BEFORE THE ENVIRONMENTAL PROTECTION AUTHORITY

IN THE MATTER	of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (**EEZ Act**)
AND	
IN THE MATTER	of an application for marine consent under section 38 of the EEZ Act by Trans-Tasman Resources Limited to undertake iron ore and processing operations offshore in the South Taranaki Bight
BETWEEN	**Trans-Tasman Resources Limited** Applicant
AND	**Environmental Protection Authority** EPA
AND	**Fisheries Inshore New Zealand Limited, New Zealand Federation of Commercial Fishermen Inc, Talley's Group Limited, Southern Inshore Fisheries Management Company Limited and Cloudy Bay Clams Limited** Fisheries Submitters

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PRIMARY EXPERT EVIDENCE OF BRUCE PATERSON CLARKE ON ENVIRONMENTAL RISK FOR FISHERIES SUBMITTERS

Dated: 23rd January 2017

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EVIDENCE SUMMARY

1. My name is Bruce Paterson Clarke and I am a Principal Environmental Consultant with Jacobs New Zealand Limited (**Jacobs**).

2. I summarise my evidence, according to the key headings in this statement, as follows:

Impact Assessment - Air Quality Modelling

(a) Report 21 – Tonkin & Taylor Ltd – Air Dispersion Modelling Studies on Gas Turbine Discharges, which assesses the air quality effects from the generation of electricity from gas turbines on the IMV, is redundant and should be removed from the application as the Trans-Tasman Resources Limited's (**TTR** or **Applicant**) Impact Assessment (**IA**) states that reciprocating engines will be used to generate electricity.

(b) There would appear to be some discrepancies between the IA and some of the technical reports as to what activities are to be assessed and the nomenclature used to describe these activities. For example, Report 22 refers to a single Floating Production, Storage and Offloading (**FPSO**) vessel, and models the discharges of combustion gases of Heavy Fuel Oil (**HFO**) at a maximum sulphur content of 4.5%. The process description provided in the IA indicates that the FPSO operations have now been split between two vessels (Integrated Mining Vessel (**IMV**) and Floating Storage and Offloading vessel (**FSO**)) and that the maximum sulphur content of the HFO is 3.5%. As a result of these changes the air dispersion modelling report (Report 22) should have been updated to reflect this change in operations and emissions. These inconsistencies between the reports and the inclusion of redundant information make it hard for the reader to determine what is being assessed and whether the effects predicted relate to the process described in the IA and what is actually going to happen if the consent were granted.

(c) The IA also describes a number of other vessels as part of the mining operations, which are sources of combustion gases, whose discharges should have been assessed in the air quality assessment (Report 22). The air discharge information is, therefore, confusing and incomplete.

Impact Assessment –Oil Spill Trajectory Modelling

(d) The oil spill trajectory modelling conducted by TTR is based on an assumed volume of oil released (100 tonnes) over a two hour period for one credible accident scenario (namely the failure of a hose during bunker oil transfer between vessels). There appears to be no information in the IA and Technical Reports which sets out the risk analysis process that has been followed to determine what the other credible accident scenarios are which could result in oil spills and the size and scale of these releases. The failure to provide such information is important given that the IMV and the FSO hold 35,000 tonnes and 20,000 tonnes of HFO respectively, in addition to other fuels (diesel), lubricating oil, hydraulic oils and hazardous substances for which no quantities are provided in the IA.

(e) I would have expected that a report on the risk analysis process, undertaken to determine the credible accident scenario(s) to be modelled, would have been provided as supporting information to the oil spill trajectory modelling. Such an approach is regarded as standard industry practice in conducting risk assessments for low frequency high severity incidents where a number of credible accident scenarios are possible and the consequences of the worst case event or a number of events are assessed.

Rebuttal of TTR's evidence

(f) The requirement of a Baseline Environmental Management Plan (**BEMP**) to conduct further baseline sampling for two years prior to mining operations commencing is questioned. In my experience preparing impact assessments for large complicated developments, good international impact assessment practices require the collection of baseline data which is adequate to confidently determine impacts of the proposed development. It is good practice for this to be undertaken as part of the impact assessment process prior to any application for consent so that there is confidence that the proposed conditions can appropriately avoid, remedy or mitigate any potential adverse effects.

(g) Good baseline data is fundamental to conducting an impact assessment and is a key cornerstone in determining whether or not the impacts of the proposed development are acceptable. The need to conduct further baseline sampling for a period for two years after the consent is granted is an indication that the database currently held by TTR is not adequate to assess the impacts of their operations.

