BEFORE THE ENVIRONMENTAL PROTECTION AUTHORITY

IN THE MATTER	of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
AND	
IN THE MATTER	of an Application for Marine Dumping Consent by Coastal Resources Limited

JOINT STATEMENT OF EXPERTS IN THE FIELD OF OCEANOGRAPHY/SEDIMENT MODELLING

Dated 23 November 2018

INTRODUCTION

1. Expert conferencing of the oceanography/ sediment modelling experts took place via Skype at 1.30pm on Wednesday 21 November 2018 (NZ time).
2. The meeting was attended by:
    a) Connon Andrews, on behalf of Applicant
    b) Dr Claus Pedersen, on behalf of the Decision Making Committee
    c) Dr Peter Longdill, on behalf of the Department of Conservation
    d) Chris Simmons, ChanceryGreen, facilitator

CODE OF CONDUCT

3. We confirm that we have read the Environment Court's Code of Conduct as set out in its Practice Note 2014 and agree to comply with it. We confirm that the issues addressed in this Joint Statement are within our area of expertise.

SCOPE OF STATEMENT

4. During the conferencing we discussed the issues relevant to the Applications which arise within our field of expertise. Prior to attending the meeting we each read the relevant parts of the application, the evidence and independent reports prepared by the other expert(s) and circulated.
5. We also considered the questions from the Decision-making Committee (“DMC”) in its document dated 14 November 2018. Those questions are:
    a) What is the level of confidence in the monitoring of plume dispersal to date using ADCP technology?
    b) Has the model been based off the most conservative material?
    c) How will plume dispersal be impacted by high sea states and wind direction?
    d) What are the maximum sea state and wind direction limits at which the spread of the plume/dispersal is contained within the NDA?
    e) Is there agreement with the modelling of currents/dispersion of reproductive stages of invasive organisms (MetOcean modelling)?
6. In relation to each issue we discussed points of agreement and disagreement in relation to:
    a) Facts;
    b) Assumptions
    c) Areas of uncertainty
    d) Expert opinions
7. Below we discuss our position by reference to points of agreement and disagreement relating to facts, assumptions, uncertainties and expert opinions.

We have noted where each of us is relying on the opinion or advice of other experts. Where we are not agreed in relation to any issue, we have set out the nature and basis of that disagreement.

8. We have also considered the draft marine consent conditions proposed by the Applicant and have considered whether they are appropriate having regard to our opinions, should the Environmental Protection Authority grant the consents sought by the Applicant. We have also considered whether other conditions could be developed that would address our concerns should consent be granted.

DMC Questions

9. Below specific responses are provided for each question posed by the DMC. Questions are in italic and response follows.

10. *What is the level of confidence in the monitoring of plume dispersal to date using ADCP technology?*

    In general, plume monitoring via ADCP represents an appropriate method to qualitatively assess passive plume dispersion.

    The ADCP monitoring conducted by Flaim (2012) is subject to limitations such as:

    - Short observation time (monitoring was cut short before the plume could have reached the boundary of the NDA);
    - Inability to resolve plume from background at the lower water column;
    - Limited calibration whereby the results were restricted to relative turbidity;
    - The indicative "background" measurements show high variability which indicates limited resolution/accuracy, or that those background measurements could have been affected by the plume itself; and
    - The disposal events monitored by Flaim (2012) are not fully representative of the current application in terms of amount and frequency of barge disposals. The results only assesses single events and does not capture cumulative plume effects which may or may not be present from the proposal.

    Despite the limitations the monitoring data does provide a qualitative measurement of plume decent and trajectory and provides useful data for physical process definition. However, due to the lack of calibration, neither Total Suspended Solids (TSS) nor actual turbidity (NTU) could not be quantified. It is noted that with further calibration there will still be uncertainty associated with quantification of TSS and NTU.

11. *Has the model been based off the most conservative material?*

    The Flaim (2012) modelling is subject to limitations due to model setup and application. Due to the shortcomings the Flaim (2012) modelling should not be relied on and the Beca (2018) modelling should take precedence. Accordingly, it is assumed that this question is addressing the Beca (2018) modelling.

The modelling has quantified dispersion of the plume and deposition on the seabed. The modelling has adopted non-cohesive silts and clays.

