BEFORE THE ENVIRONMENTAL PROTECTION AUTHORITY
AT WELLINGTON

IN THE MATTER	of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 ("the Act")
AND	
IN THE MATTER	of the applications by Trans Tasman Resources Limited (TTR) for marine and discharge consents to recover iron sand under sections 20 and 87B of the Act and
BETWEEN	**Trans- Tasman Resources Limited**
	Applicant
AND	**The Environmental Protection Authority**
	EPA
AND	**Kiwis Against Seabed Mining Incorporated (KASM)**
	Submitter

EXPERT EVIDENCE OF DOUGAL GREER
ON BEHALF OF KIWIS AGAINST SEABED MINING INCORPORATED

Dated 27 March 2017

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STATEMENT OF EVIDENCE OF DOUGAL GREER

INTRODUCTION

1. My name is Dougal Greer. I am an Oceanographer, working for marine consulting and research company eCoast.
2. I have the following qualifications and experience relevant to the evidence I have provided:
    a. I hold Bachelor of Science degree (Hons) in Physics with Computing from the University of Bath, a Masters degree (distinction) in Evolutionary and Adaptive Systems from Sussex University and a graduate diploma in Statistics from the University of Auckland.
    b. I have 9 years' experience in marine research and consulting, have co-authored 17 peer-reviewed scientific papers, and have solely or jointly produced many technical reports pertaining to physical oceanographic processes.
    c. Much of my time as a physical oceanographer has been spent developing many numerical models of waves, hydrodynamics and modelling sediment transport due to natural processes as well as from anthropogenic sources.
    d. As part of my work I have written a cohesive sediment transport model which has been used in a variety of cases including estuarine sedimentation due to road construction, sediment mobilisation due to mangrove removal and for water quality modelling as part of an investigation into seagrass health. I have also regularly been involved in plume modelling from various sources (e.g. dredging and outfalls).
3. I am currently an environmental scientist and director at eCoast, which is a marine consulting and research organisation based in New Zealand. I have worked at eCoast as an oceanographer for the past four years.

4. I have appeared as an expert witness in the EPA hearing for the first application for the Trans Tasman Resources seabed mining application and for the marine consent application by Chatham Rock Phosphate Ltd to undertake activities in the Chatham Rise.

PURPOSE AND SCOPE OF EVIDENCE

5. I have been asked by Kiwis Against Seabed Mining to prepare evidence for the 2016 Trans Tasman Resources Limited (**TTRL**) marine consent hearing. This evidence is directed specifically at the work undertaken to determine the characteristics of the sediment plume produced by the proposed mining operation.
    a. This evidence is written in response to the conferencing sessions regarding the development of the 'worst-case' scenario modelling and on the subsequent modelling results.
6. I have read the Code of Conduct for Expert Witnesses Environment Court's Consolidated Practice Note (2014). In so far as I express expert opinions, I agree to comply with that Code. In particular, except where I state that I am relying upon the specified evidence of another person as the basis for any expert opinion I have formed, my evidence is within my sphere of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions which I express.

SUMMARY OF EVIDENCE

7. Conferencing was undertaken to define a worst-case scenario for the plume modelling. A second joint witness statement was written to summarise the results of this conferencing session. Agreement was not reached for important aspects of the worst-case definition. For other aspects of the model parameterisations a worst-case could not be established due to a lack of information in the application. My opinion therefore is that this modelling does not represent a worst-case scenario.
8. The second JWS included agreement from the experts that:

    SSC contour plots and median and 99th percentile plots should be generated for shorter periods of time corresponding to the periods of highest release.

However, this analysis was not included in the worst-case scenario reporting and consequently the model results do not show how the periods of higher release affect median and 99th percentile SSC during those periods.

9. As in the reporting in the original application, the worst-case scenario reporting continues to compare the plume derived SSC with background SSC. In this comparison, regard has still not been given to the anthropogenic effects on natural SSC levels. This has the effect of reducing apparent impacts of the mining activities.

10. It was agreed by the experts that a time varying source term should be included for a modelled worst-case scenario. This includes 3 week periods during which the new mining lanes are being created. During this period returned sediment will not be deposited into a pit but rather directly onto the sea bed. The use of a time variable source term is not in itself a worst-case scenario, but rather a process that should have been included in the original modelling as part of the application.

11. An upper limit of 2.25% ultra-fines was imposed on material that would be mined. This was applied on the basis of TTRL's assertion that they would not consider mining material with a higher ultra-fines content than this for a 'period of weeks to 1 month'.

12. The Run of Mine (ROM) Particle Size Distribution (PSD) was based on analysis undertaken by TTRL. Full details of this analysis were not included in the application, and the analysis that was provided was insufficient to validate PSD based assumptions used in the modelling.

13. TTRL advises that a significant fraction of the fines content is retained in the mined material and is not returned to the seabed. Insufficient information has been provided to validate this process or what a worst-case scenario might be with regard to this process.

14. A worst-case scenario was only defined for the far field modelling and the near field modelling remained unchanged. The near field modelling only

considers wave periods between 7 and 11s with the 7s results being used to inform the far field release rate. As stated in my original evidence, wave period is as important as wave height in defining the effect of waves on the sea floor, particularly at the depths considered in this study. Underestimating the wave period will lead to an overestimation of the amount of fine material retained in the mining pit. The worst-case scenario stipulates that 50% of the 0.1 mm/s particles are retained in waves up to 2.5 m in height at which time 20% of the material is retained. This is likely to underestimate the amount of material released into the passive plume and does not represent a worst-case scenario. Not all experts were in agreement that the near-field modelling should remain unchanged for this scenario.

15. The laboratory analysis of sediment characteristics was based on only three samples. These were used to calculate the erosion threshold and settling rates used in the near field and far field modelling. This includes the effect of flocculation on settling rates of the material returned to the sea bed. The mining area is very large and it would be expected that these values would vary throughout the mining region. In the absence of analysis of other samples, worst case values for the erosion threshold and fall velocities could not be established. Instead, values were used based on the 3 analysed samples which is unlikely to represent a worst-case scenario.

16. As pointed out in my original evidence, in paragraph 79 of his evidence, Dr Michael Dearnaley points out that within approximately 3 km of the plume, bulk dry density maybe poorly represented by ROMS and consequentially the sedimentation rates should be increased by a factor of 5 in this region. It appears that this has not been included in the worst case model results.

17. As per my first expert evidence statement consideration should also have been given to the level of error associated with the far field modelling. The calibration in the near shore showed this to be approximately a factor

of two at the surface and considerably greater (up to a factor of 5 or 10) at the sea bed.

Dougal Greer