviewed scientific papers on the effects of wave-seabed interactions on surfing breaks, including how offshore wave focussing (which is very relevant to the current proposal) can influence surfing breaks on scales from the inner continental shelf to sub-tidal reefs (Mead *et al.*, 2003). More recently I have investigated natural offshore focussing features (ebb-tidal deltas, offshore reefs and ridges, etc.) and analysed the morphology (shape and volume) and locations (distance offshore) of these features. These data were then used to undertake numerical modelling tests of a range of these parameters to consider the beneficial use of the 8M m<sup>3</sup> of rubble from the Christchurch earthquake to create offshore focussing structures at the request of the Sumner Beach Earthquake Recovery working group (Mead *et al.*, 2011). I am also co-author on a Journal of Coastal Research paper titled “Sustainable Management of Surfing Breaks: Case Studies and Recommendations” (Scarfe *et al.*, 2009).

4.——I confirm that I have read the Environment Court’s Code of Conduct for Expert Witnesses and have complied with the Code when preparing this evidence. I confirm that the matters addressed in this brief of evidence are within my area of expertise. I can confirm that I have not omitted to

consider material facts known to me, which might alter or detract from my opinions expressed within this evidence.

## SCOPE OF EVIDENCE

5. I have prepared this evidence as an expert advisor to the Surfbreak Protection Society in relation to the Nationally Significant Surfing Breaks of Aramoana and Whareakeake, both of which will be impacted by the proposed application. In preparation, I have reviewed the following documents:

- ⌚ The relevant sections of the applicant's AEE
- ⌚ The ORC officer's report
- ⌚ The surfing wave dynamics report
- ⌚ As well as previously reviewing the various technical reports and expert evidence for the Next Generation capital works by Port Otago Ltd (POL).

In addition, I have undertaken refraction/diffraction modelling of the ebb-tidal delta and Aramoana Beach to consider the impacts of the disposal of 7.5M m<sup>3</sup> at the A0 site and the impacts of disposing of 200,000 m<sup>3</sup>/yr for 3 consecutive years at the Aramoana inshore disposal site and the deepening of the channel. The disposal of 200,000 m<sup>3</sup>/yr at Aramoana is no longer applicable of the current resource consent application; the volume is now 50,000 m<sup>3</sup>/yr. I have also had informal discussions with surfers familiar with the break and considered the work of Kilpatrick (2005) and Scarfe (2008) in reference to the Surfing Wave Dynamics Report (MSL, 2011).

6. From my investigations I have the following concerns relating to the potential impacts on the Nationally Significant Surfing Breaks of Aramoana and Whareakeake due to the proposed nearshore disposal resource consent application:

- ⌚ The AEE supporting the application is insufficient for considering the impacts of greatly increased dredging on the two breaks. An AEE first quantifies the existing conditions (physical or biological) and then undertakes investigations to determine how the proposed activity will impact on the existing conditions. The Surfing Wave Dynamics report goes some way to understanding the impacts of nearshore disposal on incident waves at Aramoana, however, it does not relate them to surfing wave quality because it is not possible to do so with the methods used (it was not the intention of the report). In addition, it does not consider the impacts of the 2-fold increase of spoils dumping on incident waves at Aramoana. It considers only the effect of the 2002 mound in comparison to the 2009 mound, or no mound at all. This does not assess the effects of the proposed increased disposal volumes. The impacts on Whareakeake due to

the proposed increase of 7-fold disposal volumes is completely ignored.

- ⌚ The application calls for an increase in disposal at the Aramoana and Heyward Spit nearshore disposal grounds of approximately 2-fold (from 27,000 m<sup>3</sup> to 50,000 m<sup>3</sup>) and 7-fold (from 60,000 m<sup>3</sup> to 350,000 m<sup>3</sup>), respectively, based on the 26 year average disposal volumes. These are significant increases in disposal at two sites that have had a trend of reducing disposal over the previous 26 years. Even though the same total volume for the 2 sites was the same in the past, the maximum consented volumes were never disposed of at these sites, indeed they decreased, especially in the past decade. However, it is very likely that these disposal areas will be used to their total volume in the next 3 years in order for the Port to undertake capital dredging without engaging a large dredge capable of utilizing the A0 offshore site.
- ⌚ There is no baseline data with which to assess the impacts of this activity on the 2 Nationally Significant Surfing Breaks, and the proposed Consent Conditions will not provide this due to a) the significant increase in disposal proposed in comparison the previous status quo, and b) it will be monitoring the surfing wave quality due to the larger mounds, not the effects of significantly increasing the disposal volumes compared to the existing surfing wave quality due to the existing environment.
- ⌚ There is very little information pertaining to the AEE of Aramoana Spit concerning surfing wave quality. The Surfing Wave Dynamics report is a useful document, but in no way provides information on surfing wave quality, nor an Assessment of Environmental Effects due to the proposed increases in dredge disposal. There is no AEE for Whareakeake; it has been ignored. The results of the Surfing Wave Dynamics report indicate that the Heyward disposal site already influences the right-hand point break at Whareakeake due to wave focussing and wave shadowing, depending on the incident swell direction. The 26 year average disposal at this site is to be increased by 7-fold – not just due to the consent volume increasing from the previous 200,000 m<sup>3</sup> limit to 350,000 m<sup>3</sup> limit, but because this new higher limit is very likely to be used for the disposal of capital dredge material rather than maintenance dredge material alone; as is clear from the various recent public announcements. The mitigation proposed, i.e. once the 200,000 m<sup>3</sup> volume has been reached, material will be deposited in deeper water, is designed to reduce sediment transport. However, this does little to reduce the wave-focussing/shadowing effects that will impact on Whareakeake; these potentially significant and irreversible impacts have not been addressed at all in the AEE.

- ⌚ The Consent Conditions provide no detail on how wave quality will be measured and quantified with an automated camera system, and there is no data collection of monitoring proposed for Whareakeake, while subjective assessment via online posts by surfers will provide little if any robust data to use for monitoring and/or adaptive management. More importantly, since there has been no baseline data collection, the experimental design to develop an adaptive management approach is fundamentally flawed. It will be monitoring the surfing wave quality due to a mound 2 times larger than any placed at Aramoana in recent years, but provides no understanding of how the surfing wave quality will be impacted once it is placed in comparison to the existing quality of the surfing waves. No monitoring is currently planned for Whareakeake, there has also been no baseline data collection for this Nationally Significant Surfing Site, and so the impacts on Whareakeake of a 7-fold increase in disposal at Heyward are completely ignored.

7. My initial expert opinion (9 September 2011) is attached as Appendix 1 and should be read as a preface to this evidence. It is noted that there have been modifications to disposal volumes and the production of the Surfing Wave Dynamics Report since this opinion. However, the majority of the concerns expressed and descriptions/definitions of surfing wave quality in the initial opinion are still valid.

8. I am a firm proponent of sustainable development, and reiterate from my initial opinion that there is no doubt that maintenance and expansion of the Port's operations are very important to the city of Dunedin. However, this should not come at the potential expense of Nationally Significant surfing breaks (this would not be sustainable development), and in its present form, the application does not recognise the Policies that include a precautionary approach and avoidance of impacts on Nationally Significant Surfing Breaks.

9. Before addressing my concerns with POL's resource consent application, I would like to address the concept of "surfing enhancement mounds", which has recently been proposed by the applicant as a positive benefit of nearshore dumping at Aramoana. I am very familiar with the application of this principle in the US, the Netherlands and Australia, and the basis for it. This procedure is completely out of context and irrelevant to Aramoana. A surfing enhancement mound is basically a method of beach renourishment that allows for temporary enhancement of the surfing at the beach in question. These beaches require more sand and nearshore features to break up incident wave crests to enhance the surf, i.e. modify the wave height gradient through local focussing. At Aramoana the vast majority of focussing occurs on the ebb-tidal delta well offshore of the beach (as is the case for similar set-ups such as Matakana Island (New Zealand), Duranbah (Gold Coast), Ocean Beach (San Francisco, CA), South Stradbroke Island (NSW, Australia) etc.), as was verified in the MSL (2011) report. That is, there is no requirement for creation of a wave focus at Aramoana, it already

exists and in addition, the MSL (2011) report Kilpatrick (2005) and Scarfe (2008) indicate that further focussing may be detrimental to surfing quality; the effects are unknown and un-quantified. In my opinion, based on the results presented in the MSL (2011) report, the variability of wave height gradient along the beach is reduced with a nearshore mound (discussed below). Similarly, surfers that have a long history of surfing Aramoana are of the opinion that the beach is over-full and the sediment transport modelling indicates that sand cannot easily move out of this compartment. Similarly, it is understood that sediments do not easily move out of the Aramoana Beach compartment. That is, there is no requirement for renourishment at Aramoana, and the opposite may be the case (it is over-full with respect to surfing wave quality). Therefore, surf enhancement mounds are not applicable to Aramoana and based on the scant available information, are probably more likely to be detrimental than positive.