- A single settlement velocity has been adopted to simulate the finer sediment fraction with the adopted velocities being consistent with published literature. When combined with the non-cohesive and no flocculation assumptions the sediment source term for dispersion is conservative in terms of the settling rates and likely persistence in the water column.
- For maximum dispersion and plume concentrations reaching the boundary of the NDA, finer material fractions such as silts and clays will generally be more conservative.
- For maximum sedimentation from the passive plume at the NDA boundary, slightly coarser material may produce the highest rates. While this has not been quantified in the modelling to date, this process is limited to a small proportion of sediment that is stripped from the dumped sediment and the effects on deposition depths are likely to be negligible.

12. *How will plume dispersal be impacted by high sea states and wind direction?*

    The effects of winds and waves are mostly felt in the upper part of the water column, with effects reducing with increasing water depth. The dispersion and concentration of sediments at the surface will increase and be affected by the direction of high sea states and wind. However, the larger proportion of the disposed sediment will not be significantly affected by sea states and wind.

13. *What are the maximum sea state and wind direction limits at which the spread of the plume/dispersal is contained within the NDA?*

    The sea state and wind direction has limited effect on the plume dispersal lower in the water column, where the plume can be expected to persist for longer periods, hence sea state and wind are not a good measure of the risk of dispersal beyond the NDA. The bulk of the material will settle to the bottom within minutes, irrespective of sea states and winds. Ocean currents such as the East Auckland Current are not correlated to local wind or sea states, and there can easily be ocean net flows that can transport a proportion of the passive plume beyond the NDA during calm sea state and wind conditions.

14. *Is there agreement with the modelling of currents/dispersion of reproductive stages of invasive organisms (MetOcean modelling)?*

    In terms of physical processes there is agreement between the far field plume dispersion modelling and the invasive organism modelling as they have been based off the same ocean current hindcast study. The invasive organism modelling has been set up to demonstrate the far field path-ways. Very fine sediment particles will in principle follow the same pathways while slowly settling out.

Prior Disposals

15. The prior use of the disposal site (an initial trial during 2011 and subsequent disposal operations from 2013 to 2018) along with the associated deposition monitoring undertaken during those periods has provided a substantial set of data which reduce the need to wholly rely on numerical modelling predictions with respect to disposed sediment fate and its deposition on the sea bed. Whereas that data set extends to the deposition of material on the seabed, there was only very limited monitoring during prior operations of suspended sediments and associated plumes (refer to DMC question in Paragraph 10).

Oceanographic Environment

16. In our expert opinion the physical processes considered within the assessment are acceptable and represent the best available information.
17. We are in general agreement with the responses of Claus Pedersen to questions A and B posed by the DMC that is presented in his report, which include:
    a) The assessment has utilized the best available information; and
    b) The information forms an adequate baseline for the oceanographic conditions for informed decision making.
18. Background suspended sediment concentrations are not well characterised due to a general lack of data. We would expect that background sediment concentrations at the NDA would be very low. However, we note that TSS measurements recorded during the trial disposal program (Flaim, 2012) resulted in TSS variability in near surface samples that may not be representative of background as the monitoring sites may have been affected by the disposal operation itself.

Dredging equipment

19. It is acknowledged that the physical processes modelling has been assessed for 700m^3 and 1200m^3 barge volumes. For disposal of larger volumes (i.e. in excess of 1200m^3) individual event concentrations can be expected to be higher for each disposal event but time averaged cumulative effects may be lower because of reduced barge frequency. Should the applicant seek to use barge volumes greater than 1200m^3 further quantification of effects should be performed. It could be appropriate to manage the barge size by consent conditions.

20. There is agreement that it is best practice for this type of material to utilize both mechanical excavator and bottom dump barge for dredging and disposal operations in order to minimize physical impacts. It could be appropriate to manage the excavation and disposal equipment by consent conditions.

Physical processes of sediment disposal

21. We are in agreement of the disposal plume phases and mechanics as described in Beca (2018), Flaim (2012) and the response of Claus Pedersen to questions C posed by the DMC that is presented in his report.

