Your Comment on the Waihi North application

Please include all the contact details listed below with your comments and indicate whether you can receive further communications from us by email to substantive@fasttrack.govt.nz

1. Contact Details			
Please ensure that you have authority to comment on the application on behalf of those named on this form.			
Organisation name (if relevant)	Coromandel Watchdog of Hauraki Inc.		
First name	Augusta		
Last name	Macassey-Pickard		
Postal address	[redacted]		
Home phone / Mobile phone	[redacted]	**Work phone**	[redacted]
Email *(a valid email address enables us to communicate efficiently with you)*	[redacted]		

2. We will email you draft conditions of consent for your comment			
X	I can receive emails and my email address is correct	☐	I cannot receive emails and my postal address is correct

Thank you for your comments

COROMANDEL WATCHDOG OF HAURAKI

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August 25, 2025

Coromandel Watchdog of Hauraki Comment: Oceana Gold Waihi North Fast-track Approvals Application

Please find attached the comments of Coromandel Watchdog of Hauraki on the Fast-track Approvals application of Oceana Gold New Zealand Ltd for the Waihi North project.

FTA Contact Form
Submission: Coromandel Watchdog of Hauraki Inc.
Preliminary Submissions of Counsel

Appendices:
Appendix A: Evidence Briefs
A.01 Dr Steven Emerman, Malach Consulting
A.02 Denis Tegg, retired lawyer and former Thames Coromandel representative on the Waikato Regional Council
A.03 Nic Conland, Director of Taiao Natural Resource Management Limited
A.04 Hamish Kendal, Consultant Ecologist with Natural Solutions NZ
A.05 Dr Mike Joy, Senior Research Fellow, School of Geography, Environment and Earth Sciences, Victoria University

A.06 Professor Russell Death, Emeritus Professor of Freshwater Ecology, Massey University
A.07 Kate Selby Smith, Environmental Engineer, Coromandel Consultant Limited
A.08 Dr Luke Easton, Phd
A.09 Professor Bruce Waldman, Professor in the Department of Biology at Oklahoma State University, USA and formerly at University of Canterbury and Lincoln University and National Geographic Society Explorer since 2015
A.10 Sara Smerdon, Field Operations Expert, Mahakirau Forest Trust
A.11 Dr Geoff Bertram, Visiting Scholar in the School of History, Philosophy, Political Science and International Relations at Victoria University
A.12 Dr Richard Meade, Principal Economist at Cognitus Economic Insight and Adjunct Associate Professor at Griffith University
A.13 Edward Miller, Researcher at the Centre for International Corporate Tax Accountability and Research
A.14 Professor Glenn Banks, School of People, Environment and Planning, Massey University
A.15 Catherine Delahunty, Chair of Coromandel Watchdog of Hauraki Inc. and former Member of Parliament from 2008 – 2017
A.16 Professor Bridgette Masters- Awatere, Professor of Kaupapa Māori Psychology and Registered Psychologist and Associate Dean Māori for Te Wānanga o Ngā Kete, University of Waikato

Appendix B: Non-Expert Evidence and Commentary
B.01 Further Issues Identified
B.02 Catherine Delahunty Evidence
B.03 The Endangered Species Foundation letter

For any further information, in the first instance please contact our Coordinator:
Augusta Macassey-Pickard
0220291150
info@watchdog.org.nz

BEFORE THE FAST-TRACK APPROVALS PANEL

In the matter of the Fast-Track Approvals Act 2024

And

In the Matter of applications by Oceana Gold (New Zealand) Limited for various resource consents and other authorities relating to the Waihi North Project (including the Wharekirauponga Underground Mine)

And

In the matter of the submission on the above applications

Initial Submissions for Coromandel Watchdog of Hauraki Inc

Dated: 25 August 2025

Submission in Opposition to Fast-track Application No. FTAA-2504-1046 – Waihi North Project

We are the Coromandel Watchdog of Hauraki Inc.

We oppose the application by Oceana Gold (New Zealand) Limited (**Applicant**) under the Fast-track Approvals Act 2024 (**Act**) to expand its existing gold and silver mining operations, both above and below ground, at sites in the Waihi North area of the Coromandel Peninsula, being Fast-track Application No. FTAA-2504-1046 (the **Waihi North Project Application**).

For clarity, this submission is particularly focused on the following five key areas of impact of the Proposal that merit decline under Section 85 of the Act, whether on a stand-alone basis, or in combination:

1, Significant Adverse Impacts on Receiving Environment

2, Significant Adverse Impacts on Highly Vulnerable and Nationally Significant Frog Species and Other Invertebrate Species

3. Significant Adverse Impacts from Hydrological Consequences

4. Significant Regional and National Economic Benefits are being Overstated and are Unproven

5. Late Provision of Relevant Information & Considerable Information Gaps Cause Significant Uncertainties –

We also address below a number of social impacts of the Proposal, which we also consider will be adverse and not considered by the Applicant.

We make the submissions listed below with respect to grounds relevant to the exercise of Expert Panel's discretion to decline the Waihi North Project Application in accordance with Section 85(3) of the Act.

While is our preference is that the Application is declined in full, it is submitted that the Panel is able to decline in part an approval under Section 81 and Section 85, and we ask that as a minimum the components listed above are declined for the reasons set out below.

If the Panel does not agree that it has jurisdiction to decline in part, then we seek that the Application is declined in total.

However, we note that taking an "all or nothing" approach to scope for decline does not accord with the ability to grant an approval on the basis of conditions (which may sever those parts of the Application which fail to meet the Section 85 threshold, if the scope of these parts can reasonably be severed within context of the Application as a whole).

Coromandel Watchdog of Hauraki Inc. –

The Coromandel Watchdog is a person invited to provide comment on the substantive application in respect of the Waihi North Project Application pursuant to Section 53(3) of the Act in accordance with paragraph [1](h)(iv) of Minute 1 of the Expert Panel dated 28 July 2025 (**Minute 1**).

These submissions are required by the Expert Panel to be received by the Environment Protection Agency on behalf of the Expert Panel by 25 August 2025 by paragraph [5] of Minute 1.

We note the participation of persons listed in paragraph [1](h) of Minute 1 as warranting invitation to comment on the basis of, amongst other factors specified in paragraph [4] of Minute 1, the likelihood that "*their participation will facilitate a critical testing of the bases on which the proposal is advanced*".

The submissions that follow, and the accompanying expert evidence referred to below, are provided to the Expert Panel on the basis that these submissions and reports together provide an independent, locally experienced and critical testing of key parameters and assumptions of the Waihi North Project Application.

Coromandel Watchdog of Hauraki is a community group that first incorporated as a society in 1979, as a direct response to community concerns about the [then] renewed mining interest in the region. We have remained a leading environmental group in the area, today we have more than 5000 supporters and have been involved in a range of local and national planning developments.

We recognise that Te Tiriti o Waitangi is the basis for relationships between the Crown and tangata whenua but also give us responsibility to recognize the rangatiratanga of tangata whenua in the Hauraki rohe. The authority, and concerns of the tangata whenua regarding mining, beyond consultation and engagement, should be the central decision-making focus.

It is our submission that the Wharekirauponga Underground Mine (WUG) should not have been included in this application; the WUG, and TSF3 that would be required to store the waste it produces are a distinct project, with very different impacts and effects on an environment that is definitively separate from the rest of the project.

Furthermore, the actual mining activity is not proposed to commence for another 8 years.

There are many other aspects of the total Waihi Mine Project which we have not focused on including in-depth questions around the Gladstone pit, the Martha Underground Mine (MUG), and issues such as subsidence in all sites, air quality issues at all sites, and noise impacts in Waihi; but there are limits to our capacity. We hope that the Panel will consider these matters.

Accompanying Submissions & Expert Reports –

Coromandel Watchdog of Hauraki submits the following evidence in support of its submission:

(a) Receiving Environmental Effects –

- Dr Steven Emerman, Malach Consulting
- Professor Russell Death, Emeritus Professor of Freshwater Ecology, Massey University
- Dr Mike Joy, Senior Research Fellow, School of Geography, Environment and Earth Sciences, Victoria University
- Kate Selby Smith, Environmental Engineer, Coromandel Consultant Limited
- Nic Conland, Director of Taiao Natural Resource Management Limited
- Denis Tegg, retired lawyer and former Thames Coromandel representative on the Waikato Regional Council

(b) Frog Species –

- Hamish Kendal, Consultant Ecologist with Natural Solutions NZ
- Dr Luke Easton, Department of Conservation
- Professor Bruce Waldman, Professor in the Department of Biology at Oklahoma State University, USA and formerly at University of Canterbury and Lincoln University and National Geographic Society Explorer since 2015
- Sara Smerdon, Conservation Advocate, Mahakirau Forest Trust

(c) Hydrological Consequences –

- Hamish Kendal, Consultant Ecologist with Natural Solutions NZ
- Nic Conland, Director of Taiao Natural Resource Management Limited

(d) Economic Assessment –

- Dr Geoff Bertram, Visiting Scholar in the School of History, Philosophy, Political Science and International Relations at Victoria University
- Professor Glenn Banks, School of People, Environment and Planning, Massey University
- Edward Miller, Researcher at the Centre for International Corporate Tax Accountability and Research
- Dr Richard Meade, Principal Economist at Cognitus Economic Insight and Adjunct Associate Professor at Griffith University

(e) Social Impacts –

- Catherine Delahunty, Chair of Coromandel Watchdog of Hauraki Inc. and former Member of Parliament from 2008–2017
- Professor Bridgette Masters-Awatere, Professor of Kaupapa Māori Psychology and Registered Psychologist and Associate Dean Māori for Te Wānanga o Ngā Kete, University of Waikato

Our Submissions –

Our submissions to the Expert Panel focus on five areas of primary concern, which establish (under Section 85) that there are 1 or more adverse impacts in relation to the approval sought, and those impacts are sufficiently significant to be out of proportion to the Project's alleged regional or national benefits, even after taking into account matters in Section 85(3)(b).

We relevantly note that:

(i) The Expert Panel has discretion to decline this application in accordance with Section 85 of the Act, as specified by Section 81(2)(f) of the Act.

(ii) Under Section 85(3), the Panel may decline an approval where "*1 or more*" adverse impacts are sufficiently significant to be out of proportion to a project's regional or national benefits.

(iii) The term "**adverse impacts**" is defined in Section 85(5) as meaning "*any matter considered by the panel in complying with section 81(2) that weighs against granting the approval".* The term is broad and, it is submitted, encompasses actual and potential adverse effects on the environment, including intrinsic values, indigenous biodiversity, and rare and threatened native species.

(iv) In accordance with Section 85(3), if the Expert Panel forms the view that there are one or more adverse impacts (based on Coromandel Watchdog's evidence), this will justify declining the Proposal.

We have identified the following as 5 key impacts of the Proposal that merit decline under Section 85, whether on a stand-alone basis, or in combination:

1. **Significant Adverse Impacts on Receiving Environment –**

   Our experts have identified a range of material impacts of the Waihi North Project on the receiving environment.

   We urge the Expert Panel to give due weight to this expert evidence, which identifies a range of actual and potential adverse impacts to the receiving environment. Many of these impacts are irreversible.

   These adverse impacts relevantly include:

   - Dr Emerman notes in his report that the Applicant will use cyanide to extract gold and silver from the crushed ore that is to be mined at the Project site.[1] Cyanide is a fast-acting, toxic chemical substance with associated risks for downstream receivers, including human and indigenous biodiversity, natural environments and water resources. The Applicant has provided no cyanide management plan despite proposing to store 112,000 litres of liquid cyanide and 77.180 metric tons of solid cyanide on-site. It is not a signatory of the International Cyanide Management Code, which certifies safe cyanide management practices of its signatories, and has made no public commitment to align with the World Gold Council's Responsible Gold Mining Principles.