## HISTORIC MODIFICATIONS

40. It is important to acknowledge that since the construction of the mole, Aramoana Beach, and indeed most likely many of the beaches to the west have been influenced by human intervention. Natural bypassing of the ebb-tidal delta to these beaches to the west has been modified and restricted since the construction of the training mole; indeed since dredging began in 1882. The stabilization of the ebb-tidal delta's position due to the construction of the mole potentially had a positive effect on the surfing wave quality at Aramoana by providing a more stable feature, and so more consistent surfing conditions. Due to the modification and restriction of delta-bypassing, there has also likely been a need to artificially bypass sand to maintain healthy beaches to the west, i.e. nearshore disposal. However, since the NZCPS 2010 came into effect, Aramoana and Whareakeake have been given the status of Nationally Significant Surfing Breaks that are to be preserved for future generations, while potential negative impacts are to be avoided. The POL's resource consent application is a substantial change to the previous operations of nearshore disposal, which was already being questioned by some of the surfing fraternity (i.e. concerns that Aramoana Beach is too full of sand due to nearshore disposal and is continuing to degrade with additional nearshore disposal), and incorporates significant increases in disposal volumes and capital dredge material.

41. Similar to the impacts of nearshore dumping at Aramoana Beach, there is conflicting opinion with respect to whether or not there is too much sand in the coastal system to the west of the mole. The proposed conditions to develop calibrated models to assess the requirements for equilibrium beaches in this area (i.e. how much sand is required to be bypassed on a yearly basis to mimic the natural bypassing that would have occurred in the past?) will help to determine these volumes and the development of an adaptive management plan for this issue. Indeed, such investigations should have been undertaken at many years ago. However, the proposed consent conditions with respect to impacts on the Nationally Significant

Surfing Breaks and the development of an adaptive management plan are insufficient and not applicable due to the lack of baseline data collection and the large changes in disposal volumes that will result from the addition of capital dredge materials. It is also notable that previous investigations of the surfing break mechanics at Aramoana have expressed concerns that continued nearshore disposal at Aramoana could change the wave character and have negative impacts of the surfing wave quality (Kilpatrick, 2005; Scarfe et al., 2009).

## REVIEW OF THE OFFICER'S REPORT

~~12.~~ After reviewing the application and supporting information with Policy 16 of the NZCPS in mind, it is difficult to understand how the ORC officer concluded (#297) that “the historical record shows that the effect of the sediment disposal at Heyward, Aramoana and Shelly Beach have not had an adverse effect on the physical coastal environment.” – surfing breaks are an integral part of this environment. With respect to the quality of surfing waves at the Nationally Significant Surfing Breaks, no such evidence is provided by the applicant, while the anecdotal evidence and submissions indicate that the impacts are unknown (the South Coast Boardriders), or have been negative (surfers that have surfed at Aramoana since prior to dredge disposal and the SPS), while impacts on Whareakeake have been completely ignored. Based on this complete lack of evidence, it is then concluded that “Replacement of the disposal consent for up to three years should result in no effects that are different to those that have been experienced in the past.” which is referring to a 2-fold increase in disposal at Aramoana and a 7-fold increase at Heyward, with no evidence with respect to the past impacts? These very significant increases in nearshore disposal will definitely have an impact on surfing wave quality at the 2 Nationally Significant Surfing Breaks, and there is no evidence presented to determine whether these influences will be positive, negative or benign.

~~13.~~ #299 of the officer's report “Reasons for recommendations” provides the reason a) “That it is expected that the adverse effects on the environment will be minor, can be adequately addressed through the recommended consent conditions”. It is my opinion that AEE is inadequate to consider the impacts of doubling nearshore disposal rates at Aramoana, and that the AEE does not consider the impacts on Whareakeake at all, while the monitoring could in no way address impacts on surfing wave quality due to increased nearshore disposal. It is also my opinion that the recommended consent conditions are inadequate to determine the impacts of nearshore dumping on Aramoana surfing wave quality, since no baseline surfing wave-quality has been established. Indeed, the approach is fundamentally flawed. The conditions propose an experiment at one of New Zealand's 17 Nationally Significant Surfing Breaks that may provide information on surfing wave quality when 50,000, 100,000 and 150,000 m<sup>3</sup> of sediment are dumped over a 3-year period. However, they cannot provide information on the Environmental Effects of these proposed increases, and do nothing

whatsoever to avoid impacts or take a precautionary approach as stipulated in the Statutory Considerations.

14. Considering the rationalization provided earlier in the officer's report, it is very difficult to understand how the decision to grant consent was arrived at by the officer. The following provides a brief summary of further points in the officer's report pertaining to impacts on the 2 Nationally Significant Surfing Breaks.
15. The officer's report recommends that the Heyward and Aramoana sites are selected for their "naturally moving sand bottoms". It's difficult to understand how this fits into the application and reduces environmental impacts, as well as where in the supporting information that "naturally moving sand bottoms" will be of benefit. At Heyward, it is proposed to dispose of any material over 200,000 m<sup>3</sup> in deeper water so that it will not move, while at Aramoana all the evidence indicates that disposed material cannot easily move out of this littoral cell – no movement and containment seem to be at conflict with this selection criteria of "naturally moving sand bottoms", which definitely does not address impacts on Nationally Significant Surfing Breaks.
16. The officer's report repeatedly points out that POL has 'reduced' Aramoana disposal to 50,000 m<sup>3</sup>/year. However, this amount is approximately two-times two times the volumes deposited in recent years, and therefore represents an increase, not a reduction. However, this comes with the proviso of "unless more is required for researching the impacts" – how will this decision be made, and does it provide an option for the POL to dispose of 600,000 m<sup>3</sup> of material from capital dredging? This proviso is unqualified and given the 26 year average of 27,000 m<sup>3</sup> of disposal unnecessary. It should not be the decision of POL, nor of the consultants undertaking the work, since the Port has a vested interest in disposing more material close to the harbour entrance, and the consultants have a history of working with the Port and cannot be considered independent. While POL have acknowledged the concerns of the working party that Aramoana is over-full with dredge material by reducing the yearly volume to 50,000 m<sup>3</sup> (even though there is the completely unsupported statement all through the application that nearshore dumping has a 'positive effect' on the break), the obvious conclusion from the investigations presented to date is that since the sand deposited in the Aramoana littoral cell is unlikely to move out of it easily, reducing the input rate does not avoid this impact, it simply fills it at a slower rate; noting that this 'slower rate' is slower compared to 200,000 m<sup>3</sup>/yr limit. However, this is a moot point – 50,000 m<sup>3</sup>/yr represents over 2x as much sediment as the recent disposal rates as presented by the applicant (i.e. ~20,000 m<sup>3</sup>/yr for 2008, 2009 and 2010) and 26 year average (27,000 m<sup>3</sup>/yr); it is an increase in nearshore disposal, not a reduction.
17. The officer's report includes a statement (#161) that "Shoaling within the disposal sites has results in an improved wave break for surfing at



Aramoana Beach”, and (#162), that “the effects from the ongoing disposal activity will not be adverse and is expected to continue to be a positive effect”. However, there is no evidence to support these positive effect presented by the applicant. In fact the South Coast Boardriders put in a neutral submission because *they did not know the impacts*, long time surfers familiar with the break say that it *has been degraded by the continual dumping* since the mid-1980’s and is now over-full and the waves are of lower quality than they were in the past. There is no evidence, or submissions, to support this statement in the application.

~~18.~~ #163 of the officer’s report states that “There is a relationship between the disposal mounds and the waves generated at Aramoana. Dr Single (2011) confirmed and it is agreed that shoaling within the disposal sites has resulted in an improved wave break for surfing at Aramoana.”. These conclusions by the Officer and Dr. Single are not supported by the Surfing Wave Dynamics report, the Boardriders, long-time surfers of Aramoana or the SPS. The Surfing Wave Dynamics report considered modelling events over the 2002 and 2009 bathymetries and looked at the larger-scale influences of the features. They concluded, and I concur, that the ebb-tidal delta has the greatest influence on the surfing waves at Aramoana. The modelling of the mounds versus no-mounds in the same report shows some differences wave height distribution, as would be expected, but in no way relates that to the quality of surfing and the effects of nearshore mounds on wave quality. Indeed, the impacts of the mound based on the modelling outcomes could be considered negative in that variability and peakiness along the beach is reduced by the nearshore mound reducing the number of surfing peaks along the beach (which is described further below). It cannot be determined since the modelling in the Surfing Wave Dynamics report does not consider parameters critical to surfing wave quality (e.g. peel angles and breaking intensity), and is not validated against actual events (comparing a photograph of waves in 2005 to modelling of the similar swell conditions on a 2002 bathymetry cannot be considered validation, and I do not believe that it is intended to be).