Fate of disposed material

22. We are in agreement with the mass balances, used within the application and Beca (2018) modelling, of sediment that falls rapidly and directly to the seabed during the disposal process and the proportion of sediment that is stripped from the decent plume and made available for far field dispersion.
23. We concur that nearfield[1] processes during sediment disposal are complex and the adopted nearfield model is an appropriate tool to describe physical processes and is widely used for this type of application.
24. It is acknowledged that the nearfield modelling does present nearfield peak concentrations albeit for individual events.
25. Presentation of the far field results does not provide instantaneous concentrations which could be informative for effects assessment (by others). In response to questions posed in Mr Pedersen's report to DMC Mr Andrews provided plume concentrations at 1, 2 and 4 hours post the first sediment dump presented as monthly spatial averages.
26. The output from the far field sediment plume model is presented as averages of plume concentrations and sedimentation. The time averaged values in the far field fall below the selected threshold values for plotting, and it is therefore not possible to evaluate monthly plume dispersion and sedimentation rates below 0.01 mg/l and 0.01mm respectively. It is acknowledged that the peak durations will be of a short duration as compared to mean concentrations. It is considered that additional output to illustrate the intensity-duration-frequency relation or maximum concentration of the plume would add value in further characterizing the plume composition outside the NDA in particular.

[1] Nearfield processes and modelling relate the processes in close geographic proximity to the disposal location. The near field modelling most appropriately describes the movement of the initial dense fluid like jet of disposed material. It is differentiated from the far field process and modelling which more appropriately describes the material suspended in the water column which is then subjected to passive dispersion processes.

Disposal mound development and coastal processes

27. We are in general agreement with the proposed methodology of disposing sediment at 13 locations within the 500m of the NDA centre to minimize the height of the mound.
28. As a result of the depth of the NDA, the volume to be disposed of, and physical processes, the mound is unlikely to affect coastal processes in terms of ambient and extreme waves and current patterns and the associated effects on adjacent shorelines will be negligible.
29. We concur that once sediment is deposited on the seabed resuspension is likely to be negligible.

Monitoring

30. We concur that it is best practice that multibeam surveys should be completed to monitor the mound footprint (size, shape, location) at a frequency that is proportional to the volume disposed. It is considered appropriate that surveys be undertaken for every 125,000m^3 of disposed sediment or every 2 years whichever occurs sooner. It is considered that LINZ MB2 survey precision is appropriate. It is noted that due to survey accuracy more frequent surveys is not likely to provide useful data.
31. We recommend that all monitoring sites, which should at least include the previous/current monitoring sites, be presented in geographic coordinates within the consent conditions.
32. We agree that it is best practice to define control sites in addition to sites directly affected by the proposed activity as part of a monitoring programme. In some instances, those sites could be defined with geographic coordinates within the consent conditions, and in other instances, there likely needs to be some flexibility based on the physical conditions on the day of monitoring (e.g. control sites in the case of suspended sediment monitoring need to consider the direction of water movement at the time of monitoring).
33. The absence of background suspended sediment measurements within the existing available data is acknowledged.
34. The experts acknowledge that for dredging operations it is best practice to monitor identified receptor sites for suspended solids or turbidity while dredging.
35. *Mr Andrews and Dr Pedersen consider, however, due to the location of the NDA and limitations associated with sampling, methodology and monitoring for a disposal operation it is considered that regular compliance monitoring of sediment concentrations and turbidity is not practical. In lieu of direct sediment concentration or turbidity measurements, monitoring of the downstream effect, such as the effects on flora and fauna that could be affected is considered appropriate. The form of the monitoring programme is outside the expertise of Mr Andrews and Dr Pedersen and is*

more appropriate to be developed via marine ecologists.

36. *Dr Longdill considered that in addition to the monitoring of flora and fauna that it is best practice to monitor directly suspended sediment plume. Dr Longdill considers this as appropriate for the current application considering the need to place model results into context with the surrounding environment, the weaknesses of prior surveys of the sediment plume, and absence of baseline suspended sediment information, and the resulting inability of the sediment plume model to be validated (ground-truthed) . A reasonable frequency for such monitoring could be one intensive survey every ~5 years. The survey would likely be most practical using vessel mounted ADCPs.*
37. *Dr Pedersen and Mr Andrews considered that the short term "characterization monitoring" recommended by Dr Longdill would be valuable in assessing the reliability of the model predictions*.

DATE: 23 NOVEMBER 2018

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Connon Andrews

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Dr Claus Pedersen

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Dr Peter Longdill