   - Dr Emerman notes that there is no plan to address the ability of cyanide to mobilise other chemical elements such as mercury, arsenic and antimony with a risk that this may increase the concentrations of such chemicals in the local environment beyond what is projected by the Applicant[2], with risk of their transference beyond Project containment facilities via leaching or eventual inevitable collapse of the tailings pond intended to retain the pore water.[3]

   - Dr Emerman notes that the Waihi North Project Application repeatedly confirms that the Project mining operation is expected to leak mercury into groundwater but incorrectly states that mercury is immobile in

[1] See paragraph [5](1) and paragraphs [6] to [14] of Dr Emerman's expert report evidence dated 19 August 2025.
[2] See paragraph [20](3) and paragraphs [21] to [31] of same report.
[3] See paragraph [64] of same report.

groundwater.[4] Mercury is also a toxic chemical which can accumulate in any environment and, as Dr Emerman concludes, can be highly mobile in groundwater under various conditions.[5] There is no plan to address the risk of mercury being transferred from the Project site if such conditions arise, including from flooding or in the event of tailings dam collapse.[6]

- Dr Emerman further notes that the Waihi North Project Application does not address the chemical impacts of an unplanned release of its mining tailings and the contents of the tailings holding pond into downstream waterways and aquatic life populating those waterways and groundwater.[7] Such impacts are expected to be highly adverse and potentially irreversible.

- Dr Emerman points out that "*the threat of a release of the tailings pond into downstream waterways will never end*".[8] Corresponding plans to manage the terminal life of such highly toxic chemicals have not been provided by the Applicant and, without being able to assess their strength, the potential significant adverse impacts of release, and the inevitability that the water-retention dam will collapse remains without mitigation and monitoring, maintenance and dedicated resourcing beyond the life of the Project.[9]

- Dr Emerman assesses that "*contamination of groundwater and downstream waterways should be an expected outcome of the Waihi North Project*".[10] Dissolved toxic metals from such mining operations can be transferred into stream beds as a "*chemical time bomb*".[11]

- Dr Emerman concludes that the Waihi North Project Application lacks a mining plan, which means it is "*impossible to meaningfully assess the environmental impact of the Project at the present time*".[12] Consequently, it is not possible to conclude that the Application satisfies the proportionality test in Section 85(3) of the Act at this time.

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[4] See paragraph [5](2) and paragraphs [15] to [19] of same report.
[5] See paragraph [16] of same report.
[6] For example due to flooding in a high-rainfall area or seismic activity, discussed in the accompanying expert reports entitled, "Re-evaluation of Hikurangi Subduction Zone Seismic Hazard to Waihi Tailings Storage Facilities" dated August 2025 and "Lessons from the Waitekauri (Golden Cross) Landslide for the Oceana Gold Waihi Tailings Storage Facility Fast Track Application" dated August 2025 and "Critique: Environmental and Socio-Economic Impacts of a Tailings Dam Breach" dated August 2025.
[7] See paragraph [33] and paragraphs [34] to [37] of Dr Emerman's expert report evidence dated 19 August 2025.
[8] See paragraph [33] of same report.
[9] See paragraph [59] and paragraphs [60] to [64] of same report.
[10] See paragraph [38] of same report.
[11] See paragraph [42] of same report.
[12] See paragraph [65] of same report.

- Professor Death notes the inadequacies of the methods used on behalf of the Applicant to assess the surrounding environment and the impacts of the Proposal on local species and downstream ecosystems mean that adverse impacts of the Project on the surrounding environment may be flawed, under-assessed and/or ignored and the absence of statistical tests and single occasion sampling is inappropriate and inadequate.[13]

- Professor Death also notes the likelihood that stream ecosystem diversion and relocation as proposed by the Applicant is not feasible and will result in adverse impacts on the species relocated.[14]

- Dr Mike Joy notes that impacts of destroying and relocating waterways in the Waihi town vicinity are not "low to high", they are severe for those waterways and their flora and fauna. "Offsetting" does nothing to justify this damage. In the case of the only warm spring in the Wharekirauponga area, "*total loss means total loss*".[15] There are other waterways that are also impacted with no ability to restore them[16] and treatment of mine wastewater to remove pollutants is not addressed in the Boffa Miskell report for the Applicant.[17] This has many adverse impact consequences, including in relation to the selenium impacts on fish.[18]

- Mr Hamish Kendal notes that vibrations from underground blasting may affect local species, including the Archey's Frog, and the mine shaft is likely to dewater groundwater in the Wharekirauponga catchment, with significant adverse impacts on the surrounding environment including remaining wetlands and streams.[19]

- Mr Denis Tegg raises concerns regarding inadequate and outdated seismic hazard assessments and the need to give consideration to the Te Puninga Fault as an active and independent source of seismic activity which, if triggered, could deliver significant adverse impacts on the Applicant's operations and tailings storage facilities with major adverse downstream consequences.[20]

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[13] Professor Death's expert report, "Assessment of the "Freshwater Ecological Assessment" report on the Waihi North Project proposal" dated August 2025.
[14] See paragraph [8, 9] of Professor Death's expert report.
[15] Dr Mike Joy's expert report, "Freshwater Ecology Issues. Waihi North Project" dated August 2025 paragraph [(C)1].
[16] See paragraph [(C)2] of same report.
[17] See paragraph [(C)4] of same report.
[18] See paragraph [(C)5 to 15] of same report.
[19] Mr Hamish Kendal's expert statement of evidence on behalf of Coromandel Watchdog of Hauraki Ecology dated August 2025 paragraphs [10] to [25].
[20] Mr Denis Tegg's evidence dated 23 August 2025 paragraphs [3.1.1] to [3.17.6].

2. Significant Adverse Impact on Highly Vulnerable and Nationally Significant Frog Species and Other Invertebrate Species–

Archey's frogs and Hochstetter's frogs are both expected to inhabit the surrounding area to be affected by the Waihi North Project Application.

Archey's frogs are listed by the International Union for Conservation of Nature as "Critically Endangered", which is the category just below "Extinct in the Wild", and have an "At Risk – Declining" conservation status in New Zealand.[21] Hochstetter's frogs in the southern Coromandel have a national At Risk - Declining threatened species conservation status.[22] Both species are important native New Zealand frog species, amongst four native species still in existence.[23] They are evolutionary distinct and included amongst the most globally endangered amphibian species.[24] International conservation biologist Professor Waldman describes Archey's frogs as constituting "*a globally unique and irreplaceable evolutionary lineage*".[25]

The modelling undertaken on behalf of the Applicant excludes the potentially most significant effect to frog populations, which is the dewatering of groundwater effects on the habitat of Archey's and Hochstetler's frogs throughout the forest areas. Such dewatering is likely to have significant adverse impacts on their habitats, meaning the Applicant's projected net gains in such frog populations are unlikely to result and these populations may sustain permanent loss.[26]

Mining vibration in terms of anthropogenic substrate vibrations is another significant effect which could be highly adverse to frog populations. The academic literature on the impact of such vibration is limited but should not be ignored as frogs are highly sensitive to low-frequency ground vibrations. This is addressed in the evidence of Mr Hamish Kendal,[27] Dr Luke Easton,[28] and Professor Waldman.[29]

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[21] See paragraph [26] of Hamish Kendal's statement of evidence.
[22] See paragraph [27] of same statement of evidence.
[23]https://teara.govt.nz/en/frogs/print#:~:text=Frogs%20in%20New%20Zealand,pekeketua%20or%20pepeketua%20in%20M%C4%81ori.
[24]https://www.endangeredspecies.org.nz/frogs#:~:text=Archey's%20frog%20(Leiopelma%20archeyi),that%20is%20closest%20to%20extinction.
[25] Professor Bruce Waldman's expert statement of evidence entitled "Health effects of drilling operations on Leiopelma frogs" dated 22 August 2025 at paragraph [13].
[26] See paragraph [31] of Hamish Kendal's statement of evidence.
[27] See paragraphs [10] to [17] of Hamish Kendal's statement of evidence.
[28] Dr Luke Easton's comments in respect Dylan van Winkel's assessment report at page 1.
[29] Professor Bruce Waldman's expert statement of evidence at paragraph [11].

In addition, Professor Walden observes that the Applicant's population models for Achey's frogs are unreliable and overstated, based on irregular and limited sampling data, leading him to conclude that "*I have never seen the densities claimed in Oceana Gold's reports*".[30]

Further, Professor Walden notes that "*the proposed mining activities pose a direct and unacceptable risk to the survival of these species*",[31] translocation success in frogs is poor and "*long-term establishment is rarely achieved*".[32]

In light of New Zealand's international obligations under the Convention on Biological Diversity and its statutory duties[33] to safeguard capacities of ecosystems and recognise and provide for significant indigenous fauna as matters of national importance, Professor Waldman concludes that "*the proposed mining activities are incompatible with the survival of New Zealand's endemic frog species. The risk of extinction is not a "minor effect" capable of mitigation but an irreversible and unacceptable outcome*".[34]

There are similar potential adverse impacts likely to be sustained by other species in the surrounding environment. This includes, for example, nationally endangered and vulnerable wetland tree types and lizards. In such cases, it does not appear as though the "Precautionary Principle" has been applied to avoid such effects where they are likely and unavoidable and more than minor.[35]

Likewise, pest control proposed in the surrounding environment ignores the requirement to avoid adverse effects, instead substituting pest control as a compensation measure. It appears to be "*significantly underfunded*"[36] and is also proposed only for the life of the Project and not for any future period when the adverse impacts of the mining activities will continue.[37]

3. Significant Adverse Impacts - Hydrology –

The Proposal results in a range of significant adverse impacts on hydrology and related matters.

[30] See paragraph [10] of same statement of evidence.
[31] See paragraphs [14] and [19] of same statement of evidence.
[32] See paragraph [12] of same statement of evidence.
[33] See Section 6(c) (Matters of national importance) and Sections 5(2)(b) and (c) (Purpose) of the Resource Management Act 1991.
[34] See paragraph [19] of same statement of evidence.
[35] See paragraphs [32] to [41] of same statement of evidence.
[36] See paragraph [64] of same statement of evidence.
[37] See paragraphs [48] to [54] of same statement of evidence.

For example, expected waterflow reductions will be adversely impacted but these impacts have been inadequately assessed by the Applicant. As noted by Mr Nic Conland in his evidence:

- flow reductions predicted by the Applicant are ecologically significant even at levels of 10-20% uncertainty at low flows and effects within the Applicant's model error are "*effectively unquantifiable*",[38] which means that adverse impacts are not adequately considered and addressed by the Applicant;

- the predicted drying of unique extant warm springs, which the Applicant notes "*cannot be accurately predicted at this time*", create unacceptable ecological impacts relating to recovery uncertainty and water-quality risks;[39] and

- the Applicant's own analysis suggests an identified risk zone that contradicts its conclusions on groundwater as "less than minor"[40] and assessments on post-closure water chemistry are inconclusive and do not address sulphate risks.[41]

Mr Hamish Kendal notes in his expert evidence that, in addition to matters relating to adverse impacts on wetlands and groundwater dewatering (noted elsewhere in this submission), the Applicant's assessment of streams is "*lacking in evidence to support the proposal to offset/compensate when little weight has been given to the methods of avoiding the adverse effects as a priority*".[42]

4. Significant Regional and National Economic Benefits Are Both Overstated and Not Proven –

The Waihi North's Project's regional or national economic benefits are materially relevant to any decision by a panel to decline an approval under Section 85(3).

We submit that these benefits, as primarily specified in Mr Shamubeel Eaqub's report entitled "*Economic effects of the Waihi North Project: final report to Oceana Gold New Zealand Ltd*", dated 21 February 2025 (**Eaqub**

[38] Nic Conland's evidence entitled "General Expert observations on the proposed Waihi North Fasttrack project in the Wharekirauponga Catchment" dated August 2025 at paragraph [19].
[39] See paragraphs [20] to [22] of same evidence.
[40] See paragraphs [23] to [25] of same evidence.
[41] See paragraphs [28] to [29] of same evidence.
[42] Mr Hamish Kendal's expert statement of evidence on behalf of Coromandel Watchdog of Hauraki Ecology dated August 2025 paragraph [24].

report), are not proven and are likely to be overstated and significantly lower than proposed by the Applicant.

