BEFORE COMMISSIONERS APPOINTED BY THE CANTERBURY REGIONAL COUNCIL

UNDER the Resource Management Act 1991

IN THE MATTER applications for resource consents by Lyttelton Port Company for capital and maintenance dredging

TABLED AT HEARING

Application: .....

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Date: 5 May 2017

SUMMARY OF EVIDENCE OF CHRISTOPHER HEPBURN FOR TE HAPŪ O NGĀTI WHEKE, TE RŪNANGA O KOUKOURĀRATA, NGĀI TAHU SEAFOOD, AND TE RŪNANGA O NGĀI TAHU

5 May 2017

NATURAL RESOURCES LAW LIMITED

Solicitor: M R Christensen
(mark@naturalresourceslaw.co.nz)

PO Box 6643
Upper Riccarton
CHRISTCHURCH 8442

Tel 0274 878611

SUMMARY OF EVIDENCE

Introduction

1. I am an Associate Professor in the Department of Marine Science at the University of Otago in Dunedin

2. I have over 15 years of research experience primarily working on the physiology and ecology of habitat forming kelp species, and the broader values they provide.

3. I have also worked on key species of value to and the habitats that support them over this time. This work includes connections and importance of coastal fisheries and habitats to "ways of life" for coastal human communities, often iwi, hapū and whānau.

4. Over the last 10 years I have published more than 35 papers in international peer-reviewed journals and have supervised more than 30 postgraduate students to completion.

5. In a local context, I led a broad research programme in Koukourārata Mātaitai from 2008-2011. This included extensive diving surveys determining the broader status of fisheries habitat characteristics, estimates of growth of pāua and interviews of local people to provide perceptions of the local community of the health of the mātaitai and change over the last 50 years.

6. I also have first hand experience in dredging programmes similar to that proposed by LPC in my role on the Technical Advisory Group for Port Otago's capital dredging programme.

7. My evidence outlines the sensitivity of rocky reef communities and species to any increases in sediment loads resulting from the proposed dredging programme. It also touches on the broader importance of accurate modelling backed up by responsive plume monitoring.

8. I provide a brief discussion of the importance of an effective reef monitoring programme independent of predictions from modelling and other types of monitoring. This provides a safety net if the modelling and real time monitoring are lacking in some way and an assurance that delayed and more subtle impacts are not occurring over longer time frames.

9. Due to the relatively low threshold that suspended and settled sediment must reach to impact on the values of rocky reef ecosystems it is my opinion that any additional suspended or settled sediment on or around reef habitats is likely to result in significant adverse effects and thus is not acceptable.

10. The proposal to dredge 18 million cubic metres of silt and clay brings a very high level of risk that rocky reef habitats will be subjected to major impacts and that erode the values they hold.

11. Sediment arriving in near-shore habitats has the potential to negatively affect these rocky reef habitats in a range of ways, most importantly by directly smothering species, providing a physical barrier to recruitment of sessile organisms, by altering critical habitats for key species, and by reducing light available for photosynthesis and growth by primary producers (macroalgae/seaweed/kelp).

12. Reduced primary production due to lower light results in reductions in food availability, that would likely have flow on effects for key species higher up the food web and the associated values of fisheries and other ecosystem services.

13. Additional sediment in the water column could reduce light to a level where macroalgal photosynthesis is lowered to a level where macroalgae are no longer able to be competitive. Thus, a shift from a macroalgal-dominated community to another community that may not provide the same values.

14. For example, replacing large productive kelp species with small, sediment tolerant species that provide less food and habitat will fundamentally change the functioning of that ecosystem and the values it provides. A community modified by sediment will provide less for key mahinga kai species that directly or indirectly rely on kelp beds that provide a broad range of values to rocky reefs and also the soft sediment habitats that surround them. A less productive, less structurally diverse rocky reef compromised by additional sediment loading will not provide for mahinga kai to the same extent as the status quo.

15. I outline the sensitivity of rocky reef habitats to sediment that will be released by the dredging programme proposed through two species as an example. These species are important in a range of contexts

and also provide an indication of broader implications of increased sediment loads to many species that are present in these important ecosystems.

16. The first is the giant or bladder kelp *Macrocystis pyrifera* which is a key habitat forming macroalgal species. As an ecosystem engineer, the presence of *Macrocystis* along provides a productive ecosystem and provides food for many fish and invertebrates and many other values. It's also representative for a range of habitat forming macroalgal species, such as *Ecklonia radiata* (Common kelp), *Carpopyhyllum* (Flap Jack).

17. *Macrocystis pyrifera* kelp forests are very sensitive to the effects of sedimentation. A reduction in light availability resulting from additional sediment in the water could reduce the habitat and food available to invertebrates and fish by reducing the size, biomass and vertical extent of key habitat forming macroalgae including *Macrocystis*. Even thin layers of sediment in reef surfaces have been shown to prevent attachment and establishment of Macrocystis spores.

18. The second key species is *Haliotis iris* (blackfoot pāua). Pāua is considered a cultural keystone. A cultural keystone has been defined as a species that forms a key aspect of the language, ceremonies, and narratives of indigenous people and as such can be considered cultural icons. Without these cultural icons key functions of indigenous communities can be compromised.