~~19.~~ In the following statement, #164 of the officer’s report, it seems there is a reversal of opinion which states “However, the level of the proposal deposition is in excess of what has previously been deposited (Figure 6) and therefore effects on the surf breaks are unknown and potential detrimental, if the deposition is not managed appropriately.” The application provides no impact assessment on the effects of depositing 50,000 m<sup>3</sup> sediment at Aramoana and 350,000 m<sup>3</sup>/yr at Heyward, and how the volume of disposal is to be managed by monitoring Aramoana surfing break. In addition, the proposed monitoring in consent conditions can in no way be considered an appropriate management system.

~~20.~~ Monitoring is collecting information that can be used to determine impacts and/or develop a management plan; however, it is not management in itself. Furthermore, to develop an adaptive management plan, you must first establish a good baseline dataset. In the present case, data on the

wave quality prior to dumping more than twice the recent disposal rates at Aramoana needs to be established before disposal is initiated. If it is not, then the experiment is only considering what the surfing conditions are like with a 50,000, then 100,000, then 150,000 m<sup>3</sup> mound (accumulated over 3 years) just offshore of Aramoana are like. The proposed methodology does not determine what the impact of nearshore dumping is on the break. With a 7-fold increase of disposal volumes at Heyward, these concerns are even greater and completely ignored by the applicant.

21. To determine these impacts, the correct methodology would be to not dump any material in the Aramoana nearshore site for 3 years while conducting comprehensive and independent monitoring to attain a non-disposal dataset. Then on year 4, if all parties are in agreement based on the previous 3 years of data, a disposal would be made, monitored independently and the changes to wave quality over the following year assessed to determine whether or not the dumping was detrimental and whether or not dumping should continue into the following year. That is an adaptive management plan, not what is considered appropriate by the officer in #166 of the report. Even so, the question still remains as to whether or not it is appropriate to experiment with one (actually 2) of New Zealand's 17 Nationally Significant Surfing breaks? This is admittedly a difficult question, since human influence has played a role on these breaks and this coast for a considerable time. However, the proposed consent presents significant changes to the status quo and little in the way of impact assessment on the proposed activities. Given the unknowns and the 'national significance' of the breaks, a precautionary approach should be taken, which is definitely not demonstrated in the application.
22. #180-181 of the officers report summarises impacts on Aramoana, which does not seem to incorporate the findings of the Surfing Wave Dynamics Report, and states that 2-fold increased disposal at Aramoana "are likely to confer positive outcomes for surfing.". As previous, this is unsupported by evidence and contrary to submissions by the Boardriders (neutral), long-time surfers, and the SPS.
23. Figure 7 of the officer's report (reproduced here as Figure 1) well sums up the huge change and increase to nearshore disposal proposed – the impacts of this large change have not been adequately assessed for Aramoana, and not assessed at all for Whareakeake. This Figure indicates that there will be a massive change in disposal activity due to the addition of capital dredge material, based on the historical disposal volumes – i.e. an average of 27,000 m<sup>3</sup> for Aramoana compared to the proposed increase to 50,000 m<sup>3</sup> (with a proviso for more if required for the 'experiment'), and an average of 60,000 m<sup>3</sup> for Heyward compared to the proposed increase to 350,000 m<sup>3</sup>.
24. Figure 7 of the officer's report (Figure 1 herein) clearly shows the trend for disposal at the Hayward and Aramoana sites have been towards decreasing volumes at these sites. The current proposal is for a 316%

increase in nearshore disposal rates (i.e. 1,42M m<sup>3</sup> between 2000 and 2010 (i.e. over 10 years) compared to 1.35M m<sup>3</sup> in 3 years), without adequately assessing the impacts. This is a massive change to the status quo and is driven by economic rather than environmental considerations or consideration of the impact on 2 of New Zealand's 17 Nationally Significant Surfing Breaks. Specifically, the primary consideration is the cost to the Port for disposing of capital dredge material at the A0 site versus inshore. Inadequate investigations have been undertaken to support the applicants position that the impacts will be less than minor. This is compounded by the lack of baseline data – since early 2010 SPS has requested that baseline monitoring be initiated to provide a quantified understanding of current wave quality at these breaks. In addition, Dr. Single advocated monitoring of the surfing breaks in the mid-2000's. This has not been initiated. Therefore a meaningful monitoring programme to determine impacts of nearshore disposal and development of an adaptive management plan is currently not possible.

25. — To put these volumes in some context of potential effects, the investigations of Mead *et al.* (2011) can be considered. While natural offshore wave focussing features were found to have volumes of between 25,000 m<sup>3</sup> and up to ten's of millions of m<sup>3</sup>, refraction/diffraction modelling investigations considered artificial offshore mounds of 100,000 m<sup>3</sup>, 500,000 m<sup>3</sup> and 1M m<sup>3</sup> i.e. reasonable volumes for disposal of earthquake debris. The results indicated that even the smallest mound (100,000 m<sup>3</sup>) had a significant focussing effect. In addition, as would be expected, the larger the offshore mound's volume, the large the consequent impact. The Surfing Wave Dynamics report also shows the significant effects of the disposal mounds, the larger and deeper Heyward site having an impact along large parts of the coast comparable to the effect of the ebb-tidal delta. Like the impact of the mound at Aramoana, it is unknown whether the impacts of the Heyward disposal mound are positive, negative or benign at Whareakeake. However, given the 7-fold proposed increase in disposal and the focussing/wave-shadowing presented in the Surfing Wave Dynamics report, there is obviously the potential to have significant impacts on Whareakeake. These impacts have not been investigated even through simple modelling techniques.

26. — #191 states that the proposed consent could “in a worst case establish a different equilibrium that may cause an irreversible effect by changing the coastal environment.” And that this more than 2-fold increase in disposal at Aramoana and almost 7-fold increase at Whareakeake will be avoided (not mitigated, these impacts should be avoided for 2 of New Zealand's Nationally Significant Surfing Breaks according to Policy 16 of the NZCPS) by reducing input at Aramoana (this is factually incorrect, the average input has been 27,000 m<sup>3</sup>/yr, with the more recent inputs of the order of 20,000 m<sup>3</sup>/yr, making 50,000 m<sup>3</sup>/yr an increase at Aramoana), and putting spoil deeper at Heyward to prevent wave remobilization. The biggest immediate impact on Whareakeake will be the focussing effects of the mound, which will change the inshore wave height distribution and has the potential to

negatively impact on the break. This has not been address at all in the application. These significant changes in operation are considered reasonable by the officer, without any supporting impact assessments. As above, based on the information provided by the applicant, it is very difficult to understanding how the officer arrived at the reason for recommending the application “That it is expected that the adverse effects on the environment will be minor, can be adequately addressed through the recommended consent conditions”?

## REVIEW OF THE SURFING WAVE DYNAMICS REPORT

~~27.~~—Since my initial expert opinion on the POL’s AEE and supporting technical documents (9 September 2011, appended below), a further report has been produced by MetOeacn Solution Ltd titled “Surfing Wave Dynamics Report” in support of the applicants (MSL, 2011). This report provides some very useful information and insight into the effects of the offshore and nearshore features on wave height and direction modifications that are useful in understanding the broader impacts of the ebb-tidal delta and historic disposal mound configurations. Unfortunately the title of this report is not really supported by the content – there is very little, if any, meaningful assessment of the surfing wave dynamics, how past dredge disposal has impacted on surfing wave quality, and most importantly how the proposed activities that dramatically reverses the historical declining disposal trends to increases of over 300% will have no adverse impacts on the Nationally significant breaks, which is what the NZCPS stipulates;

“Policy 16(a) ensuring that activities on the coastal environment do not adversely affect the surf breaks.”

The applicant has presented no evidence that indicates that the proposed activities will not adversely affect the Nationally Significant Surfing Breaks of Aramoana and Whareakeake. Quite the contrary, the report on “Surfing Wave Dynamics” clearly shows that the disposal grounds have the capacity to greatly influence wave dynamics (although surfing wave dynamics are not addressed), and so increasing the Heyward disposal from an average of 60,000 m<sup>3</sup> to 350,000 m<sup>3</sup> and Aramoana from 27,000 m<sup>3</sup> to 50,000 m<sup>3</sup> is most definitely *going to have an impact*. These increased volumes represent significant increases in disposal volumes and consequently significant changes on the wave dynamics (i.e. focussing, wave-shadowing, changes in wave directions, etc.) are to be expected. Since the Port has modified the renewal to incorporate capital dredging, these volumes sought are not just maximum limits as in the past, they are what will be deposited.

~~28.~~—The most likely results for Whareakeake is an increased loss of wave height during some wave conditions due to increase focussing over the Heyward disposal site and unknown changes due to the increased volumes of sand moving shoreward. The most likely results for Aramoana is the accelerated degradation of wave quality as the confined embayment is filled at twice the previous rate, at a site that anecdotal evidence indicates

is already over-full. Given the evidence provided by the applicant, it is my opinion that this is an application based on economics not environmental impacts and the consequent social impacts defined under the RMA and NZCPS.