For example:

> Dr Richard Meade raises concerns about the use of appropriate methodologies for assessing regional or national benefits and considers that cost-benefit analysis is a preferred methodology for quantifying net benefits[43] in line with New Zealand Treasury direction that the economic impact analysis adopted by the Applicant "*is not suitable as a tool for measuring the balance of costs and benefits of a decision to society".*[44]

> This view is shared by Professor Glenn Banks who states that the Eaqub report "*provides a partial account of the economic benefits of the proposed extension that significantly exaggerates the economic benefits of the proposal to the regional and national economies and does not consider the loss of resource to the nation that the project very clearly entails".*[45]

> Similarly, Dr Geoff Bertram considers that the Eaqub report *is a selective assessment of some positive impacts that are predicted to flow from expansion of the mining operation at Waihi, but it does not meet the requirements or standards of professional mainstream economic analysis*.[46] Indeed the "*absence of any consideration of costs automatically rules this report out as cost-benefit analysis*".[47]

> Dr Richard Meade also raises concerns about the narrow range of benefits considered by the Applicant in its economic assessment and the lack of accounting for non-market benefits and costs[48] and the likelihood of using an Economic Impact Analysis methodology to overstate benefits and understate costs.[49] These benefits should be treated on a net basis and are not. They should also be assessed on a net present value basis and are not.[50] As a result, it is unclear whether the Project will actually deliver a net benefit to the Waikato region, let alone whether that benefit may come at a cost to other regions.[51]

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[43] Dr Richard Meade's expert report entitled "Waihi North Project Fast-Track Coromandel Watchdog of Hauraki Specialist Memo" dated 21 August 2025 paragraphs [13] to [15].
[44] The Treasury New Zealand, 2015, "Guide to Social Cost Benefit Analysis", July, at p. 39.
[45] Professor Glenn Banks' expert evidence at paragraph [11].
[46] Dr Geoff Bertram's review of the Eaqub report dated 19 August 2025 at paragraph [1].
[47] See paragraph [3] of same review.
[48] Dr Richard Meade's expert report at paragraphs [20] to [22]; see also [54] to [67]; and see Dr Geoff Bertram's discussion on unaddressed costs in his review at paragraphs [10] to [12].
[49] See paragraphs [29] to [33] of same report; see also paragraphs [68] to [83].
[50] See paragraphs [29] to [33] of same report.
[51] See paragraphs [43] to [45] of same report.

> Dr Richard Meade also highlights risks associated with leakage of purported economic benefits to overseas parties[52] and the potential for profit shifting through techniques such as management fees and related party borrowings.[53] As a result the estimate of benefits may be overstated and lack credibility. This is also a focus of Professor Glenn Banks' analysis, who concludes that "*it is likely that significantly more than half of the total value of the gold mined accrues to the foreign investor – the bulk of the value of the resource will provide a much reduced contribution to New Zealand*".[54]

> Mr Ed Miller reviews the corporate tax projections accompanying the Waihi North Project Application and concludes that "*projected corporate tax revenue figures mentioned in the Eaqub report assume fantastical margins that are well out of step with current firm performance*".[55] In addition, current profit-shifting behaviours in the New Zealand market by the Applicant raise doubt as to whether taxable earnings will generate the return to New Zealand suggested by the Eaqub report.[56]

> In addition, the Social Impact Assessment carried out by WSP for the Applicant is inadequate, unrealistic, limited in its assessment and fails to observe that "*the extended presence of the Waihi mine (3 decades plus a lot longer) has not had a clear benefit for Waihi as a community".*[57]

> As a result, as Professor Glenn Banks concludes, the Applicant is "*betting on the extension of mining bringing about a change in the socio-economic situation in Waihi that hasn't occurred over the last century of mining*".[58] Past experience should not be disregarded in assessing likely future benefits where the Applicant is unchanged and is not incentivised or required to deliver genuine regional or national economic benefits that will come at real cost to its own future profitability.

5. **Late Provision of Relevant Information & Material Information Gaps With Resultant Uncertainty –**

The amended draft set of proposed conditions was only posted to the Fast-track website relating to the Waihi North Project Application, and thus accessible for public review, earlier in the week of 18 August.

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[52] See paragraphs [85] to [93] of same report.
[53] Discussed by Ed Miller in his expert evidence prepared for Coromandel Watchdog of Hauraki Inc. at paragraphs [22] to [26] and earlier.
[54] Professor Glenn Banks' expert evidence at paragraphs [15] and [22].
[55] See paragraph [30] of Ed Miller's expert evidence.
[56] See paragraph [31] of Ed Miller's expert evidence.
[57] Professor Glenn Banks' expert evidence at paragraph [24].
[58] Professor Glenn Banks' expert evidence at paragraph [27].

A period of 5 working days or less is simply too short a time period to review and respond to such complex, substantial and important conditions relating to the design, implementation, ongoing management and eventual cessation of the Waihi North Project. Further time is required, to evaluate and respond to the latest iteration of conditions.

There are considerable information gaps in the information provided by the Applicant. For example:

- lack of measurable and enforceable performance standards with respect to Project conditions and incomplete analysis of post-closure geochemistry,[59]
- stacked stressors (e.g. vibration + vent discharges + dust + water loss) being assessed separately not cumulatively which creates a "*critical knowledge gap*",[60]
- lack of information on actual invertebrates present at the proposed Project sites and lack of assessment of the uniqueness and potential impacts of the Project on lower catchments and receiving environments,[61]
- no assessment of the uniqueness of freshwater systems potentially at risk,[62]
- lack of information on any cyanide management plan,[63]
- no information as to how mine wastewater will be treated to remove the range of pollutants such as selenium,[64]
- aged and potentially misleading data in respect of stormwater management (in some cases 5 years old),[65]
- lack of a clear carbonisation or offsetting pathway over the Project lifecycle etc.[66]

These information gaps are inclusive only. They are intended to exemplify, and not be exhaustive of, the matters raised in Coromandel Watchdog's expert evidence.

We submit that the effect of the information delays and gaps is to:

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[59] Nic Conland's evidence entitled "General Expert observations on the proposed Waihi North Fasttrack project in the Wharekirauponga Catchment" dated August 2025.
[60] See paragraphs [30] to [33] of Nic Conland's report.
[61] Professor Death's evidence, "Assessment of the "Freshwater Ecological Assessment" report on the Waihi North Project proposal" dated August 2025.
[62] Professor Death's evidence at paragraph [5] in the "Further Detail" section.
[63] Dr Emerman's evidence dated 19 August 2025.
[64] Dr Mike Joy's evidence, "Freshwater Ecology Issues. Waihi North Project" dated August 2025 paragraph [(C)4].
[65] Ms Selby Smith's expert water management review letter dated 11 August 2025.
[66] Report entitled "Climate Impact Assessment: OceanaGold's Waihi North Project (Wharekirauponga)" dated August 2025.

(1) create significant uncertainty as to whether the Applicant's reasoning and conclusions are correct, adequate and justified;

(2) not allow any respondent, including Coromandel Watchdog, the opportunity to evaluate those matters covered by information gaps either on a stand-alone basis or in relation to their cumulative impacts on the consentability of the Waihi North Project Application; and

(3) exacerbate procedural unfairness to respondents, who have a legitimate expectation that the quality, sufficiency and timeliness of information provided by the Applicant should be of appropriate and meaningful quality with sufficient time given to enable respondents to substantively respond to that information in accordance with the processes permitted by the Act.

Adverse Social Impacts –

In addition to the 5 key impacts of the Proposal that merit decline under Section 85, we highlight below adverse social impacts of the Proposal in the accompanying evidence from Catherine Delahunty and Professor Bridgette Masters-Awatere:

- Ms Delahunty notes that, with 37 years' experience working in local communities including Waihi and Whangamata and dealing with contaminated sites in the Hauraki and Coromandel area, she has encountered many social impacts of the expansion of mining in and under the town of Waihi that the Applicant does not consider. These impacts include "*effects of noise, dust, blasting and vibration, damage to homes and property, mental health issues as a result of blasts etc*".[67]

- Ms Delahunty comments that the proposed underground mining expansion is of greater concern to people in the vicinity who "*have complained regularly about the effects of blasting causing vibration under their homes and minor damage to homes and driveways*",[68] but who cannot afford costs associated with proving a causal link between blasting and damage they sustain. These impacts exist at present, are sustained, and will increase if the Application is approved.

- At present, the Applicant has not satisfactorily dealt with the above matters and has not proposed any form of meaningful social impact support in the

[67] Expert evidence submission of Ms Catherine Delahunty addressed to The Expert Panel on the Oceana Gold Mining Application dated 25 August 2025 at page 2.
[68] See page 2 of same submission.

Application. This will mean the risk of more of the same adverse social impacts, with greater magnitude, that Waihi people have experienced to date without relief.

- These impacts have already been recognised by the Applicant to the extent that it has provide subsidence compensation to at least 27 households in Waihi, via a company-run scheme that is not replicated in any other town in New Zealand.[69]

- The Application is impacting the Waihi community at present, and elevating community concerns. These concerns relate to placing at risk key dependencies that the town and its surrounding communities have on tourism, accessibility, clean and plentiful water supplies, clean natural environments with a healthy thriving mix of local species of flora and fauna, and rights to freely enjoy their homes and habitat. These community dependencies are further threatened by fears of what the mining could leave behind and the risks that its tailings and toxic byproducts could be absorbed by local environments, species, and people as highlighted in other parts of this submission.

- Separately, Professor Masters-Awatere notes that there is "*absence of a clear and consistent voice of support for the mining project from iwi, hapū, hāpori groups or others who represent the diverse range of interests and livelihoods of Māori".*[70]

- Professor Masters-Awatere also notes that Cultural Impact Assessments have not been completed at the time of submission of her evidence.[71] This is a significant social impact assessment gap in the Application. It risks ignoring warnings from overseas mining projects where weak governance and poor accountability have created devastating indigenous outcomes because "*poorly governed extractive industries, including mining, pose unacceptable risks to public health, environmental justice, and intergenerational wellbeing. To allow mining expansion under weakened regulatory oversight would repeat these same mistakes, exposing communities and ecosystems to irreversible damage".*[72]

[69] See page 3 of same submission.
[70] Expert evidence submission of Professor Master-Awatere entitled "Waihi North Project. Social Science Impacts" at page 1.
[71] See page 1 of same submission.
[72] See page 2 of same submission.

- Professor Masters-Awatere lists a range of social impact concerns specific to local Māori that have not been considered by the Applicant in its assessments, such as:
    - damage to Marae and Urupā,
    - consequences for food security and kai sovereignty,
    - loss of waterways and mahinga kai,
    - indigenous physical and spiritual health impacts, and
    - detrimental outcomes for intergenerational responsibilities, whakapapa, whanaungatanga and kaitaikitanga obligations.[73]

We submit that these social impacts are significant adverse impacts, with immediate and long-term consequences, that have not been addressed by the Applicant in its Application.

As a result, the representative voices, of both indigenous and other local inhabitants, articulating social impacts have been disregarded by the Proposal.[74]

As such, the social impacts outlined above represent additional costs of the Project that have not been - and should be - included in any assessment of the proportional benefits at a local, regional and national level flowing from the Application.

Summary –

In summary, we submit that our evidence demonstrates that the Proposal fails the proportionality test in Section 85(3) of the Act. With the result being that the Panel should decline in whole (as a first preference), or in part (as a second preference), the Waihi North Project Application because:

(a) the Project's adverse impacts on the receiving environment, hydrology, impacts on highly vulnerable and nationally significant frog species and other invertebrate species inhabiting that environment substantially outweigh any regional or national benefits (even after taking into account proposed mitigation measures); and

(b) the Waihi North Project's regional and national economic benefits are overstated and do not undertake orthodox cost benefit analysis, with the consequence that these assessments are flawed; and

[73] See pages 3 to 5 of same submission.
[74] See page 3 of same submission.

(c) the late provision of relevant information by the Applicant and considerable remaining information gaps reinforces significant uncertainties with the Waihi North Project Application.

In addition, the social impacts of the Proposal are significant and have not been adequately addressed by the Applicant.

After more than 30 years of mining operations in Waihi by the Applicant, we can see that "*the mine has not had a clear benefit for Waihi as a community*" (Professor Glenn Baker, cited above).[75] As a long-standing representative of the Waihi community, we see no evidence given by the Applicant that the Project would change our situation for the betterment of our community or on a regional or national basis. The adverse impacts described above are expected to significantly and irreparably worsen our situation.