(h) If consent is granted on the basis of the proposed conditions, notwithstanding the absence of adequate baseline information, TTR needs to address what actions would be taken if the BEMP sampling identifies other sensitive areas or more endangered species in the mining area and area of influence from the mining activities. I would recommend that the consent conditions require a series of reviews by the EPA, of the BEMP data to ensure transparency of results and findings of the BEMP programme and how any issues not previously identified are to be addressed.

(i) Mr Thompson in paragraph [15] of his Operational evidence states that *"TTR together with representatives from MNZ, Work Safe's HHU, Taranaki Regional Council and Horizons Regional Council completed an initial Operational Risk Review"*, and as a result of this review five major hazards were identified. Mr Thompson in paragraph [18] of his Operational evidence goes on to say that *"TTR provided a Risk Assessment for the IMV operations that was prepared by its Naval Architect, Vuyk Engineering Rotterdam BV."* Neither of these reports has been supplied and as such it is difficult to determine whether the risk assessment methodologies and processes used to develop these reports are appropriate, and as such I question whether TTR's findings can be relied on.

(j) There is a need for more detailed information to be provided by the Applicant on the risk assessment methodology it followed, how the hazards were identified, and the level of risk determined for the Operation Risk Review and the Risk Assessment for the IMV operations.

Conclusion

(k) The IA and some of the technical reports are not consistent in terms of input data, activities analysed and terminologies used and as such it is difficult to determine what the actual level of effects of the proposed mining operations are. The IA quotes a Heavy Fuel Oil (**HFO**) sulphur content of 3.5% in IMV and FSO vessels, when the air dispersion modelling study used 4.5% and a single FPSO vessel to conduct the air dispersion modelling.

(l) The need to conduct further baseline sampling for a further two years prior to mining commencing indicates that there is currently not sufficient baseline data to adequately determine the sensitivity of the receiving environment and the level of impact(s) from mining activities.

(m) TTR has not provided any reports or information in sufficient detail on the risk assessment processes undertaken to date as described in Mr Thompson's evidence to allow the Decision Making Committee (**DMC**) and submitters to make any educated conclusions on their adequacy or not.

INTRODUCTION

Qualifications and Experience

3. My name is Bruce Paterson Clarke. I hold a Bachelor of Science from Victoria University of Wellington (1981), a Diploma for Public Health Inspectors from the Royal Society of Health, London (1984) and a Diploma in Safety Management (with Distinction) from Massey University (1988). I am registered as an Environmental Auditor with the Institute of Environmental Management and Assessment (United Kingdom).

4. I hold the position of Principal Environmental Consultant with Jacobs New Zealand Limited (**Jacobs**) based in that company's Wellington office. I have been employed by Jacobs since 1993. In that capacity, I specialise in and routinely undertake environmental and social impact assessments, environmental risk assessments, hazardous substances management and air quality assessments, providing these services to a variety of industrial, commercial and local authority clients.

5. Prior to joining Jacobs I was employed:

   (a) By the Department of Health as a Health Protection Officer in Palmerston North - 1984 – 1989;

   (b) By Water Technology (New Zealand) Limited as an Environmental Scientist - 1989 to 1990; and

   (c) By WS Atkins (United Kingdom) as a Senior Environmental Scientist - 1991 to 1993.

6. My experience relevant to my assessment of this proposal includes:

   (a) Preparation of an Environmental and Social Impact Assessment for a 2000 MWe power plant and port development in Vietnam to meet the requirements of the IFC Performance Standards for Environmental and Social Sustainability. The project which included the assessment of environmental impacts of dredging and the marine disposal of 6,000,000m^3 of clean and contaminated sediments.

(b) Hazardous substances assessment of a proposed gas turbine power plant (peaker) covering the storage and use of hazardous substances including diesel. The assessment included a qualitative and quantitative environmental and community risk assessment in respect of potential onsite and offsite consequences.

(c) Leading the preparation of an Assessment of Environmental Effects including baseline sampling, and presentation of evidence at hearing to successfully obtain resource consents for dredging of the Wellington Harbour entrance channel and key harbour berths and the disposal of the material at Fitzroy Bay for clean material and in a harbour containment cell for contaminated material.