29. Review of the Surfing Wave Dynamics report also does not support Dr. Single's statement that the nearshore disposal at Aramoana has enhanced wave quality. As described in the report, the A-frame type focussed waves at Aramoana are created by refraction over the offshore ebb-tidal delta. There are many examples of such breaks around the world and in New Zealand (e.g. Matakana Island, now classified a regionally significant surfing break by the Bay of Plenty Regional Council, due to refraction over the Tauranga Harbour delta; Ocean Beach due to the refraction/focussing/crest-splitting across the San Francisco Harbour delta; Duranbah due to the refraction/focussing/crest-splitting across the Tweed River delta).
30. The modelling of bathymetries with mounds and no-mounds in the report demonstrated that the nearshore mounds have an effect on wave height gradients along the beach, but does not conclude whether these impacts are positive or negative. This is an appropriate assessment since this modelling is considering wave height gradients rather than specific surfing wave-quality parameters such as peel angle, breaking intensity and length of ride. This report is an investigation into how incident wave heights and direction are influenced by offshore features (i.e. the ebb-tidal delta and the disposal mounds). It does not address surfing wave-quality and whether or not the proposed 2 to 7-fold increases in disposal volumes will impact on the Nationally Significant surfing breaks; it is considering past mound configurations.
31. As in the application, very little attention is given to the impacts of disposal at Heyward Point on the Nationally Significant right-hand point break at Whareakeake. There is mention of focussing from the results of one of the model simulations, and there are also results presented that show significant de-focussing, or height reduction/wave-shadowing, at Whareakeake during particular swell conditions (e.g. from 60°). It is notable that focussing is good for surfing conditions at Aramoana, but has potentially negative impacts on Whareakeake, especially if the current focussing on the Heyward disposal mound was to be increased 7-fold (which is described below).
32. Of great concern is that the impacts of the increase of 7-fold disposal volumes at Heyward on the Nationally Significant Surfing Break at Whareakeake – these have been completely ignored. The Surfing Wave Dynamics report provides some insight on how the Heyward disposal site impacts on Whareakeake (based on historical mounds). It is important to realise that Whareakeake is a point break, which is very different from a focus break like Aramoana. Aramoana is basically a planar beach, with the wave peakiness and subsequent peel angles, and to an extent the breaking

intensity of the wave, dependent on focussing on the offshore delta, i.e. splitting wave crests so that they form distinct bands and variable wave height gradient (e.g. Figure 3.7 of the MSL (2011) report, reproduced as Figure 2 here). Whareakeake is a point break, with the angle of the headland and subsequent seabed to the incoming wave direction resulting in waves peeling down the point. The best conditions for point breaks are straight, even crested waves, not waves that have been split and have a variable wave crest due to focussing over an offshore mound – this is negative to the wave quality of a point break. The focussing Figures in the Surfing Wave Dynamics report clearly shows the variable height gradient due to focussing on the Heyward disposal mound, and that it can indeed be detrimental, e.g. Figure 3.7 (Figure 2 herein) shows the large loss of wave height during swells from 60°. This effect will be modified and very likely exacerbated by increasing the volumes of disposal at Heyward by 7-fold. No investigations of these detrimental impacts on the Nationally Significant surfing break at Whareakeake have been undertaken for this Resource Consent application.

33. Because the influence of the disposal mound on Whareakeake is both a large distance offshore and has been occurring since pre-Aramoana inshore disposal from the mid-1980's, the impacts are unknown. The results of the Surfing Wave Dynamics report present the significant impact that the Heyward disposal ground has on a large area of the coast, which is basically centred on Whareakeake. Therefore, it is unknown when the swell is 'missing' Whareakeake (small waves are present when other parts of the coast have good sized swell), or the swell was 'lumpy' (the wave crests are broken up), whether such effects are due to the swell of the influence of the disposal site. Obviously such an understanding is required before granting consent for a 7-fold increase in disposal and for the development of adaptive management plans.

34. The MSL (2011) report concludes that a defined mound increases the wave height gradient at Aramoana, and implies that this is an improvement. However, considering the results of the impacts of a defined mound versus no mound (Figure 5.9, reproduced here as Figure 3), it is also very evident that the presence of a nearshore mound reduces the variability/peakiness along the beach, potentially reducing the surfing potential and quality by reducing the number of peaks along the beach. Indeed, delta-focus breaks such as Matakana Island, Ocean Beach, and South Stradbroke Island, have defined peaks during a particular swell, i.e. the A-frame waves consistently break in the same places along the beach (pers. obs.) – the modelling with a mound suggests that this is reduced when a mound is present (Figure 3). These results are consistent with the anecdotal evidence of long time surfers, i.e. that there are less quality peaks at Aramoana than there used to be when a swell is running and a greater tendency for waves to close-out (i.e. break along long sections without peeling and thus not presenting a good wave for surfing).

35. I agree with the summary statements that a mound at Aramoana causes increased wave height in the lee of the mound at the beach, and without a mound wave energy is more broadly distributed along the beach. However the wave field exhibits the strong zones of wave focussing created by the offshore bar when there is no nearshore mound and the variability in the wave height gradient is diminished with the presence of a mound (Figure 3). A definitive conclusion with respect to enhancement versus degradation cannot be made based on these modelling results.
36. The modelling undertaken by the applicant and modelling that we have undertaken independently indicates that the deepening of the channel will have a significant impact on wave height at Aramoana, as can be seen in Figures 5.4 and 5.5 of the Surfing Wave Dynamics report (reproduced here as Figures 4 and 5). However, like the impacts of focussing on the Heyward disposal site on Whareakeake, this impact has been mostly ignored.
37. It is summarised that it is not clear whether the change in refraction over the ebb-tidal delta due to deepening of the channel will have an overall negative effect on surfing wave quality. While there is this change in refraction due to the deepening, there is also the reduction in wave height due to the deepening of the channel. It has been suggested that this reduction in wave height due to waves crossing a channel at an oblique angle is caused by reflection of wave energy, and has been proposed in other locations for port protection rather than using hard structures to reduce wave height (Nielsen, 2011). While it is recognised that unlike the disposal of material, the deeper channel cannot be moved elsewhere to avoid the impact, it is still the case that this impact is not investigated and not considered in the context of Policy 16 of the NZCPS.

## **DEVELOPMENT OF AN ADAPTIVE MANAGEMENT STRATEGY**

38. The monitoring conditions are lacking in detail, which needs to be addressed to ensure that useful data is collected with respect to surfing wave quality (see Scarfe et al., 2009), but more importantly, is fundamentally flawed with respect to the development of an adaptive management plan.
39. The current draft conditions propose an experiment for Aramoana and ignore the potential impacts on Whareakeake. It is very difficult to support that these conditions are based on the RMA, the NZCPS and the precautionary approach, especially when 2 of New Zealand's 17 Nationally Significant Surfing Breaks are at the centre of the application. A substantially more appropriate 'experiment' would be to cease all nearshore disposal and monitor the surfing quality at these breaks over the next 3 or more years to a) develop a data base with which to measure impacts such as nearshore disposal has on the breaks, and b) determine whether or not the quality of surfing waves improves, remains the same, or is diminished with the cessation of nearshore disposal.

40. It is my opinion that multi-year baseline data is required, since a single year of data collection to determine the mechanics of a break could easily provide very biased results due to the large year-year and season-season variation with respect to conditions at surfing breaks. I can use my home break as an example, although it is applicable world-wide. For example, at Raglan the summer of 2011/12 could be considered (subjectively) above average, with this summer being well below average; this autumn/early winter has been above average, while last autumn/early winter was below average for good surfing conditions (although the late winter was average to above average). Similarly, particular weather patterns can persist for extended periods and as a result some conditions may rarely or never occur in a year (e.g. the clean long-period groundswells from the NW that reach Raglan from the east coast of Australia – some years we have several, some years none). Similar situations are related for Aramoana – e.g. if the monitoring had been undertaken for just the past year as a baseline dataset it would have been biased towards few swells and low quality surfing waves.
41. The best way forward for consent conditions would be to undertake the studies to determine how much sediment the coast west of the mole requires, the sediment pathways and processes, etc., without any further dredge disposal at Heyward and Aramoana, while undertaking 3 years of baseline data collection with respect to the existing wave quality at Aramoana and Whareakeake. These data would then be used to develop methods of predicting the impacts of adding sediment to the 2 nearshore disposal grounds, which could then be validated with controlled disposal. In this way, an adaptive management strategy can be developed. As stated above, due to the human intervention at the harbour entrance, it is likely that there will always be a need for management of the coast west of the mole.
42. The monitoring should include measurement of surfing parameters such as peel angle and ride length, breaking position (all of which could be collected through appropriately sited cameras at Aramoana and Whareakeake with the application of image rectification) and wave breaking intensity (which requires the collection of images from sealevel and normal to wave crests and so is more difficult data to collect), as well as the considerations described by Scarfe *et al.* (2009). These data should also be correlated to a) the incident wave and wind conditions, and b) numerical modelling of the incident waves over the existing offshore bathymetry, including the ebb-tidal delta and disposal mounds (with bathymetry data collection proposed in the draft consent conditions).
43. Through these methods of data collection, a baseline data set of the existing wave quality at these Nationally Significant Surfing Breaks will be developed, along with an understanding of how the existing mounds interact with incident waves and what the effects of these mounds are (e.g. during xx-conditions at Whareakeake, the Heyward disposal mound results in increased wave height, while during xx-conditions wave heights are



reduced; during xx-conditions at Aramoana, the wave height is large enough that breaking occurs on the nearshore mound and reduces surfing wave quality; etc, etc.).