Actions Sought in Response –

We respectfully seek the following actions to be initiated by the Expert Panel:

(1). calling a hearing in accordance with the Expert Panel's discretion to do so under Section 57(1) of the Act in order to hear evidence on material contested issues relevant to the thresholds in Section 85; and

(2). following that hearing, unless the evidence produced at the hearing resolves the areas of primary concern, a determination by the Expert Panel that the Waihi North Project Application is declined on the basis that the adverse impacts of the Waihi North Project, as presently proposed, are sufficiently significant to be out of proportion to the resulting regional and national benefits that the Expert Panel has considered under Section 81(4) in accordance with the Expert Panel's discretion to decline under Section 85(3).

Finally –

We gratefully acknowledge the expertise and hard work of the Expert Panel and members of the Environment Protection Agency who are dedicated to receiving and considering the above submissions.

We are available at any time to further discuss matters raised in this letter.

Ngā mihi nui.

[75] Professor Glenn Banks' expert evidence at paragraph [24].

Nāku noa, nā,

BEFORE THE FAST-TRACK APPROVALS PANEL

In the matter of the Fast-Track Approvals Act 2024

And

In the Matter of applications by Oceana Gold (New Zealand) Limited for various resource consents and other authorities relating to the Waihi North Project (including the Wharekirauponga Underground Mine)

And

In the matter of the submission on the above applications

by Coromandel Watchdog of Hauraki Inc

Preliminary submissions of Counsel for Coromandel Watchdog of Hauraki Inc

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Dated: 25 August 2025

Solicitor Acting:

Richard Allen Law Ltd

richard@richardallenlaw.co.nz

Counsel Acting:

Rob Enright / Marti Enright

Magdalene Chambers

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May it please the Panel

1 Counsel has recently been instructed to act for Coromandel Watchdog of Hauraki Inc on this matter. Coromandel Watchdog was a discretionary invitee under s51 of the Act, and is grateful to the Panel for recognising its relevant interest in the proposal.

2 Despite the limitations of time and resourcing, Coromandel Watchdog has prepared a substantial case identifying why the Waihi North project should be declined under s85 of the Act. This includes a range of eminently qualified independent experts.

3 A preliminary summary of relevant legal issues include:

3.1 whether the Project can be declined in whole, or part, if the Panel is ultimately satisfied that the relevant grounds in s85 for discretionary refusal are met. In that regard, Coromandel Watchdog submits that, as a first priority, the entire Project suffers from fundamental information gaps which bear upon the s85 tests, and should be declined. Alternatively, the evidence provided by Coromandel Watchdog identifies material adverse impacts associated with the new underground mine at Wharekirauponga and the closely related third tailings storage facility/rock storage facility, and these components of the Project should at minimum be declined.

3.2 how to address issues of uncertainty, including gaps in the information and analysis provided by the Applicant. It is submitted that the Applicant bears an evidential onus, and must, for example, satisfy the Panel that the proposal can achieve the claimed regional or national benefits under s81(4) and s85.

3.3 It is submitted that when assessing the extent of regional or national benefits, an orthodox cost-benefit assessment should apply. Detailed reasons for this are set out in the economics evidence being filed herewith.

3.4 The proportionality test in s85 requires the Panel to examine the accuracy of the alleged regional or national benefits, as part of an assessment as to whether approvals may be granted.

3.5 In light of the detailed expert evidence compiled by Coromandel Watchdog, it is submitted that the Panel should exercise its power under s57 to direct that a focused hearing should be held on the issues listed below, with provision for cross-examination by parties of the relevant expert witnesses, on the basis that there are fundamental inconsistencies in the evidence unlikely to be resolved by a hearing on the papers. This could follow on from any expert caucusing process directed by the Panel to narrow issues.

3.6 The key issues include:

3.6.1 The extent of claimed regional or national benefits of the Waihi North project, including in light of cost-benefit analysis;

3.6.2 The extent of impacts on Hochstetter and Archey's frog species, and invertebrate species with threatened or at-risk conservation status, including in light of baseline data and proposed consent conditions, and;

3.6.3 The extent of hydrological and biodiversity effects from proposed discharges of contaminants to the receiving environment, related management of these discharges, and in light of baseline data on the receiving environment and proposed consent conditions;

3.6.4 Whether the assessment of the risk of failure of the tailings storage facility has identified and had regard to all relevant factors;

3.6.5 Legal issues associated with the above, including whether a Project may be declined in part under s85 of the Act;

3.6.6 Other issues identified by Coromandel Watchdog's evidence filed herein.

4 Coromandel Watchdog acknowledges that the Panel also has the ability to direct provision of further information including independent peer review. Counsel are available to be heard further on procedural matters, should that assist the Panel.

Dated this 25th August 2025

Rob Enright / Marti Enright
Counsel for Coromandel Watchdog of Hauraki Inc

IN THE MATTER of the Fast Track Approvals Act 2024 (FTA2024)

and

IN THE MATTER of the Application of Oceana Gold New Zealand Limited to extract minerals, in the Waihī and Wharekirauponga area

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EVIDENCE OF: STEVEN H EMERMAN

SUBJECT: OCEANA GOLD MINE APPLICATION AT WAIHI/WHAREKIRAUPONGA

DATE: 19/08/2025

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August 19, 2025

Evidence of: STEVEN H EMERMAN

Introduction

1. My name is STEVEN H EMERMAN
2. I have a B.S. in Mathematics from The Ohio State University, M.A. in Geophysics from Princeton University, and Ph.D. in Geophysics from Cornell University.
3. I have 31 years of experience teaching hydrology and geophysics, including teaching as a Fulbright Professor in Ecuador and Nepal, and have over 70 peer-reviewed publications in those areas. Since 2018 I have been the owner of Malach Consulting, which specializes in evaluating the environmental impacts of mining for mining companies, as well as governmental and nongovernmental organizations. I have evaluated proposed and existing mining projects in North America, South America, Europe, Africa, Asia and Oceania, and have testified on issues of mining and water before the U.S. House of Representatives Subcommittee on Indigenous Peoples of the United States, the European Parliament, the United Nations Permanent Forum on Indigenous Issues, the United Nations Environment Assembly, the Permanent Commission on Human Rights of the Chamber of Deputies of the Dominican Republic, and the Minnesota Senate Environment, Climate and Legacy Committee.
4. I am the former Chair of the Body of Knowledge Subcommittee of the U.S. Society on Dams and one of the authors of Safety First: Guidelines for Responsible Mine Tailings Management.

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While this is not a New Zealand Environment Court hearing I note that, in preparing my evidence, I have reviewed and agree to comply with the Code of Conduct for Expert Witnesses contained in Part 9 of the Environment Court Practice Note 2023. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where relying on the opinion or evidence of other witnesses, which I will specify. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

I have also generally reviewed the first iteration of consent conditions. I have not reviewed, but seek an opportunity to review, the latest iteration of consent conditions, and related documents. Unfortunately these arrived too late in preparation of my evidence.

4. Each of my concerns regarding the proposed Waihi North Project is stated briefly in bold italics, followed by a more detailed explanation.

5.

1) ***Although OceanaGold will use cyanide to extract gold and silver and will store on-site 112,000 liters of liquid cyanide and 77.180 metric tons of solid cyanide, there is no cyanide management plan, OceanaGold is not a signatory of the International Cyanide Management Code, and OceanaGold has not committed to the Responsible Gold Mining Principles of the World Gold Council.***

6. Although OceanaGold has stated that they will use cyanide to extract gold and silver from the crushed ore, the application is remarkably lacking in information on the safe management of cyanide. According to the Pre-Feasibility Study that OceanaGold provided to its investors, “The silica associated gold is readily leached via conventional grinding and cyanide leaching flowsheets” (OceanaGold, 2024). The application further states that the project will store on-site

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112,000 liters of liquid cyanide and 77.180 metric tons of solid cyanide (OceanaGold, 2025a). However, there is no cyanide management plan and OceanaGold is not a signatory of the International Cyanide Management Code (The Cyanide Code, 2025). Haile Gold Mine, Inc., a wholly owned subsidiary of OceanaGold, is a signatory of the International Cyanide Management Code, while the three other operating mines owned by OceanaGold (the Didipio mine in the Philippines, and the Macraes and Waihi mines in New Zealand) are not signatories (OceanaGold, 2025b; The Cyanide Code, 2025). Thus, OceanaGold is fully aware of the International Cyanide Management Code and is fully capable of becoming a signatory when it is an expectation of the relevant regulatory agencies. Based on the above, OceanaGold cannot be trusted to safely manage cyanide at its proposed Waihi North Project.

7. The development of the International Cyanide Management Code began with the failure of the tailings dam at the Aurul S.A. gold mine near Baia Mare, Romania, in January 2000. The tailings dam failure released 100,000 cubic meters of cyanide-rich water into the Somes and Tisza Rivers, which then flowed into the Danube River and finally into the Black Sea, a distance of over 2000 kilometers. The cyanide spill resulted in massive fishkill and the destruction of aquatic species (ICOLD and UNEP, 2001). The public and governmental response led to a concern in the gold mining industry that governments would begin banning the use of cyanide, which would effectively put an end to the gold mining industry in those jurisdictions.

8. In fact, following the tailings dam failure at Baia Mare, the use of cyanide in ore processing was banned in Costa Rica, Czech Republic, Germany, and Hungary (Laitos, 2013). Turkey had already banned the use of cyanide in 1997 (Laitos, 2012). In 2010 the European Parliament called for a ban on the use of cyanide in mineral processing throughout the European Union, stating that a ban “is the only safe way to protect our water resources and ecosystems against cyanide pollution from mining activities” (Environment and Natural Resources Law & Policy Program, 2010). In the United States, the state of Montana had already banned the use of cyanide

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at open-pit mines in 1998 (Laitos, 2013). The states of Wisconsin and Virginia banned the use of cyanide in 2001 and 2024, respectively (Wisconsin State Legislature, 2001; Virginia's Legislative Information System, 2024). Eight provinces of Argentina have prohibited the use of cyanide in mineral processing, although there is no nationwide prohibition (Laitos, 2013).

9. In an effort to forestall such governmental bans and their existential threat to the industry, the gold mining industry created the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold (called the International Cyanide Management Code in this report) (The Cyanide Code, 2025a). The International Cyanide Management Code is a voluntary commitment that includes third-party audits for full certification. Thus far, over 225 companies are signatory to the International Cyanide Management Code, including mining companies, cyanide producers, and cyanide transporters. There are no signatory companies in New Zealand, where there is no expectation for compliance with the International Cyanide Management Code, but signatory companies in neighboring countries include 15 in Australia, seven in Indonesia, and two in Papua New Guinea (The Cyanide Code (2025b). The Responsible Gold Mining Principles, which were developed by the World Gold Council are even broader than the International Cyanide Management Code because they incorporate the International Cyanide Management Code, in addition to other requirements. According to the Responsible Gold Mining Principles, "Where our operations use cyanide, we will ensure that our arrangements for the transport, storage, use and disposal of cyanide are in line with the standards of practice set out in the International Cyanide Management Code" (World Gold Council, 2019a).

10. It should be noted that the International Cyanide Management Code is not a guidance document, but a certification program. Thus, a company cannot commit to the requirements of the International Cyanide Management Code without engaging in the certification process. The Introduction to the International Cyanide Management Code begins, "The 'International

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Cyanide Management Code For the Manufacture, Transport, and Use of Cyanide In the Production of Gold' (Cyanide Code) is a voluntary, performance driven, certification program of best practices for gold and silver mining companies and the companies producing and transporting cyanide used in gold and silver mining … The objective of the Cyanide Code is to improve the management of cyanide used in gold and silver mining and to improve the protection of human health and the reduction of environmental impacts, while assuring stakeholders of the safe handling of cyanide through the disclosure of results from periodic audits by independent professional auditors. Implementation of the Cyanide Code is verified through triennial audits conducted by independent third-party auditors. Companies that adopt the Cyanide Code must have their operations that use, transport, or produce cyanide audited to determine the status of Cyanide Code implementation. Those operations that meet the Cyanide Code requirements are certified" (International Cyanide Management Institute, 2021a). The detailed procedures for carrying out audits are described in International Cyanide Management Institute (2021b-c). Although OceanaGold has never stated a commitment to comply with the International Cyanide Management Code, but without the third-party audits that would be required by becoming a signatory, it has been my experience that companies with such commitments do not comply with the actual International Cyanide Management Code, but with their own version of the code.