(d) Undertaking a study to determine the major environmental accident consequences for various accident scenarios involving the storage of LPG and oil as part of the company's Control of Industrial Major Accident Hazards Safety Case at the BP Terminal located at Poole Harbour, England.

Code of Conduct

7. I have read the Environment Court Code of Conduct for expert witnesses and agree to comply with it.

8. I confirm that the topics and opinions addressed in this statement are within my area of expertise except where I state that I have relied on the evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

9. I have been retained by the Fisheries Submitters to prepare a statement of evidence on the adequacy of the risk assessments provided by Trans-Tasman Resources Limited (**TTR**) in the Impact Assessment (**IA**) and evidence supplied, and on issues identified in the impact assessment approach against recognised international good practice for environmental impact assessments.

Background to Evidence Preparation

10. I am familiar with the general site of the application and surrounding environment having spent time on the coastal area between Waverley and Hawera.

11. In preparing this evidence I have read the following documents:

    (a) TTR (2016) South Taranaki Bight Offshore Iron Sand Extraction and Processing Project Impact Assessment;

    (b) Report 21 – Tonkin & Taylor Ltd – Air Dispersion Modelling Studies on Gas Turbine Discharges;

    (c) Report 22 - Tonkin & Taylor Ltd - Air Dispersion Modelling Studies on Reciprocating engine discharges;

    (d) Report 28 – Hegley Acoustics – Assessment of Noise Effects;

    (e) Report 33 – MetOcean – Oil Spill Trajectory Modelling;

    (f) Corporate Evidence of Shawn Thompson on behalf of TTR, First Statement - Operational Description, dated 16 December 2016;

    (g) Corporate Evidence of Shawn Thompson on behalf of TTR, Second Statement - Project Description, dated 16 December 2016; and

    (h) Evidence of Daniel Govier on monitoring of effects and management plans on behalf of TTR, dated 15 December 2016.

IMPACT ASESSMENT

Air Quality Modelling

12. The IA states that the reciprocating engines will be used to generate electricity on the Integrated Mining Vessel (**IMV**). As such, Report 21 – Tonkin & Taylor Ltd – Air Dispersion Modelling Studies on Gas Turbine Discharges, which assesses the air quality effects from the generation of electricity from gas turbines on the IMV, is redundant and should be removed from the application. Having a report which assesses the impacts of an option which is no longer

being pursued adds a degree of confusion to what is already an extensive set of impact assessment technical reports.

13. There would appear to be some discrepancies between the IA and some of the technical reports as to what activities are to be assessed and the nomenclature used to describe these activities. For example, Report 22 refers to the IMV (as referred to in the IA) as the Floating Production, Storage and Offloading (**FPSO**) vessel and only the discharges to air from the combustion of Heavy Fuel Oil (**HFO**) in reciprocating engines in the FPSO has been assessed in the modelling study. Other vessels in the iron sands mining operation which also have discharges of combustion gases to air as set out in the IA (at Section 2.2.2) appear to have not been covered in this assessment of effects on air quality. They include:

    (a) Floating Storage and Offloading vessel (**FSO**);

    (b) Bulk Cape Size Export Vessel (**CEV**);

    (c) Anchor handling tug (**AHT**);

    (d) Refuelling Vessel; and

    (e) Geotechnical support vessel.

14. It would appear based on the process description provided in the IA that the FPSO operations have now been split between two vessels (IMV and FSO) which will be on station at the iron sands mining area and the air dispersion modelling report should have been updated to reflect this change. These inconsistencies between the reports and the inclusion of redundant information make it hard for the reader to determine what is being assessed and whether the effects predicted relate to the process described in the IA and what is actually going to happen if the consent were granted.

15. The IA states that the maximum sulphur content of the HFO is 3.5% (at page. 16 of IA) while the air dispersion modelling assessment assumed maximum sulphur content of 4.5% (refer Table 2.2 of Report 22). As a result, the modelling conducted indicates that national ambient air quality standard for sulphur dioxide (SO_2) of 350 $\mu g/m^3$ as a one hour average is exceeded. The reduction in the sulphur content of the HFO as set out in the IA results in a

reduction of 23% of the FPSO discharges to air and as a result the highest maximum ground level concentration for SO_2 predicted by the modelling as a one hour average reduces from 453 µg/m^3 to 349 µg/m^3. This now means it complies with the national ambient air quality standard for SO_2 as one hour average of 350 µg/m^3. Again, it would be helpful if Report 22 had been updated to include the revised sulphur content for HFO of 3.5% as set out in the IA and splitting the discharge of combustion gases between the IMV and the FSO making it easier to determine what the actual proposed level of effects are. The air discharge information is, therefore, confusing and incomplete.