44. Once the baseline dataset has been established, and the mechanics of the 2 breaks and interactions between the nearshore disposal sites are understood, the tools will be available to undertaken an AEE, which has not been undertaken in the current application. For example, different volumes and placement location/configuration can be modelled and the impacts accessed *before* experimental nearshore disposal is undertaken at Aramoana or very large volumes are disposed of at Heyward and cause irreversible (at least in the medium term) negative impacts on Whareakeake – it is notable that it is proposed to include rock material at the Heyward disposal site.
45. Aramoana and Whareakeake have been designated a Nationally Significant Surfing Breaks since 2010, however the applicant does not seem to fully appreciate this and continues to look backwards and not recognise the significance of this designation. Surfing breaks have been given some of the recognition they deserve, like say national parks – it is my opinion that the applicant needs to appreciate this, which is not evident in the AEE supporting the application. Similarly, the status of these breaks has been largely ignored by the officer that prepared the report on the application.

## SUMMARY

46. The AEE pertaining to the impacts of the 2 of New Zealand's Nationally Significant surfing breaks is insufficient to non-existent. There has been no assessment of existing wave quality and no assessment as to the impacts on this due to the proposed increased disposal of maintenance and capital dredge. The applicant and the ORC officer have not given the Policies pertaining to Surfing Breaks of National Significance (16) and the Precautionary Approach (3) sufficient regard, i.e. impacts are not being avoided and a precautionary approach is not being taken when currently there are uncertainties, unknowns and little is understood about the impacts of significant increases in nearshore disposal 2 of New Zealand's Nationally Significant Surfing Breaks.
47. The proposed activities increase nearshore disposal of 2-fold the 26 year average at Aramoana and 7-fold the 26 year average at Heyward. These increases will have significant impacts on the breaks. There is concern that the nearshore disposal at Aramoana has led to continued degradation of the surfing wave quality, with anecdotal evidence supporting the results of the Surfing Wave Dynamics report – i.e. there are a reduced number of quality peaks along the beach and large swells are nowadays rarely surfable; Aramoana used to get better as it got bigger and nowadays waves are broken or degraded by the nearshore mound and almost unsurfable. The Surfing Wave Dynamics report also demonstrates the profound

impacts that the Heyward disposal ground has on Whareakeake. However, there has been no investigation into whether these impacts are positive or negative, nor what the 7-fold increase in disposal and Heyward will result in.

48. The proposed monitoring and adaptive management is poorly designed with respect to understanding impacts of increased dredge spoil and avoiding negative impacts at both breaks. Since there is no baseline information about existing surfing wave quality, there is nothing to compare the changes that will be caused the significant increase in disposal volumes. This is not a monitoring programme, it is merely quantification of how waves break due to increasing volumes of disposal nearshore at Aramoana. Impacts and management for Whareakeake are completely ignored.
49. It is my opinion that the significant increases in disposal at Aramoana and Heyward will have significant impacts on the 2 Nationally Significant Surfing Breaks at Aramoana and Whareakeake, respectively. The incident wave modelling presented in the Surfing Wave Dynamics report and anecdotal evidence indicates that these significant impacts have the potential to be negative. The proposed monitoring for the development of an adaptive management plan is fundamentally flawed and will in no way result in an understanding of impacts of increased nearshore disposal on surfing wave quality.
50. Therefore, it is my opinion that the Resource Consents should not be granted and that no disposal should be allowed at the Aramoana and Heyward disposal site, since this activity has the potential to negatively impact on 2 of New Zealand's Nationally Significant Surfing Breaks. Until existing surfing wave quality at the 2 Nationally Significant Surfing Breaks is quantified, the mechanics of these breaks is better understood and the influence of the existing disposal mounds at Aramoana and Heyward are understood, it is not possible to develop an adaptive management plan to avoid negative impacts due to nearshore dredge disposal.

51. It is recognised that the coast to the west of the mole has been influenced by human intervention for a long period of time and that ongoing management of this coast will be required. However, this is all the more reason to understand it and manage rather than over-exploit and experiment. This will require comprehensive investigations to determine the mechanics of this coastal system. However, increasing the current nearshore disposal by more than 300% with very little understanding of how this will impact on Nationally Significant Surfing Breaks is definitely not an acceptable method to develop this understanding, cannot be considered a precautionary approach, and could potentially have negative impacts on these breaks.

2 May 2013

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Shaw Mead

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Figure 1. Historic and proposed disposal volumes adapted Figure 7 from the officers report.

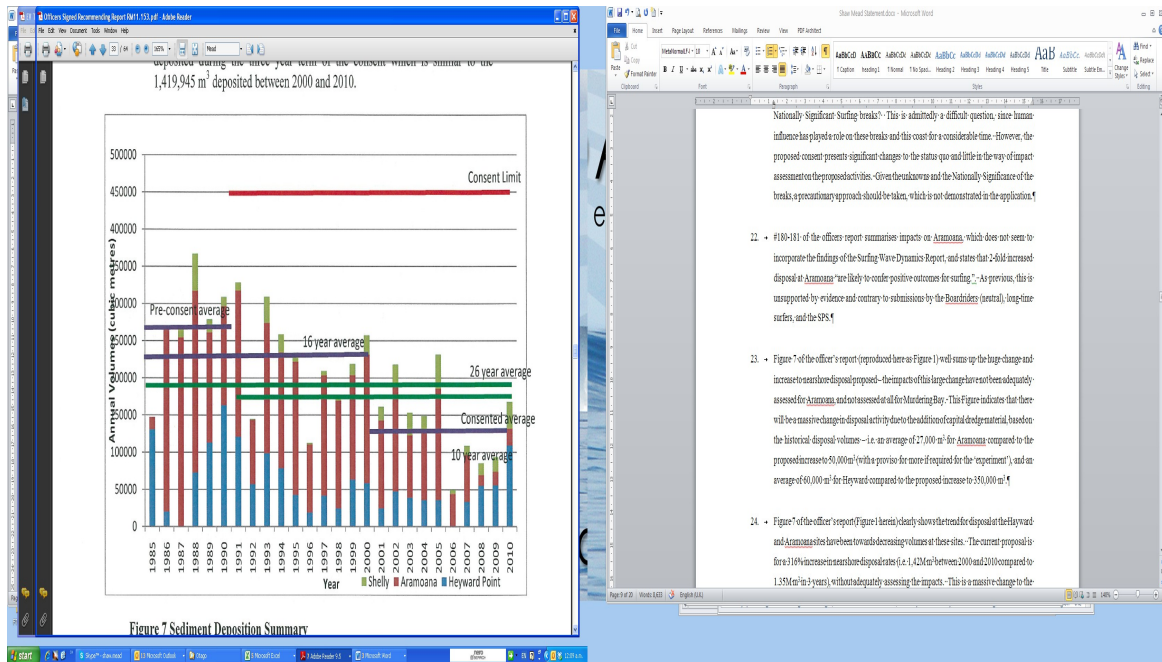


Figure 2. Figure 3.7 from the Surfing Wave Dynamics report showing wave focussing and shadowing due to the presence of the offshore disposal site at Heyward the ebb-tidal delta, demonstrating shadowing of the right-hand point break at Whareakeake during a wave event from 60°