11. A signatory company does not need to have an operating facility to obtain certification, so that a regulatory agency could reasonably require certification for proposals alone. According to the International Cyanide Management Institute (2021c), "The Code allows for pre-operational certification of a mining operation that is not yet active but that is sufficiently advanced in its planning, design, or construction that its plans and proposed operating procedures can be audited for conformance with the Code … Since mines that are not yet active cannot be audited for their actual operation, pre-operational certification is based on their commitments to design, construct and operate the mine in full compliance with the Cyanide Code's Principles and Standards of

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Practice. Auditors of mines seeking pre-operational certification must determine if the operation can reasonably be expected to be in full compliance with the Code's Principles and Standards of Practices once its plans are implemented and it becomes active … A preoperational facility found in full compliance is conditionally certified, subject to an on-site audit to confirm that the operation has been constructed and is being operated in compliance with the Code." Thus, OceanaGold could become a signatory on behalf of the Waihi North Project at the present time without waiting for the mine to begin operation.

12. In a similar way, OceanaGold has never made a public commitment to align with the Responsible Gold Mining Principles of the World Gold Council, and could not do so without providing third-party assurance. According to World Gold Council (2019a), "The Principles require implementing companies to:

1. Make a public commitment to align with the Responsible Gold Mining Principles
2. Develop internal systems, processes and performance that conform with the Principles
3. Report publicly on the status of their conformance with the Principles
4. Obtain independent assurance on their conformance with the Principles."

World Gold Council (2019a) continues, "Two public reports are associated with the assurance:

1. An annual report on implementation of the Responsible Gold Mining Principles produced by the implementing company
2. An Independent Assurance Report produced annually by the assurance provider."

World Gold Council (2019b) describes the detailed procedures for implementation and assurance of the Responsible Gold Mining Principles. It should be noted that OceanaGold has never made a public commitment to align with the Responsible Gold Mining Principles of the World Gold Council.

13. The failure of OceanaGold to include a cyanide management plan within the application, to become a signatory of the International Cyanide Management Code, and to align with the

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Responsible Gold Mining Principles of the World Gold Council should be sufficient cause to reject the application for the Waihi North Project without further consideration.

14.

2) Although the application confirms that the mining operation will leak mercury into groundwater, the application incorrectly states that mercury is immobile in groundwater.

15. The application repeatedly confirms that the mining operation is expected to leak mercury into groundwater, but then quickly dismisses any concerns based on the assumed immobility of mercury in groundwater. For example, according to OceanaGold (2025c), "The results indicate that elevated concentrations of number of parameters associated with tailings discharge are likely within the shallow groundwater west of the Gladstone pit during the long-term TSF scenario. This includes iron, mercury and zinc which are predicted to exceed the receiving water quality criteria. Mercury is typically immobile in groundwater due to volatilization and/or precipitation processes and has not been reported in significant persistent concentrations by OGNZL (2020). It is not a parameter of concern for these reasons … Groundwater discharge from the TSF to the surface water receiving environment in the long-term TSF scenario is predicted to be in the order of 65 m^3/day to the west of the pit (Table 3.16). Of this discharge, approximately 5 m^3/day is predicted to comprise tailings porewater, with the remainder being groundwater and infiltrated rainwater that has migrated through rock backfill to the point of discharge from the pit. Shallow groundwater quality following mixing and geochemical equilibrium (AECOM, 2021a) is predicted to result in an increase in the concentration of iron and mercury within the shallow groundwater to levels exceeding the receiving water quality criteria … Emplacement of rock at the NRS [Northern Rock Stack] will result in leachate generation during both operation and after closure that will percolate downwards through the rock stack … The predicted concentrations of mercury are greater than the RWQC [Receiving Water Quality Criteria] as the laboratory

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detection limit of this parameter is greater than the criterion. As discussed previously, mercury is typically immobile in groundwater due to volatilization and/or precipitation processes and has not been reported in significant persistent concentrations by OGNZL (2020). It is not a parameter of concern for these reasons." OceanaGold (2025d) continues, "The mass flux leaving the TSF3 and expected to enter the Ohinemuri River is provided in Table 5.15 … The predicted concentrations of mercury are greater than the RWQC as the laboratory detection limit of this parameter is greater than the criterion. Mercury is typically immobile in groundwater due to volatilisation and/or precipitation processes and has not been reported in significant, persistent concentrations by OGNZL (2020)."

16. It is not correct to state that mercury is typically immobile in groundwater. It is certainly not warranted to dismiss any considerations of the circumstances under which mercury will be transported through groundwater, simply based upon its assumed immobility. Mercury can be highly mobile in groundwater under acidic conditions, if mercury attaches to colloidal particles, if biological processes transform mercury into methylmercury or other organo-mercury compounds, or if mercury forms complexes with chloride, bromide, or dissolved organic matter.

17. For example, according to the review paper "Mercury in Groundwater – Source, Transport and Remediation," "Precipitation-dissolution, oxidation-reduction, adsorption-desorption, and aqueous complexation reactions control Hg transport and fate in groundwater. Adsorption of Hg^{2+} onto goethite and hematite or co-precipitation with/ or adsorption onto mackinawite or HgS along the flow path (Johannesson and Neumann, 2013) can restrict Hg mobility unless Hg is bound to colloids (particles <1 um) … The quality and quantity of dissolved organic matter (DOM) can also control the aqueous transport and the formation of toxic MeHg under various environmental conditions … under oxidizing conditions, Hg sorbed on FeOOH particulates could become mobilized in groundwater systems … Several investigations revealed that mobilization, transport, and fate of Hg in groundwater are strongly controlled by (1) redox

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processes that support precipitation-dissolution and microbial activity (including methylation of Hg^{2+}) within the aquifer; (2) a pH condition favorable to adsorption-desorption and the availability of Fe and DOM in the groundwater" (Aleku et al., 2024). The earlier review paper "Occurrence and Mobility of Mercury in Groundwater" summarized, "Oxidation-reduction, precipitation-dissolution, aqueous complexation, and adsorption-desorption reactions will strongly influence the fate and transport of Hg in groundwater" (Barringer et al., 2013).

18. It should be noted that, even when contaminants are immobilized in groundwater due to a particular chemical and biological environment, those contaminants can later be re-mobilized as a result of a change in groundwater chemistry or biology. For this reason, immobilized mining-related contaminants are often referred to as the "chemical time bomb."

19. In summary, the mobility in groundwater of mercury resulting from the Waihi North Project requires a serious investigation, rather than a simple dismissal.

20.

3) ***Although the application emphasizes the high arsenic, antimony and mercury contents in the ore body and the tailings, there is no consideration of the ability of cyanide to mobilize those elements and, thus, increase the arsenic, antimony and mercury concentrations in the tailings pond and tailings pore water.***

21. According to the Pre-Feasibility Study that OceanaGold (2024) provided to its investors, "The GOP [Gladstone Open Pit] orebody contains significant levels of mercury at levels higher than currently experienced in the mill (up to 4 g/t Hg) [4 parts per million]." Since, according to Aleku et al. (2024), "Hg is one of the least abundant elements in the upper continental Earth's crust, with an estimated concentration ranging from 12.3 to 96 μg/kg [0.0123 to 0.096 parts per million]," the GOP ore body has a mercury concentration that is 42 to 325 times the global

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background concentration. From another perspective, since the gold grade of the GOP is in the range 1.00 to 1.44 grams per metric ton (equivalent to parts per million), the GOP would be primarily a mercury mine, not a gold mine (see Figs. 1a-b).

22. The application repeats the above point, but also with regard to arsenic and antimony. According to OceanaGold (2025e), "The static field tests confirmed that in general, Andesite and Breccia material from GOP is elevated in mercury, antimony, and arsenic relative to the historical Waihi dataset and mean concentrations in the earth's crust … Of note is mercury, which has largely been recorded below the laboratory method detection limit in site mine waters and shows an order of magnitude increase in total concentration within the Gladstone rock … Elevated trace element concentrations (antimony, arsenic and mercury) in the rock (and ore body) relative to historical mined areas need to be assessed for potential implications for consent compliance at the point of discharge (both to water and to air). An assessment of the distribution of trace elements within the rock shows that mercury is elevated in the highly clay altered Andesitic material located near the surface and associated with the Breccia material … Mercury is more elevated in Gladstone ore and is therefore the primary focus area with regard to management of mine tailings."

23. In fact, the application states even higher mercury concentrations than were reported in the Pre-Feasibility Study (OceanaGold, 2024). According to OceanaGold (2025e), "From the figure, a pattern of decreasing mercury concentration with depth can be observed with the higher mercury concentrations (red > 10 ppm, orange 5-10 ppm) focused on the Breccia rock material or within the Andesitic material bordering the Breccia material."

24. As with the release of cyanide into groundwater, the application concludes that elevated concentrations of arsenic, antimony and cyanide are not a matter of concern. According to OceanaGold (2025e), "When compared to historical rock trace element data, the proposed

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Gladstone Pit rock is generally depressed in trace element concentrations with the exception of antimony, arsenic, and mercury, which are elevated. Although these elements are elevated, geochemical controls such as co-precipitation and complexion, along with the current on-site treatment facilities will control the trace element concentrations from the mine area to within the current operating limits for treated water. It is predicted that elevated trace element concentrations in mine waters arising from elevated concentrations within the rock material (with respect to historical mining areas) will not impact the site's ability to meet the existing discharge consent conditions."

25. What is entirely missing from the application is the recognition that the ability of cyanide to extract arsenic, antimony, and mercury, as well as gold and silver, from crushed ore is well-established. Thus, the concentrations of dissolved arsenic, antimony and mercury in the tailings pore water have been under-estimated, so that the releases of arsenic, antimony and mercury into groundwater and surface water have also been under-estimated.

26. The explanation of the above point requires some detail on the use of cyanide in mineral processing. An excellent reference on this subject is the SME (Society for Mining, Metallurgy and Exploration) handbook Basic Cyanide Chemistry (Botz, 2024). The process of gold ore processing using cyanide involves dissolving a cyanide salt (such as sodium cyanide) in water, so that it dissociates to form the cyanide ion (CN^-) and hydrogen cyanide (HCN). The gold ore is crushed and is either placed onto a heap leach pad, where cyanide solution is poured over it, or mixed with the cyanide solution in a vat. The cyanide ion extracts the gold from the ore to form a dissolved gold-cyanide complex. The solution with the gold-cyanide complex is called the pregnant solution.

27. There are two important processes for removing the gold-cyanide complex from the pregnant solution. In the first process, the pregnant solution is mixed with or passed over activated carbon,

so that the gold-cyanide complex leaves the solution and attaches to the activated carbon, after which the solution is referred to as the barren solution. Further steps (called stripping or elution) remove the gold from the activated carbon and restore the cyanide to the barren solution. Any lost cyanide is replaced in the barren solution and the solution is then recycled to extract additional gold from more gold ore. The second important process is called zinc cementation or the Merrill-Crowe process. In this process, the addition of zinc dust to the pregnant solution creates a highly-reducing (low-oxygen) environment. The highly-reducing environment causes gold to be reduced to its elemental (metallic) state, so that it precipitates as solid particles of gold. As with the activated carbon process, any lost cyanide is replaced in the barren solution and the solution is then recycled to extract additional gold from more gold ore.

28. Cyanide can also be used to extract silver from crushed ore. However, there are other, safer methods for the processing of silver ore and cyanide is rarely used to extract silver, unless there is a desire to extract both gold and silver from the same ore body. The reaction of silver with free cyanide will form a dissolved silver-cyanide complex and both of the above processes can then be used to remove the silver-cyanide complex from the pregnant solution. The silver-cyanide complex will attach to activated carbon, although not as strongly as the gold-cyanide complex, so that gold can out-compete silver for adsorption sites. The addition of zinc dust will also cause the reduction of silver to its elemental state and its precipitation as solid particles of silver. Generally, the Merrill-Crowe process is preferred when there are higher concentrations of silver in the ore with the activated carbon process used for lower concentrations (Botz, 2024). The combined cyanide extraction of gold and silver results in a semi-pure gold-silver alloy called doré, after which further refining can be carried out to produce pure gold and pure silver.