Oil Spill Trajectory Modelling

16. The modelling conducted for TTR is based on an assumed volume of oil released (100 tonnes) over a two hour period for one credible accident scenario (namely the failure of a hose during bunker oil transfer between vessels). There appears to be no other information in the IA and Technical Reports which sets out the risk analysis process that has been followed to determine what the other credible accident scenarios are, as a result of the iron sands mining operations which could result in oil spills and the size and scale of these releases. This is important given that the IMV and the FSO hold 35,000 tonnes and 20,000 tonnes of HFO respectively, in addition to other fuels (diesel), lubricating oil, hydraulic oils and hazardous substances for which no quantities are provided in the IA.

17. I would have expected that a report on the risk analysis process undertaken to determine the credible accident scenario(s) to be modelled would have been provided as supporting information to the oil spill trajectory modelling. This risk analysis process to determine the credible oil spill accident scenarios would have included the following steps:

    (a) Hazard Identification;

    (b) Fault/Failure mode analysis;

    (c) Likelihood analysis of the fault/failure mode/release;

    (d) Off-site consequence analysis of the accident event; and

(e) Determine the level of risk of the hazard.

18. The approach I have briefly outlined is standard industry practice in conducting risk assessments for low frequency high severity incidents where a number of credible accident scenarios are possible and the consequences of worst case event or a number of events is assessed. Evidence that a robust process to determine that the credible accident scenario to be modelled is appropriate is just not present in the information I have reviewed.

REBUTTAL OF TTR'S EVIDENCE

Environmental Baseline Sampling

19. The evidence provided by Mr Govier proposes the establishment and implementation of a BEMP, with the monitoring to determine the baseline environment, to be conducted for two years prior to iron sand mining commencing, in order to establish a baseline set of environmental data to identify natural background levels of the South Taranaki Bight.

20. In my experience in preparing impact assessments for large complicated developments, baseline sampling to determine natural baseline conditions of the receiving environment is normally carried out prior to any application for consent. It is good practice for baseline sampling to be completed to a level which allows the environmental effects from the development on the receiving environment to be adequately determined and whether additional mitigation is required to reduce effects to acceptable levels as part of the assessment process and prior to any application for consent.

21. Good baseline data is fundamental in conducting an impact assessment and is a key cornerstone in determining whether or not the impacts of the proposed development are acceptable. I have worked on a number of large impact assessments over the years (including Sellafield Low Level Nuclear Waste Repository, Vinh Tan 3 Thermal Power Station, and Centreport Dredging and Disposal). All of these projects have been undertaken in accordance with good environmental assessment practice. In all instances baseline sampling was conducted to a level to adequately determine the sensitivity of the receiving environment prior to application.

22. The Vinh Tan 3 study involved the dredging and disposal at sea of around 4 million cubic metres of material. A Sampling and Analysis Plan (SAP) which sets out the number of sediment and ecological samples to be collected at the dredge and disposal sites in order to adequately quantify baseline conditions was developed and implemented in accordance with international good practice set out in the following documents:

    (a) The National Assessment Guidelines for Dredging (**NAGD**; Commonwealth of Australia, 2009), published by the Australian Government. The NAGD provide clear, consistent standards and criteria for assessment of dredged material, and were developed to conform with the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Protocol).

    (b) The United States Environmental Protection Agency Evaluation of Dredged Material Proposed for Ocean Disposal (USEPA "Green Book"; USEPA, 1991).

    (c) United States Department of Commerce National Oceanic and Atmospheric Administration (NOAA) Sediment Quality Guidelines (NOAA, 1999).

    (d) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 2002). These guidelines provide Interim Sediment Quality Guidelines (ISQG) and Probable Effect Levels (PEL) for a range of contaminants in sediment. The ISQGs will be applied for the assessment of results in this project.

23. Good baseline data is also fundamental to addressing the potential impacts of a proposal where the information concerning potential impacts is uncertain or may change over time. Baseline information must be adequate enough in these circumstances to enable any changes to the receiving environment (i.e. uncertain impacts) to be monitored and appropriate environmental triggers to be established. This is the rationale and policy behind taking an adaptive management approach. For example, we had a situation recently in Indonesia that some Sun Bears were noted in a hydropower construction site area, even though they were not expected to be in this area after extensive

baseline sampling with camera traps etc. The presence of Sun Bears in this area was unknown but the impacts were not, insofar as their habitat would be destroyed and they would need to be relocated away from the construction area. As a result of this discovery the client changed its monitoring and habitat management procedures to cover off the potential for Sun Bears to be present especially in the location they were observed.