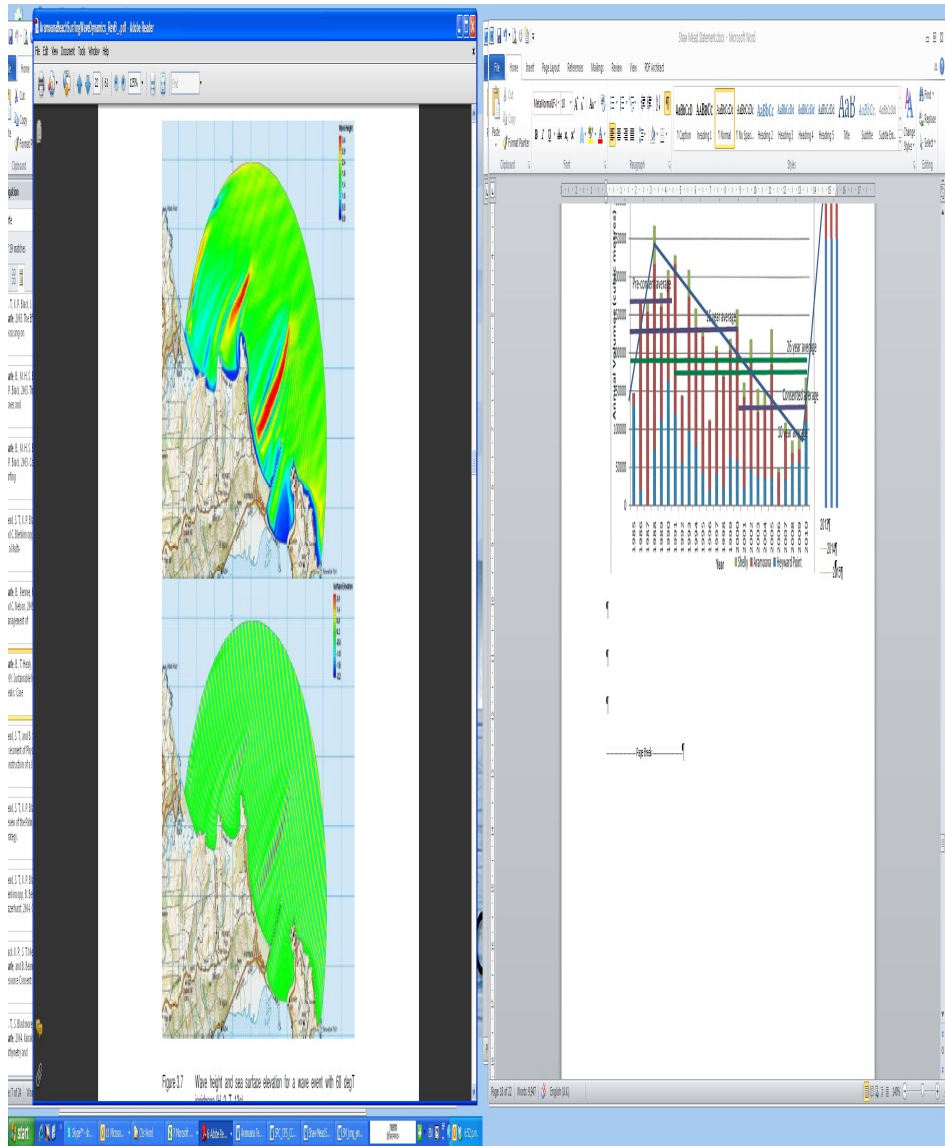


Figure 3. Figure 5.9 from the Surfing Wave Dynamics report showing the wave height gradient along Aramoana Beach due to the presence of a mound in the nearshore disposal site (top) and without a mound (bottom) demonstrating the reduced variability due to the mound and consequent reduced number of surfing peaks.

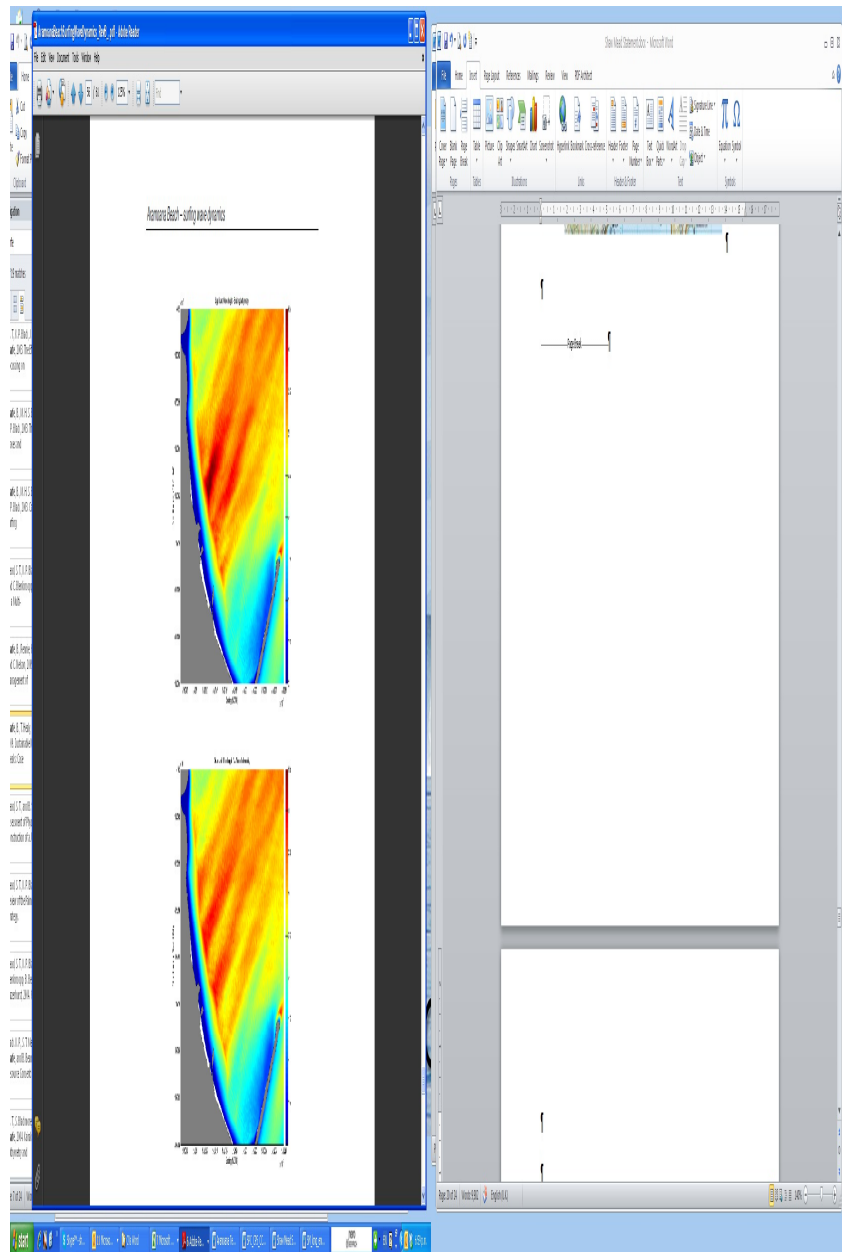


Figure 4. Figure 5.4 from the Surfing Wave Dynamics report showing the changes to significant wave heights at Aramoana due to the deepening of the Entrance Channel.