29. Aside from the question of the persistence of cyanide in the environment (which will be addressed in Point #4), a considerable portion of the environmental toxicity that is a consequence of the use of cyanide in gold ore processing is not the cyanide itself, but the by-products of the

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use of cyanide. Cyanide is equally effective in extracting mercury from crushed ore, so that any mercury present in the gold ore also appears as a dissolved mercury-cyanide complex within the pregnant solution. There is a mercury-cyanide complex that could attach to activated carbon along with the gold-cyanide complex, but not the particular mercury-cyanide complex that forms under the alkaline conditions that are necessary for processing with cyanide. Some of the hydrogen cyanide that develops when sodium cyanide is dissolved to form the cyanide solution remains in the dissolved form, but most of it volatilizes to escape as hydrogen cyanide gas. Hydrogen cyanide gas would be lethal to the mineworkers and would be economically undesirable, even if it could be ventilated, because it represents a loss of cyanide from the processing circuit. In order to minimize the production of hydrogen cyanide and maximize the production of the cyanide ion, the cyanide solution is maintained in a very alkaline state, in the pH range of 10-11 (Botz, 2024). In such a high pH range, the mercury-cyanide complex remains in the barren solution. Thus, every passage of the cyanide solution through the processing circuit causes the solution to encounter more ore that may contain additional mercury. As a consequence, the cyanide solution becomes increasingly enriched in mercury, which can be far more toxic to the environment than cyanide.

30. Other contaminants can be mobilized into the cyanide solution solely as a result of the high pH. These contaminants include elements that form oxyanions (negatively-charged ions that include oxygen) in the dissolved form. Examples of such elements are arsenic, antimony, molybdenum, selenium, and uranium. As with mercury, since none of the preceding oxyanions will attach to activated carbon, they will remain in the barren solution. Thus, every passage of the cyanide solution through the processing circuit will cause the solution to become increasingly enriched in arsenic, antimony, molybdenum, selenium, and uranium, if those elements are present in the gold ore.

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31. It should be noted that the tailings pore water is simply the barren cyanide solution as it has been incorporated into the tailings. In summary, the tailings pore water should be expected to be enriched in arsenic, antimony, and mercury over and above what has been predicted in the application.

32.

4) ***The application does not include any consideration of the impact of a failure of the tailings dam on the water quality of downstream waterways.***

33. Although OceanaGold (2025f) analyzes the impact of a dam breach on downstream waterways, the analysis is concerned only with physical parameters, such as the depth of the tailings flood, the tailings flow velocities, and the arrival times of the tailings flood. There has not been any analysis of the chemical impact of the release of the tailings and the tailings pond on the downstream waterways and the aquatic life in those waterways. It has already been mentioned that predictions of the chemistry of the tailings pore water are overly optimistic. It is even more important that there is no analysis whatsoever of the chemistry of the tailings pond, especially in terms of arsenic, antimony, cyanide and mercury. In this respect, it should be borne in mind that, according to the application, TSF3 will have a perpetual water cover after closure, so that the threat of a release of the tailings pond into downstream waterways will never end (OceanaGold, 2025a; see Fig. 2). It should also be noted that, although the Pre-Feasibility Study (OceanaGold, 2024) describes a plan for oxidation of water with hydrogen peroxide for destruction of cyanide prior to the intentional release of mine wastewater into the environment, it does not describe any corresponding plan for the destruction of the cyanide in the tailings pore water prior to deposition of the tailings in TSF3. The lack of a plan for the destruction of cyanide in tailings pore water is, of course, consistent with the lack of any cyanide management plan, as was discussed under Point #1. Even if there were such a plan, the destruction of cyanide in tailings pore water is always partial.

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34. It is often said in mining corporate communications that cyanide does not persist in the environment, since it rapidly breaks down into carbon dioxide and ammonia as a result of processes such as oxidation, volatilization, photo dissociation, and biodegradation. The statement is generally true, but requires three critical qualifications. The first qualification is that the processes of cyanide attenuation in surface water can require days to weeks, depending upon many factors, such as the extent of aeration or mixing of the water, the depth of the water, the intensity of sunlight, and the presence of the appropriate microbial community. During that time period of days to weeks, extensive destruction of aquatic life and impacts on municipal water supply are still possible. For example, the leakage of cyanide-enriched water from the Summitville gold mine in Rio Grande County, Colorado (USA), destroyed nearly all aquatic life along a 37-kilometer reach of the Alamosa River (Laitos, 2013). In the case of the spill of cyanide-enriched water from the Aurul S.A. gold mine near Baia Mare, Romania, in 2000, the cyanide plume traveled over 2000 kilometers down the Danube River to the Black Sea.

35. The second qualification is that dissolved cyanide can disappear from the water column as carbon dioxide and ammonia, which is true destruction of the cyanide. On the other hand, cyanide can also disappear from the water column as a result of the adsorption of cyanide onto solid particles or the precipitation of a solid cyanide salt, such as iron cyanide. In these cases, the cyanide has not been destroyed, but is only being stored in the solid form. This type of storage is referred to as the "chemical time bomb," because a change in water chemistry or photo dissociation can cause the transfer of adsorbed cyanide back into the dissolved form or the dissolution of the precipitated cyanide salts. According to Johnson (2015), "Of these fates, dispersal to the atmosphere and chemical transformation amount to permanent elimination of the cyanide, whereas sequestration amounts to storage of cyanide. If physicochemical conditions change, stored cyanide can potentially be released to infiltrating waters by means of dissolution or desorption reactions."

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36. The third and most important qualification is that most of the processes leading to destruction function only for surface water and can be absent for groundwater. In particular, groundwater can have low oxygen levels, be disconnected from the atmosphere or sunlight, or lack the microbial community that can biodegrade cyanide. According to Laitos (2013), "In contrast to surface waters, because groundwater lacks ultraviolet light and has less available oxygen, cyanide will persist for longer periods of time if it works its way underground." Johnson (2015) drew attention to the problematic aspects of both large-scale spills of cyanide into surface water and leakage into groundwater. According to Johnson (2015), "From an environmental perspective, the most significant cyanide releases from gold leach operations have involved catastrophic spills of process solutions or leakage of effluent from solid wastes to the unsaturated [soil water] or saturated zones [groundwater]. Key to the environmental significance of spills and leakage is that these release pathways are unfavorable for two important cyanide attenuation mechanisms that can occur naturally: catastrophic spills allow little time for offgassing of free cyanide to the atmosphere, and effluent leakage to the subsurface does not allow for photodissociation of strong cyanometallic complexes to give free cyanide that can offgas." Free cyanide refers to cyanide in the highly toxic forms of either the cyanide ion or hydrogen cyanide.

37. In summary, the impacts of a release of a tailings pond and tailings pore water that is enriched in arsenic, antimony, cyanide, and mercury have not been analyzed at all.

38.

5) ***Based on the high precipitation and the past history of sulfide-ore mining, the release of acid mine drainage and the contamination of groundwater and downstream waterways should be an expected outcome of the Waihi North Project.***

39. The ore that would be mined at the Waihi North Project is a classic sulfide ore. According to OceanaGold (2024), "Gold occurs mostly as small inclusions of electrum (averaging 38 % silver) occurring as both free grains in the quartz and as inclusions in sulphides such as pyrite, galena, sphalerite and less commonly chalcopyrite."

40. The central issue with the mining of sulfide ores is the release of acid mine drainage and heavy metals into groundwater and downstream waterways. Acid generation occurs when sulfide minerals from beneath the surface are excavated and exposed to oxygen and water on the surface, so that the reaction with oxygen and water (called oxidation) converts the sulfides into sulfuric acid. The conversion of sulfide minerals to sulfuric acid is promoted both by crushing the sulfide minerals, which increases the surface area that is exposed to oxygen and water, and by the permanent aboveground disposal, which allows for an extended time over which the acid-generating reactions can occur.

41. A by-product of acid generation is the mobilization of heavy metals into the dissolved form. For example, the oxidation of pyrite (iron sulfide) results in the mobilization of dissolved iron, while the oxidation of galena (lead sulfide) results in the mobilization of lead. However, most sulfide minerals include a variety of other heavy metals that can substitute for the primary metal (such as substitutes for iron in the mineral pyrite), so that the oxidation of pyrite can result in the mobilization of a wide range of other heavy metals.

42. Acid mine drainage can induce a positive feedback in that the downstream load of dissolved metals can greatly exceed the dissolved metals that result from the oxidation of the exposed sulfide minerals. Stream sediments typically include clay minerals, whose surfaces have negatively-charged sites that bind cations (positively-charged ions). Most dissolved metals are cations, although there are some exceptions, such as arsenic (actually a metalloid), molybdenum and uranium, which occur in dissolved form as oxyanions (polyatomic negatively-charged ions

that include oxygen). When acidic water interacts with these stream sediments, the hydrogen cations in the water displace other cations (such as metallic cations) from the negatively-charged sites on stream sediments, so that metals are no longer fixed onto sediment, but are mobilized in the stream column as dissolved metals. Stream beds can also include tailings from previous episodes of mining that have heavy metals attached to surface sites. As above, these heavy metals can be mobilized by the introduction of new acid mine drainage into streams or by other anthropogenic increases in stream acidity. For this reason, mine tailings in stream beds are often referred to as another example of the "chemical time bomb."

43. The application clarifies that not only will the ore body and, thus, the tailings, be potentially acid forming (PAF), but also the overburden, the waste rock, and even the walls of the open pit. The various means for preventing acid mine drainage and metal leaching from PAF materials include mixing with limestone to neutralize the acidity, placement of liners underneath PAF materials, capping PAF materials with NAF (non-acid forming) materials, and the permanent submergence of PAF materials. Permanent water covers are not recommended by the mining industry, which is discussed in Point #6.

44. The application includes considerable doubts as to how much PAF material should be expected and is filled with multiple possibilities. According to OceanaGold (2025a), "The design of the WRS [Willows Rock Stack] incorporates clean water diversion drains to separate the balance of the catchment water from the WRS contact water … Limestone will be used to neutralise any PAF materials … This will involve backfilling the pit with 5 Mt of suitable rock material and the reworking and capping of PAF pit walls if required … In the instance that any PAF material is to be placed within the Western Borrow Area, a low permeability liner will be established within the area … Initially the working areas of the NRS [Northern Rock Stack] will consist of converting the existing NAF Northern Stockpile into a potentially acid forming PAF stockpile … During construction, any PAF working surfaces will be regularly tested and limed as

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required, and extensive geochemistry and water quality monitoring will continue to be undertaken. The cover design for the NRS will be consistent with the existing TSF embankments, including progressive and final rehabilitation of outer surfaces with layers which limit oxygen and water ingress … The proposed embankment and impoundment design for TSF3 … takes into consideration: … • The need to encapsulate PAF rock with low permeability NAF rock to minimise the potential for sulphide oxidation and the generation of acid leachate, and to collect and contain any leachate that forms for pumping to treatment; • The need to add crushed limestones to any PAF material within the TSF3 embankment to delay acid generation during construction until the capping layers are in place … The TSF3 embankment will be constructed with low permeability liners and capping to limit oxygen and water ingress to any PAF materials used in the embankment construction. Limestones may also be placed in the embankment to minimise any acid generation potential during constriction … The key works associated with mining the GOP will include: … • Rehabilitation of the GOP TSF, including its capping with NAF rock … The Closure Plan for TSF3 includes: • A partial dry capping of the perimeter of the impoundment as has been done at TSF2; • A wet capping of the tailings in the centre of the impoundment not covered by the dry capping." The lack of knowledge as to how much PAF material will exist and the existence of sufficient NAF material to cap the PAF material will be discussed in Point #8.