19. Recent research suggests pāua are of primary importance as a fishery species to in New Zealand and are of great importance to hapū surrounding the proposed dredging activity. Examples of other species that can be considered cultural keystones have been provided by evidence from Ngāi Tahu experts.

20. From interviews conducted in 2008/09 of 18 local experts on fisheries from Koukourārata, pāua stands out as a local taonga and of greatest concern surrounding fisheries decline and in need of active management in the region.

21. Research has shown that deposition of small amounts of sediment can alter the behaviour of juvenile pāua making them move from refugia beneath rocks where sediment accumulated, to areas on the top on and edges of rocks free from sediment. This response to sediment

deposition could result in greater predation on juvenile pāua by fish and starfish that cannot access juvenile pāua when they are hidden beneath rocks.

22. A thin layer sediment is enough to prevent reattachment of pāua after being removed from rock surfaces. This is a key response for a species that live in wave exposed habitats and can be washed from rock surfaces by wave action or other disturbance.

Modelling and Turbidity and Plume monitoring

23. To have confidence around the potential effects on reef habitats, I consider that accurate modelling is of primary importance. It must be fit for purpose and accurately predict the fate of sediment at the dredging and disposal sites, in all conditions.

24. Modelling must provide an accurate prediction for the fate of sediment in all conditions before any dredging of the scale proposed can be considered. Once the sediment is resuspended into the water there is no going back, it cannot be removed and the impacts of this sediment can be long term due to re-suspension and permanent inundation of reef habitats.

25. Modelling must also be accurate enough to guide operations allowing dredge operators to focus on sites that are likely to produce plumes that have less environmental effects in particular conditions. This is one of the few means of reducing any impacts of sediment released by the proposed programme.

26. Real time sediment plume monitoring is essential to provide a "safety net" and must be designed to allow informed and rapid operational responses if sediment dispersal occurs in a manner which is not predicted by the model

27. Real time turbidity and plume monitoring provides a safety net if things do not go to plan and must be directly tied to the operation by clear consent conditions. Any consent must make clear what happens if appropriate limits are exceeded and how the dredging and disposal programme should respond to unforeseen issues.

Reef Monitoring

28. Monitoring sensitive habitats that surround the proposed activity is essential to provide assurance that impacts have not occurred if

models and other monitoring fail to predict or determine the ultimate fate of sediment.

29. This is key as modelling and plume monitoring operate over relatively short timescales and may fail to determine the final fate of sediment released from the dredging programme.

30. A reef monitoring programme must have the appropriate design and power to detect impacts and untangle these from other processes occurring independently from the proposed activity.

31. Sites for monitoring should not be defined by the modelled plume but as a safety net for key habitat types that could be impacted by disposal and in a way most effective for detecting the extent and impact of disposed sediment.

32. Reef monitoring programmes must have a strong methodology and statistical design that can untangle impacts of different process and detect, often delayed, effects of the proposed programme.

33. The number and positioning of monitoring sites appear tied to practical concerns rather than in detecting and understanding the extent of any impacts of the proposed activity. As it currently stands, it is my opinion that the proposed reef monitoring programme is not fit for purpose.

34. The most appropriate way to do this is through replicate sites that cover the range of reef habitats that could be affected by the proposed activity. The specifics of a monitoring programme must have the appropriate design and power to detect impacts and untangle these from other processes occurring independently from the proposed activity.

35. Replicate reference or control sites in fairly similar areas that are more distant from the dredging and disposal sites are required. The geography of Banks Peninsula allows for this and this will allow other unexpected and unexplained events that could occur generally in the region from being tied to the dredging and disposal programme. This provides for a powerful design to identify impacts of the proposed activity and is a very achievable and appropriate approach for this region.

36. I have significant concerns surrounding the low numbers of monitoring sites generally and the apparent lack of a clear design for monitoring

these sites. This is particularly evident in more sheltered inner sections of Koukourārata (Port Levy) and Whakaraupō (Lyttelton Harbour) that are of high value for mahinga kai and are protected by Mātaitai.

37. I do not consider that one site will provide any information on the general impact of dredging in Whakaraupō. I do not consider that if wide spread sedimentation occurs, that one subtidal monitoring site for both Koukourārata and Whakaraupō will be sufficiently robust to demonstrate whether dredging is responsible, or otherwise. For this reason I do not believe the sites suggested in Appendix15A, Section 10.7 of the LPC Application dated September 2016) are fit for purpose.

38. Many of the issues I raise are echoed in the section 42A Officer's Report. Any monitoring programme must be independent of modelling and provide a safety net if modelling and other monitoring (plume and turbidity) proves to be inadequate. Monitoring must cover the appropriate spatial and temporal scales to detect any effects of the proposed programme.

39. Any monitoring programme must have the ability to reasonably and transparently attribute the cause of any events that could be related to the proposed activity. The robustness of monitoring is of particular importance for rocky reefs that are sensitive to any change in sediment loading and are key to the functioning of marine ecosystems in the region and their associated values.

DATE 5 May 2017

Christopher Hepburn