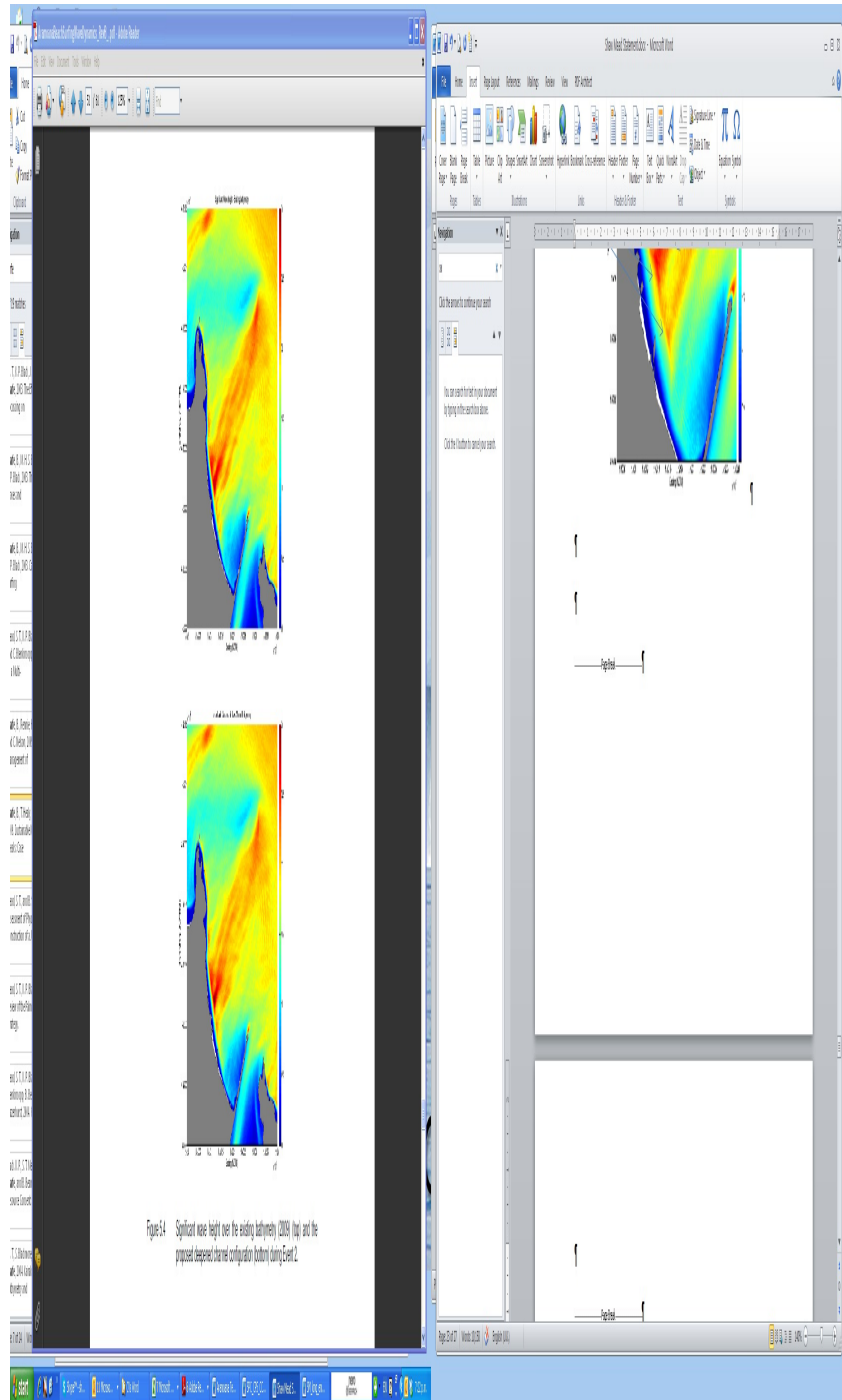
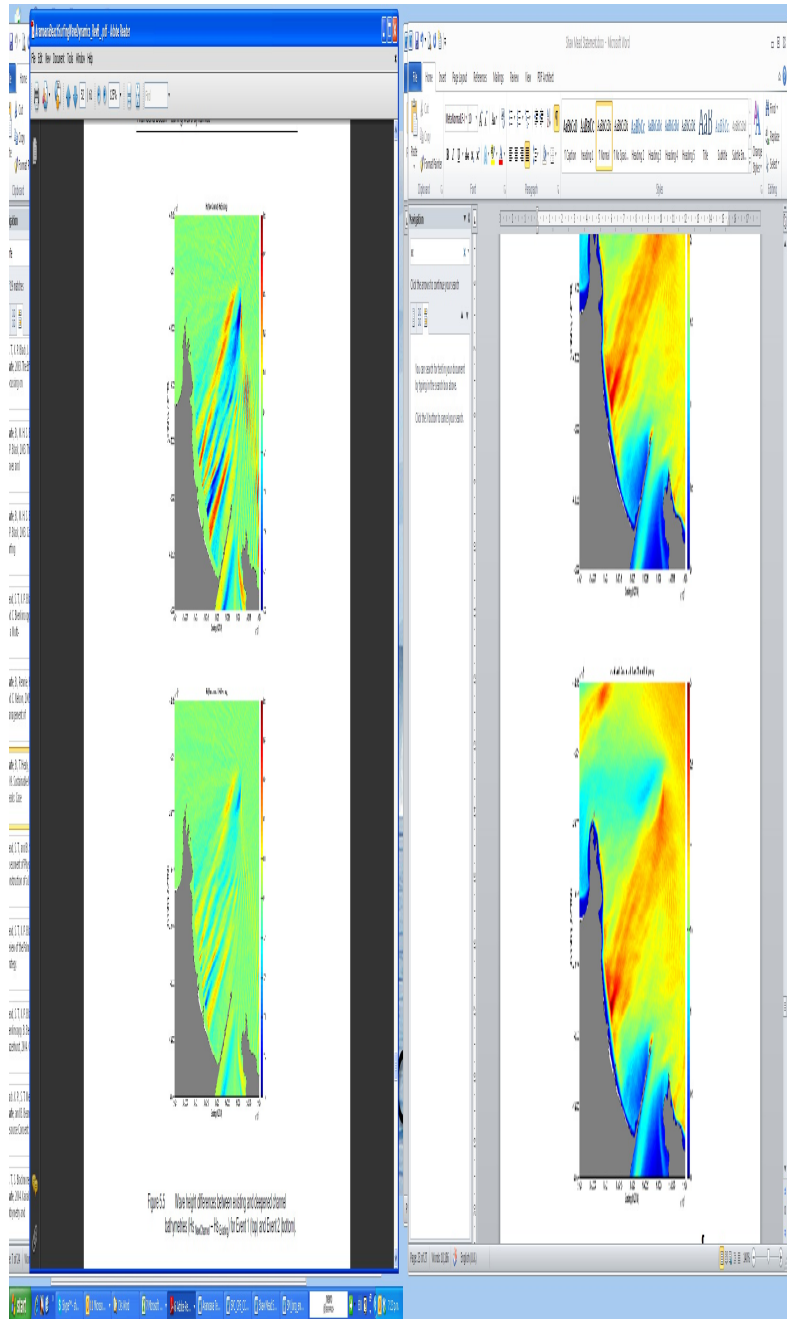




Figure 5. Figure 5.5 from the Surfing Wave Dynamics report showing the differences to significant wave heights at Aramoana due to the deepening of the Entrance Channel.



## Appendix 1

Dr. Shaw Mead  
PO Box 151  
Raglan 3265

9 September 2011

Matt Skellern  
Surfbreak Protection Society Inc.

Dear Matt

### **Re: Application to Renew Resource Consent for the Disposal of Dredged Material at Aramoana Spit.**

I have reviewed the Application and supporting technical appendices that pertain to potential impacts on the Nationally Significant Surfing Break, Aramoana Spit. My expert opinion follows, with my relevant qualifications attached as an addendum below this.

1. Given the Nationally Significant status of Aramoana Spit, it is very surprising to find that the few references to the surfing break and potential impacts on the surfability of the waves at the break total less than one page. The application refers to “research” and “monitoring” which indicate “positive effects” to the surfing wave quality at the Spit, although neither is presented in the supporting technical documents. In addition, there is no quantification of the surfing wave characteristics that make this break Nationally Significant, no quantification of the physical parameters (e.g. seabed features, wave events, tidal phases, etc) that contribute to make this a Nationally Significant surfing break, and no adequate monitoring proposed – the latter is not possible without first quantify the parameters that make this break Nationally Significant, i.e. baseline data. The large deficiencies in assessing the environmental impacts of continued nearshore dumping at this site and lack of a monitoring regime on which to base the proposed adaptive management are very concerning since there are a number of current issues that could lead to negative impacts on this Nationally Significant surfing Break:
  - a) As described in SPS’s submission in consideration of the capital dredging of the Port, during larger swells waves are already breaking on the nearshore disposal ground, which leads to reduced inshore wave heights;
  - b) Due to uncertainties about the capital dredging for the Port, the nearshore disposal grounds will be utilized first, greatly increasing the volumes of spoil put just offshore of the break (i.e. it would be reasonable to expect that the maximum of 200,000 m<sup>3</sup> will be placed per year, while only 162,293 m<sup>3</sup> has been placed here in the past 5 years);

- c) A sediment transport pathway out of the Aramoana Spit region has not been identified and it is expected that sediment deposited here will have a long residence time, and;
- d) There opposing views amongst the surfing fraternity – some are concerned that the break is already overfilled with sand and while in the early years nearshore disposal improved the break, it has been degraded in the last decade with continued nearshore dumping, while others believe it is making little impact, i.e., you cannot base a monitoring programme on the opinion of surfers as proposed in the application.

While there is no doubt that maintenance and expansion of the Ports operations are very important to the city of Dunedin, it should not come at the potential expense of a Nationally Significant surfing break. The research, monitoring, AEE and proposed monitoring citing and described in the Resource Consent renewal application are not sufficient and do not support the claims of positive impacts on the surfing break. The following provides more detail on the parameters of a surfing break, concerns with respect to the current application, and investigations/monitoring that could be applied to develop base-line data and measure changes to the break should Resource consent be granted.

2. The Spit surfing break at Aramoana is designated as protected under Policy 16 of the New Zealand Coastal Policy Statement 2011 (NZCPS). The wave is an asset of significant amenity value because of the high quality of surfing waves breaking there. Primarily, there are 2 fundamental aspects of breaking that determine the quality of a wave in regard to surfing. The first is peel angle, which is related to the rate at which the wave breaks along its crest. The lower the peel angle the faster the wave breaks. If the peel angle is too low the wave breaks faster than the down the line speed achievable by the surfer. If the peel angle is too high the ride is slow which is undesirable. Secondly is the breaking wave shape. It can be quantified by the vortex ratio or described qualitatively by one of four terms: spilling, plunging, collapsing and surging. Wave shape largely determines the range of surfing manoeuvres possible on the wave. Novice surfers are more suited to spilling waves. Advanced surfers generally prefer plunging waves, with steep faces.
3. For anyone with an innate understanding of wave breaking ideal for surfing, the necessity of adequate peel angle and wave shape is quite clear. It is imperative that any assessment of surfing wave quality incorporates both of these wave breaking aspects. Both of these surfing wave parameters are determined by the local bathymetry and the offshore bathymetry that “conditions” waves before they arrive at the break. The shoaling observed at Aramoana is a two phase process. The ebb tide delta of Otago Harbour focusses wave height centrally to Aramoana Beach, as observed by MetOcean Solutions Ltd (2011). Near the shore, the Aramoana dump site again acts as a focus, although the majority of focussing occurs on the ebb tide delta. The result of the focussing of wave energy is longshore gradients in wave height that provide suitable peel angles, the gradients of

the nearshore bathymetry are reflected in the shape of the waves observed at the Spit, with both contributing to the high wave quality observed at the Spit.