24. The need for TTR to conduct further baseline sampling for a period for two years after the consent is granted is an indication that the database currently held by TTR is not adequate to assess the impacts of their operations.

25. If consent is granted notwithstanding the absence of adequate baseline information, Mr Govier's evidence does not address what actions would be taken if the BEMP sampling identifies other sensitive areas or more endangered species in the mining areas and areas of influence from the mining activities. I recommend in these circumstances that the consent conditions should require a series of reviews by the EPA, of the BEMP data to ensure transparency of results and findings of the BEMP programme and how any issues not previously identified are to be addressed.

Risk Assessment

26. Mr Thompson in paragraph [15] of his Operational evidence for TTR states that *"TTR together with representatives from MNZ, Work Safe's HHU, Taranaki Regional Council and Horizons Regional Council completed an initial Operational Risk Review"* and as a result of this review five major hazards were identified being:

(a) Vessel collision, largely due to there being numerous vessels operating and interacting with each other during production, processing, offloading, maintenance, anchor movement, and supply transfer activities;

(b) The AHT is vulnerable to impact from larger vessels;

(c) Release of HFO during transfer and refuelling;

(d) Helicopter crash onto a vessel or into the sea; and

(e) Loss of anchors and the IMV being swept off station.

27. It would appear that this Operational Risk Review was conducted in 2013 and I would have expected as part of good risk management for this review to have been updated to account for any changes to the design and proposed operation of the mining activities. The high level results of the Operational Risk Review are provided but there is no report setting out the methodology used to conduct the risk review. For example, was it in accordance with ISO31000 Risk Management Standard, what were the tools used (qualitative descriptors, semi-quantitative or quantitative) to determine the level of risk of the hazards analysed, the list of hazards analysed, and what level of risk was assigned to each hazard? No information is provided on whether the level of risk is acceptable or not, or is tolerable being as low as reasonably practicable when the level of mitigation applied is assessed. This information would have been helpful in determining whether or not the five major hazards identified are appropriate and that a robust process in conducting this assessment has been followed. This lack of information has made it difficult for submitters to determine whether or not the risk assessment process followed is appropriate and whether the risks have been adequately assessed.

28. Mr Thompson in paragraph [18] of his Operational evidence for TTR goes on to say that *"TTR provided a Risk Assessment for the IMV operations that was prepared by its Naval Architect, Vuyk Engineering Rotterdam BV (See Appendix 3 of my First Statement of Evidence – Project Description)"*. When I refer to Appendix 3 I do not find this report, but reference is made to this report and its findings in Appendix 5 in a letter from TTR to Origin Energy.

29. The TTR letter to Origin Energy (Appendix 5: Origin Energy – Record of Engagement, of Shawn Thompson Project Description evidence) sets out three key failures and risks related to the IMV which are summarised in Mr Thompson's evidence. Again I am not able to assess the adequacy of this risk assessment without seeing the contents of the full report by the Naval Architect at Vuyk Engineering.

CONCLUSION

30. In summary, I conclude that:

(a) The IA and some of the technical reports are not consistent in terms of input data, activities analysed and terminologies used and as such it is difficult to determine what the actual level of effects of the proposed mining operations are. The IA quotes a Heavy Fuel Oil (HFO) sulphur content of 3.5% in IMV and FSO vessels, when the air dispersion modelling study used 4.5% and a single FPSO vessel to conduct the air dispersion modelling.

(b) The need to conduct further baseline sampling for a further two years prior to mining commencing indicates that there is currently not sufficient baseline data to adequately determine the sensitivity of the receiving environment and the level of impact from mining activities. It is recommended if consent is granted that the consent conditions should include a requirement for a series of reviews by the EPA, of the BEMP data to ensure transparency of results and findings of the BEMP programme and how any issues not previously identified are to be addressed.

(c) TTR has not provided any reports or information in sufficient detail on the risk assessment processes undertaken to date as described in Mr Thompson's evidence to allow the submitters to make any educated conclusions on their adequacy or not.

Dated this 23rd day of January 2017

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Bruce Clarke