45. Although mixing with limestone, placement of liners, and capping of PAF material with NAF material are typical tools for prevention of acid mine drainage, it is crucial to recognize that there has never existed a sulfide-ore mine that has not caused environmental contamination. In response to the concerns regarding acid mine drainage and metal leaching, in 1997 the Wisconsin (USA) legislature enacted Statute 239.50 entitled "Moratorium on Issuance of Permits for Mining of Sulfide Ore Bodies" (National Wildlife Federation, 2012). The statute defined "a sulfide ore body" as "a mineral deposit in which nonferrous metals are mixed with sulfide minerals" (Wisconsin Statutes Archive, 2023). The statute then stated, "Beginning on May 7,

1998, the department [Department of Natural Resources] may not issue a permit under s. 293.49 for the purpose of the mining of a sulfide ore body until all of the following conditions are satisfied: (a) The department determines, based on information provided by an applicant for a permit under s. 293.49 and verified by the department, that a mining operation has operated in a sulfide ore body which, together with the host nonferrous rock, has a net acid generating potential in the United States or Canada for at least 10 years without the pollution of groundwater or surface water from acid drainage at the tailings site or at the mine site or from the release of heavy metals. (b) The department determines, based on information provided by an applicant for a permit under s. 293.49 and verified by the department, that a mining operation that operated in a sulfide ore body which, together with the host nonferrous rock, has a net acid generating potential in the United States or Canada has been closed for at least 10 years without the pollution of groundwater or surface water from acid drainage at the tailings site or at the mine site or from the release of heavy metals" (Wisconsin Statutes Archive, 2023).

46. In other words, the Wisconsin statute implicitly recognized the theoretical possibility of sulfide ore mines that had either operated or been closed without environmental contamination, but also implicitly insisted that Wisconsin should not be the testing ground. Another implicit implication was that any successful proposal for a sulfide ore mine in Wisconsin should demonstrate how it would incorporate the lessons from any previous sulfide ore mines that had been free from environmental pollution, as well as the myriad of sulfide ore mines that had resulted in environmental pollution.

47. Over the next two decades, despite the generally-recognized inevitability of environmental contamination by sulfide ore mining, eight candidates were formally or informally put forward as model sulfide ore mines that met the requirements of the Wisconsin statute (see Table 1). Each of the eight candidates were rebuffed because, in fact, they each had extensive records of environmental contamination. As a consequence, no sulfide ore mines were approved in

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Wisconsin during the tenure of the statute (National Wildlife Federation, 2012). The impasse was broken in favor of the mining industry when the statute was repealed in 2017 with effect in 2018 (Frye, 2018).

48. Each year since 2021 a bill for a similar statute has been introduced into the Minnesota legislature entitled 93.2501 “Moratorium on Issuing Permits for Nonferrous Sulfide Ore” and popularly known as the “Prove It First Bill.” The bill defines “nonferrous sulfide ore” as “any ore, other than iron ore, consisting of sufficient sulfide minerals to generate acid mine drainage” (Minnesota Legislature, 2021). According to the bill, “The commissioner [of Natural Resources] may not issue a permit required to mine nonferrous sulfide ore unless the commissioner and the commissioner of the Minnesota Pollution Control Agency both determine, based on published, peer-reviewed scientific information and public records, that a mine for nonferrous sulfide ore has operated commercially for at least ten years and has been closed for at least ten years without resulting in a release of a hazardous substance, hazardous waste, or pollutant or contaminant as defined under section 115B.02. The mine must have operated in the United States in a similar environment to the mine for which the permit is sought and must have used reclamation techniques substantially similar to those proposed in the permit application. The applicant for a permit required to mine nonferrous sulfide ore bears the burden of demonstrating each of the conditions necessary for a determination under this paragraph that a permit may be issued” (Minnesota Legislature, 2021). “Similar environment” is defined as “a location with similar abiotic ecological features, such as average annual precipitation and average monthly temperature, and in which the proximity of surface water and groundwater to mining operations is similar to the proximity of surface water or groundwater to the Minnesota site or sites for which the permit is sought” (Minnesota Legislature, 2021). The Prove It First bill refers to “nonferrous sulfide ore” presumably because it is unheard of to exploit sulfide ores for iron due to the possibility of acid mine drainage, a variety of processing challenges, and the remaining abundance of iron oxide ore bodies in the world.

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49. Since the opening of the public discussion over the Minnesota Prove it First Bill, again despite the generally-recognized inevitability of environmental contamination by sulfide ore mining, ten candidates have been informally put forward as model sulfide ore mines that would meet the requirements of the Minnesota bill. The proposals for model mines have been informal, such as in communications from elected officials or blogs or letters to the editor, since there is not yet any formal process. The irony is that, out of the ten candidates that have been put forward as model sulfide ore mines that would meet the requirements of the Minnesota Prove It First Bill, eight are the exact same candidates that were put forward and rebuffed during the tenure of the Wisconsin statute, the only new candidates being the Musselwhite gold mine in Ontario and the Rainy River gold-silver mine in Ontario (see Table 1). The fact that only two new potential candidates for model mines have emerged over the past 25 years is the best evidence of all that there has never been a sulfide ore mine that did not result in environmental contamination. The evidence for actual environmental contamination by each of the ten candidates for sulfide ore mines without environmental contamination was compiled in an earlier report by the author (Emerman, 2023).

50. It is now appropriate to return to the ten candidates for sulfide ore mines that have operated or been closed without environmental contamination (see Table 1). Note that the evidence that all of these candidate mines actually do have extensive records of environmental contamination has been compiled by Emerman (2023). Out of the ten candidate mines, two are in arid regions (annual precipitation less than 250 mm), while three more are in semi-arid regions (annual precipitation between 250 and 500 mm) (see Table 1). The candidate mine in the wettest climate is the Flambeau mine in Wisconsin with a mean annual precipitation of 860.3 mm (see Table 1).

52. By contrast, according to OceanaGold (2025c), "The average annual rainfall adopted for this assessment is 2,110 mm/year." If a sulfide ore mine were to be operated and then eventually

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closed at the site of the proposed Waihi North project, it would be the first example of a sulfide ore mine that had operated or been closed without environmental contamination. Based on the preceding discussion and the high rainfall at the site of the Waihi North Project, it seems highly unlikely that the Waihi North Project could be the first example of a sulfide ore mine without environmental contamination. Certainly there is no discussion in documents from OceanaGold as to what technology or site characteristics would separate the Waihi North Project from every other sulfide ore mine.

53. In summary, OceanaGold is invited to submit an example of a sulfide-ore mine in a climate similar to that of the Waihi North Project that has been operated and closed without environmental contamination. In the absence of such an example, it should be expected that the release of acid mine drainage and the contamination of groundwater and downstream waterways should be an expected outcome of the Waihi North Project.

54.

6) ***The proposal for a permanent water cover on TSF3 is not recommended by the mining industry because of its detrimental impact on the physical stability of the tailings dam.***

55. According to OceanaGold (2025c), “The Closure Plan for TSF3 includes: • A partial dry capping of the perimeter of the impoundment as has been done at TSF2; • A wet capping of the tailings in the centre of the impoundment not covered by the dry capping” (see Fig. 2). A permanent water cover is not recommended by the mining industry due to its detrimental impact on dam stability and, thus, should be regarded as a desperate act to somehow prevent the oxidation of sulfidic tailings that will be permanently exposed on the surface.

56. The panel that investigated the failure of the Mount Polley tailings storage facility in British Columbia (Canada) in 2014 concluded that “The goal of BAT [Best Available Technology] for

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tailings management is to assure physical stability of the tailings deposit. This is achieved by preventing release of impoundment contents, independent of the integrity of any containment structures. In accomplishing this objective, BAT has three components that derive from first principles of soil mechanics: 1. Eliminate surface water from the impoundment … In short, the most serious chemical stability problem concerns tailings that contain sulfide minerals, particularly in metal and coal mining. In the presence of oxygen, these sulfides react to produce acid that then mobilizes a variety of metals in solution. There are a number of ways to arrest this reaction, and one is to saturate the tailings so that water replaces oxygen in the void spaces. This saturation is most conveniently achieved by maintaining water over the surface of the tailings. Hence, so-called water covers have sometimes been adopted for reactive tailings during operation and for closure. It can be quickly recognized that water covers run counter to the BAT principles … But the Mount Polley failure shows why physical stability must remain foremost and cannot be compromised. Although the tailings released at Mount Polley were not highly reactive, it is sobering to contemplate the chemical effects had they been. No method for achieving chemical stability can succeed without first ensuring physical stability: chemical stability requires above all else that the tailings stay in one place" (Independent Expert Engineering Investigation and Review Panel, 2015a). The subsequent revisions to the mining legislation in British Columbia concurred in writing, "Physical stability is of paramount importance, and options that require a compromise to physical stability should be discarded" (Ministry of Energy and Mines, 2016).

57. Plans to maintain permanent water covers over reactive mine waste after mine closure in order to prevent the reaction of sulfide minerals with oxygen in perpetuity should be regarded as especially problematic. Independent Expert Engineering Investigation and Review Panel (2015b) defined an "active tailings dam" as "a tailings dam whose impoundment contains surface water," even for tailings storage facilities that are no longer receiving tailings. Independent Expert Engineering Investigation and Review Panel (2015a) continued, "BAT principles should be

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applied to closure of active impoundments so that they are progressively removed from the inventory by attrition. Where applicable, alternatives to water covers should be aggressively pursued." The SME Tailings Management Handbook further concurred in writing, "Where tailings subaqueous disposal is employed behind constructed dams, the dam safety liability associated with maintaining the tailings in a flooded condition also remains … A dam that retains a large water pond is inherently less safe than an embankment that does not. There are no case records of impoundments designed for perpetual submergence behind constructed dams that have been perpetually submerged. So, there is no demonstrated precedent for the legacy of permanent submergence being constructed today. We have only just started the clock" (Andrews et al., 2022).

58. Besides the detrimental impact on dam stability, the application provides no information regarding how the permanent water cover will be maintained. Presumably, the permanent water cover will result from the balance among precipitation, surface runoff, infiltration, and evapotranspiration. However, considering all of the ways in which the climate could change in the indefinite future, it is difficult to imagine how the proper balance could be maintained in perpetuity simply as a result of natural processes without any human intervention. The application certainly does not include any plan for perpetual maintenance of the water cover. On that basis, it could be assumed that, eventually, the water cover will dry up and the exposed sulfidic tailings will be converted into sulfuric acid.

59.

7) ***Based upon mining industry guidance, it should be assumed that the eventual collapse of the tailings dam at the proposed Waihi North Project with the release of the confined tailings into downstream waterway is inevitable.***

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60. At the end of its useful life, or when it is no longer possible to inspect and maintain a water-retention dam, the dam is completely dismantled. A water-retention dam cannot simply be abandoned or it will eventually fail at an unpredictable time with consequences that are difficult to predict. However, the permanent storage of tailings, which has already been mentioned several times, cannot be overemphasized. A tailings dam can never be dismantled unless the tailings can be moved to another location, such as an exhausted open pit. Typically, a tailings dam is expected to confine the often toxic tailings in perpetuity, although normally the inspection, monitoring, maintenance, and review of the dam cease at some point after the end of the mining project.

61. The overall problem with the closure plan for the tailings storage facility at the Waihi North Project is that there is no plan for long-term monitoring, inspection, maintenance and review of the facility. The need for perpetual care of tailings storage facilities is, in fact, the official view of the mining industry. According to the SME (Society for Mining, Metallurgy and Exploration) Tailings Management Handbook, "The mining industry has a significant challenge in that these TSFs [Tailings Storage Facilities] will last for perpetuity. Unfortunately, humans have no experience in designing facilities to last forever, so responsible tailings management is required for as long as the TSF exists" (Morrison and Lammers, 2022). In the absence of a plan for perpetual monitoring, inspection, maintenance and review of the tailings storage facility, the eventual collapse of the facility should be assumed.

62. The need for perpetual maintenance of a tailings dam, as well as the realism of such a prospect, was discussed in the guidance document Safety First: Guidelines for Responsible Mine Tailings Management. According to Morrill et al. (2022), "It is imperative that the reclamation and closure of tailings facilities be a factor in their initial design and siting … A tailings facility is safely closed when deposition of tailings has ceased and all closure activities have been completed so that the facility requires only routine monitoring, inspection and maintenance in

perpetuity or until there are no credible failure modes … Currently, there is no technology to ensure that an active tailings facility can be closed in such a way so as to withstand the PMF [Probable Maximum Flood] or MCE [Maximum Credible Earthquake] indefinitely without perpetual monitoring, inspection, and maintenance ... Given that operating companies will not exist long enough to accomplish perpetual monitoring, inspection, maintenance, and review, the operating company's ability to eventually eliminate all credible failure modes must be a key consideration during the permitting process. If a regulatory agency does not believe an operating company can carry out perpetual care and financial responsibility, or eliminate all credible failure modes, they must not approve the facility."