4. In POL's AEE (Chpt 6, pg 23) it is stated that "the research undertaken to date indicates that the disposal activity has positive effects in terms of Aramoana surf break". The research undertaken is with reference to Single's (2011) report, Appendix C of the AEE. The reference made by Single to surf quality is that "shoaling within the disposal sites has resulted in an improved wave break for surfing at Aramoana" (Appendix C, Chpt 7, pg 22). However, the AEE presents no evidence alongside this statement. If there is no current, detailed baseline information available about the processes acting to create high quality surfing waves at Aramoana, how can future assessments be made of the disposal activities in a comprehensive manner? Single (2011) suggests "observations related to the resource use of the beaches will provide a means to further assess the sustainability of the disposal operation". Surfers surf at breaks suited to their personal ability. Surfing wave quality is subjective and ability dependent. If the waves at a given break are not desirable to advanced surfers they may be ideal for novices. Observing the number of users in the water is not a sufficient method for assessing the impacts of spoil disposal on surfing wave quality. To put the issue of wave quality into perspective, New Zealand has a longer coastline than the USA, however, only 17 surfing breaks have been recognized as nationally Significant, including The Spit (Aramoana) and Whareakeake (Murder's Beach, inshore of the Hayward Point dump site).
5. "Port Otago intends to work with local surfers during the 3 year consent to get a better understanding of the relationship between disposal and surfability at Aramoana, in order to develop a management plan which minimizes any long term negative effects on this surf break." (Chpt 6, pg 27). As stated previously, surfing wave quality is subjective and does not provide quantitative details of how wave are breaking. The MetOcean Solutions Ltd document states that, with reference to the Aramoanan spoil site, "it is likely that the dredged sediments deposited here will have long residence times. Significant transport beyond this immediate area is likely to occur infrequently and only during high storm conditions". These points represent the combination of a subjective monitoring programme and the potential slow reversal of negative impacts, that may be compounded by a 5-fold increase in the rate of disposal that has been carried out in the past 5 years. If disposal at Aramoana does take place, and the effects are detrimental, there is potential that the existing high quality, NZCPS-protected standard waves will be lost of a prolonged periods. This approach is not precautionary and does not provide a basis for adaptive management of impacts.
6. Single (2011) states that MetOcean Ltd (2011) provides information about wave shoaling and the surfability of the waves at Aramoana. There is only one paragraph concerning surfing wave quality in any detail in the MetOcean document (Chpt 4, pg 57), and it is done so without reference to

any scientific literature or quantification of characteristics that comprise surfability. The effects on focussing creating longshore height gradients are discussed and it is postulated that the focussing process is dependent on seabed mound shape. There is no detailed assessment of surfing wave quality, and no dedicated modelling to determine spoil mound effects. The fundamental aspects of wave shape and peel angle are not discussed.

7. From POL's AEE, "The effect of continued disposal activity at the Spit Beach disposal ground on wave generation at Aramoana could be both positive and negative" (Chpt 6, pg 27). This statement summarizes the situation at POL and effectively nullifies any dredge disposal activities involving the Spit spoil site, and also indicates that the Environment Effects are unknown. The author appears not to be an authority on nearshore processes as "wave generation" does not relate to the subject matter, and without an adequate assessment of the impacts on surfability is left floundering. Any effects deemed negative are prohibited by Policy 16 as it requires that adverse effects on the use and enjoyment of the surf break be avoided.
8. This exert is from page 27 of the AEE, "In the meantime, on the basis of the specialist work undertaken, the effects on surfing from the on-going disposal activity will not be adverse and is expected to continue to be a positive effect within the term of the consent sought" (POL, AEE, 2011). "In the meantime", is simply not good enough when considering a nationally significant asset. There has been **no** specialist work regarding surfing wave quality on which to base anything. It is not correct to state that the disposal activity will not be adverse and actually have a positive effect. This is because not a single, indicative piece of evidence has been presented.
9. The deposition of dredge spoil will raise the seabed level offshore of The Spit. The shoaling process would be modified and breaking could possibly occur. The reduction in wave height due to breaking would compromise the longshore wave height gradients that provide the surfable peel angles at the Spit. Preliminary modelling that we have recently undertaken indicates that if 60% of material remains onsite (at maximum dumping volumes of 200,000 m<sup>3</sup>), breaking on the nearshore disposal mound will be a regular occurrence within 3 years. That is, there will be significant impacts, however, how these relate to surfability has yet to be determined.
10. The focus has been on The Spit at Aramoana, where the spoil ground is closer to the beach and is easily observed. However, the same concerns can be applied to Whareakeake. It is possible that spoil deposition could have no impact on the break, or enhance wave quality at The Spit. However, there has been no data collection, data analysis and application of empirical and numerical models to consider existing conditions and potential impacts, nor has anything close to an adequate monitoring programme been put forward. As a result, the areas of the AEE pertinent to impacts on Nationally Significant surfing breaks have made with any degree of confidence or substance. Without undertaking an adequate AEE

to consider the impacts on the breaks, a precautionary approach should be taken and consent to dispose of 200,000 m<sup>3</sup> of material just offshore of Nationally Significant Surfing Breaks should not be granted; further information is required. At present there is insufficient information to discern what the impacts will be on the quality of the surfing waves resulting in no understanding of ways to avoid, remedy or mitigate any adverse effects of disposal activities on the surfing environment.

11. It is recommended that a thorough baseline investigation is undertaken, an adequate AEE of the impacts of continued nearshore disposal on the surfing wave quality is undertaken, and should these studies indicate that there will be insignificant to minor impacts, a monitoring be developed and undertaken to ensure that deterioration in wave quality is prevented should the study's conclusions be wrong. There are a range of surf quality monitoring programmes being applied world-wide that could be utilized following the identification and quantification of the existing wave-quality parameters at the two Nationally Significant surfing breaks that could be effected by nearshore dumping, should the AEE indicate that these impacts will be minor or less. The most obvious and cost-effective monitoring would utilize remote video monitoring that can be used to assess wave breaking parameters of peel angle and breaking intensity.

Yours truly,



Dr. Shaw Mead

## Appendix 2: Qualifications and Statement of Dr. Jose C. Borrero

**IN THE MATTER** of the Resource Management Act 1991

**AND**

**IN THE MATTER** of Applications by **PORT OTAGO LIMITED** to the **OTAGO REGIONAL COUNCIL** for resource consents in respect of applications to dispose of capital and maintenance dredge spoil nearshore in the vicinity of two Nationally Significant Surfing Breaks.

### STATEMENT OF EVIDENCE OF DR. JOSE CARLOS BORRERO

#### QUALIFICATIONS AND EXPERIENCE

4. I hold B.S., M.S. and Ph.D. degrees in civil and environmental engineering from the University of Southern California in Los Angeles. My M.S. and Ph.D. degrees were focused on the area of ocean and coastal engineering. I am currently a senior consultant and director of eCoast Ltd., a marine consulting and research organization. I have worked in this field for the past 7 years in New Zealand and 5 years prior to that in Los Angeles while I was research faculty at the University of Southern California. In total I have 15 years of post-baccalaureate experience in marine research and consulting with more than 40 articles published in top level peer-reviewed research journals as well as scores of technical reports, conference papers and presentations either solely or jointly produced. I am a member of the New Zealand Coastal Society (IPENZ) and part of that group's Executive Committee. I am also a member of the American Geophysical Union. I am also a technical advisor for the Surfbreak Protection Society (NZ) and Save the Waves Coalition, which mostly entails considering the impacts of developments and the impacts they will, or have, had on high-quality surfing breaks.

52. I have a background in coastal oceanography and engineering with an emphasis on numerical modelling techniques and field studies. I also have a background in 'surfbreak science' having worked as a technical advisor for the Surfrider Foundation in the USA and as a consultant in New Zealand. Specifically my experience in that regard was related to the monitoring of a surfbreak and the assessment of changes in the surfing wave conditions as a result of a construction project. Besides having conducted a number of technical studies on surfbreak mechanics and functional performance, I have also lead or-co-organized three international

conferences related to the science and engineering of natural and artificial surfbreaks.

53. I am presenting evidence on behalf of Dr. Shaw Trevor Mead and I am in agreement with Dr. Mead's statements regarding the potential negative impacts to the Aramoana and Whareakeake surfbreaks as a result of the proposed dumping of dredged material at the Aramoana Spit and Hayward Point sites.

54. I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses and have complied with the Code when preparing this evidence. I confirm that the matters addressed in this brief of evidence are within my area of expertise. I can confirm that I have not omitted to consider material facts known to me, which might alter or detract from my opinions expressed within this evidence.