63. The world expert on tailings dams is Professor Steven Vick, who is the author of the textbook Planning, Design and Analysis of Tailings Dams (Vick, 1990). The view of Prof. Vick is that the eventual collapse of a tailings dam is inevitable, regardless of any plan for perpetual maintenance, simply due to the multitude of things that could go wrong given enough time. In a conference presentation, Vick (2014a) concluded that "System failure probabilities much less than 50/50 are unlikely to be achievable over performance periods greater than 100 years … system failure probability approaches 1.0 after several hundred years." Vick (2014a) continued, "For closure, system failure is inevitable … so closure risk depends solely on failure consequences." In the accompanying conference paper, Vick (2014b) elaborated, "Regardless of the return period selected for design events, the cumulative failure probability will approach 1.0 for typical numbers of failure modes and durations. This has major implications. For closure conditions, the likelihood component of risk becomes unimportant and only the consequence component matters … This counterintuitive result for closure differs so markedly from operating conditions that it bears repeating. In general, reducing failure likelihood during closure—through more stringent design criteria or otherwise—does not materially reduce risk, simply because there are too many opportunities for too many things to go wrong. In a statistical sense, all it can do is to push failure farther out in time. System failure must be accepted as inevitable, leaving

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reduction of failure consequences as the only effective strategy for risk reduction during closure."

64. In summary, the critical decision that is facing the government and people of New Zealand is whether the eventual collapse of the tailings dams at the Waihi North Project would be an acceptable outcome. This decision should involve taking into consideration the acid-generating potential of the tailings, as well as the presumed high concentrations of arsenic, antimony, and mercury in the tailings pond and the tailings pore water, which was discussed in Point #4.

65.

8) ***The lack of any mining plan means that it is impossible to meaningfully assess the environmental impact of the proposed Waihi North Project at the present time.***

66. There is no mining plan for the Waihi North Project because OceanaGold still does not know whether there is anything worth mining. This extraordinary finding results from the fact that, in their latest report to investors, OceanaGold (2024) did not report any measurable resources for any of their mining areas (see Fig. 1a), no proven reserves for any of their mining areas (see Fig. 1b), and not even any probable reserves for either the MOP (Martha Open Pit) or the GOP (Gladstone Open Pit) (see Fig. 1b). Mining plans are developed based upon the sum of probable reserves plus proven reserves. OceanaGold (2024) confirms, "Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability" (see Fig. 1a). It has been my experience that all environmental impact studies and other similar documents are based upon the assumption that the project proponent will mine the sum of probable reserves plus proven reserves and will produce the corresponding quantities of tailings and waste rock.

67. I will clarify the above finding with more explanation on the distinction between mineral resources and mineral reserves. In general terms, mineral resources refer to the size of an ore body containing a commodity of value (typically, above some specified cut-off grade), while mineral reserves refer to the quantity of ore that can be economically mined given current technology. Since OceanaGold trades on the Toronto Stock Exchange and because the Pre-Feasibility Study (OceanaGold, 2024) follows the requirements for an NI 43-101 Technical Report, the precise definitions of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) will be reviewed here. According to CIM (2014), "A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction." Since there must be "reasonable prospects for eventual economic extraction," the conversion of an ore body into a commodity cannot be only a theoretical possibility. In other words, the estimation of resources must be based upon a particular cut-off grade with an assumed commodity price, along with many other factors. The conversion of resources into reserves is based upon "Modifying Factors," which may include "mining, processing, metallurgical, infrastructure, economic, marketing, legal, environmental, social and governmental factors" (CIM, 2014).

68. Mineral resources are then subdivided into inferred resources, indicated resources and measured resources, according to the level of confidence in the existence of the resources, with the greatest confidence placed in measured resources, and the least confidence in inferred resources. CIM (2014) explains, "An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling." On the other hand, "An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of

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the deposit" (CIM, 2014). The difference between indicated resources and measured resources is that measured resources can be used to support "**detailed** mine planning and **final** evaluation of the economic viability of the deposit" (emphasis added; CIM, 2014).

69. By contrast, "a Mineral Reserve is the economically mineable part of a measured and/or Indicated Mineral Resource" (CIM, 2014). Note that an inferred mineral resource cannot be regarded as a mineral reserve, or economically mineable. By analogy with mineral resources, mineral reserves are subdivided into probable reserves and proven reserves. According to CIM (2014), "A Probable Mineral Reserve is the economically mineable part of an indicated, and in some circumstances, a Measured Mineral Resource. The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve ... A Proven Mineral Reserve is the economically mineable part of a Measured Mineral Resource. A Proven Mineral Reserve implies a high degree of confidence in the Modifying Factors." Clearly, the specified cut-off grade and the anticipated commodity price are important factors in determining which portion of an indicated or measured resource is an economically mineable reserve and whether a reserve is probable or proven.

70. The absence of any mineral reserves and, thus, the absence of any mining plan means that the most basic information is missing. Some categories of missing information include the following:

1. the duration of the mining project
2. the quantity and schedule of ore extraction
3. the quantity and schedule of tailings production
4. the quantity and schedule of production of PAF waste rock
5. the quantity and schedule of production of NAF waste rock

71. As a consequence of the lack of a mining plan, it is impossible to evaluate the environmental impact of a mining project that is essentially only in the conceptual stage. For example, although

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there are numerous commitments to cover or encapsulate all PAF waste rock with NAF waste rock, it is not known whether there will be enough NAF waste rock to accomplish this task. As another example, the application calls for the use of NAF waste rock that has a low mercury content for construction of the tailings dam. According to OceanaGold (2025c), "AECOM has recommended that high mercury NAF is not used in NAF zones which perform a liner function or are exposed to the surface." OceanaGold (2025g) also states, "PAF mine overburden material and high mercury (>3.5 mg/kg) is not permitted for use in Zones A, G, H and I," in which Zone A is the "low permeability zone (earth liner) that restricts seepage from mine overburden material into underlying ground," Zone G is the "outer sealing layer of the embankment that restricts entry of oxygen and water," Zone H is the "plant growth layer," and Zone I is "structural fill forming downstream section of the Perimeter road where it is in fill." It is impossible to evaluate the above claims when there is no information as to how much low-mercury NAF waste rock will be available or whether there will be any low-mercury NAF waste rock.

72. In summary, the current application for the Waihi North Project is premature and should be paused until OceanaGold has established the existence of mineral reserves and developed a mining plan (sometimes called the general plan of operations).

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Table 1. Candidates for model sulfide ore mines with comparison to precipitation at the site of the Waihi North Project[1]

Mine	Location	Principal Commodities	Opening – Closure	Mean Annual Precipitation (mm)
Bagdad	Arizona (USA)	Copper	1928-2101	424.4
Cactus	Arizona (USA)	Copper, silver, gold	1972-1984	235.5
Cullaton Lake	Nunavut (Canada)	Gold	1976-1985	244.0
Eagle	Michigan (USA)	Nickel, copper	2014-2026	739.9
Flambeau	Wisconsin (USA)	Copper, gold, silver	1993-1997	860.3
McLaughlin	California (USA)	Gold	1985-2002	798.1
Musselwhite	Ontario (Canada)	Gold	1997-2029	717.4
Raglan	Quebec (Canada)	Nickel	1997-2027	401.0
Rainy River	Ontario (Canada)	Gold, silver	2017-2032	709.5
Stillwater	Montana (USA)	Palladium, platinum	1986-2055	458.5
		Site of Waihi North Project[2]		2110.0

[1]Table adapted from Emerman (2023)

[2]OceanaGold (2025c)

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Table 1-1: Summary of Mineral Resources Estimate as of June 30, 2024

Area	Indicated					Inferred				
	Tonnes (Mt)	Grade (g/t Au)	Grade (g/t Ag)	Au (Moz)	Ag (Moz)	Tonnes (Mt)	Grade (g/t Au)	Grade (g/t Ag)	Au (Moz)	Ag (Moz)
MOP	6.50	1.95	13.4	0.41	2.81	2.3	2.1	12.1	0.2	0.9
GOP	3.22	1.44	3.76	0.15	0.39	0.8	1.0	2.6	0.03	0.1
MUG	6.42	5.29	25.5	1.09	5.27	2.7	4.7	27.1	0.4	2.4
WUG	2.39	17.9	28.0	1.37	2.15	1.3	9.6	17.1	0.4	0.7
Total Mineral Resources	18.5	5.07	17.8	3.02	10.6	7.1	4.3	17.6	1.0	4.0

Notes:

- Mineral Resources are reported inclusive of Mineral Reserves. Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
- Mineral Resources estimate was reviewed and approved by, or is based on information prepared by or under the supervision of, Leroy Crawford-Flett, BSc Geology, MAusIMM CP (Geology), the Company's Exploration and Geology Manager and a qualified person under NI 43-101.
- Mineral Resources are reported at a gold price of $1,950/oz.
- Mineral Resources estimate for MUG is reported below the MOP design and constrained to within a conceptual underground design based upon the incremental cut-off grade of 2.15 g/t Au.
- Mineral Resources estimate for Wharekirauponga WUG is reported within a conceptual underground design at a 2.10 g/t Au cut-off grade.
- Mineral Resources estimates for MOP and GOP are reported within conceptual pit designs and incremental cut-off grades of 0.50 g/t and 0.56 g/t, respectively. The MOP conceptual pit design is limited by infrastructural considerations.
- Tonnage and grade measurements are in metric units. Gold ounces are reported as troy ounces and "g/t" represents grams per tonne.
- No dilution is included in the reported figures and no allowances for processing or mining recoveries have been made.
- All figures have been rounded; totals may therefore not sum exactly.
- OceanaGold is not aware of any environmental, permitting, legal, socio-economic, marketing, political, or other factors that might materially affect the Mineral Resource estimates. The QPs acknowledge that the consenting timeline is a risk, however, are satisfied with the Company's risk mitigation plans.
- MUG and WUG Resources are reported within conceptual stopes, only for material above the nominated cut-off grade. This constrains the tonnes and grade reporting to the mineralized or vein interpretation as shown in Figure 1-3.

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Figure 1a. OceanaGold reported to its investors that it has zero measurable resources at any of its mining areas. Even so, the table clarifies that "Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability" (see table of mineral reserves in Fig. 1b). Table from OceanaGold (2024).

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Table 1-2: MUG and WUG Combined Mineral Reserves Estimate as of June 30, 2024

Reserve Area	Class	Tonnes (Mt)	Au (g/t)	Ag (g/t)	Au (Moz)	Ag (Moz)
MUG	Proven	-	-	-	-	-
	Probable	4.4	3.8	16.1	0.5	2.3
Total MUG		4.4	3.8	16.1	0.5	2.3
WUG	Proven	-	-	-	-	-
	Probable	4.1	9.2	16.1	1.2	2.1
Total WUG		4.1	9.2	16.1	1.2	2.1
Total Mineral Reserve		8.5	6.4	16.1	1.7	4.4

Note:

- The WUG Mineral Reserves estimate was reviewed and approved by, or is based on information prepared by or under the supervision of, Euan Leslie, MAusIMM (CP), the Company's Group Mining Engineer and a qualified person under NI 43-101.
- The MUG Mineral Reserves estimate was reviewed and approved by, or is based on information prepared by or under the supervision of, David Townsend, MAusIMM (CP), the Company's Mining Manager and a qualified person under NI 43-101.
- Mineral Reserves are reported based on OceanaGold's mine design, mine plan, mine schedule and cash flow model at a gold price of $1,750 /oz.
- Tonnages include allowances for losses resulting from mining methods. Tonnages are rounded to the nearest 100,000 tonnes.
- Ounces are estimates of metal contained in the Mineral Reserves and do not include allowances for processing losses. Ounces are rounded to the nearest hundred thousand ounces.
- All figures have been rounded; totals may therefore not sum exactly.
- Tonnage and grade measurements are in metric units. Gold ounces are reported as troy ounces and "g/t" represents grams per tonne.

Figure 1b. OceanaGold reported to its investors that it has zero mineral reserves at the MOG (Martha Open Pit) and Gop (Gladstone Open Pit) mining areas and only probable reserves at its other mining areas. Note the statement that "Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability" (see Fig. 1a). In other words, at the present time, OceanaGold is unable to tell its investors that there is anything worth mining at the MOP and GOP areas. Table from OceanaGold (2024).

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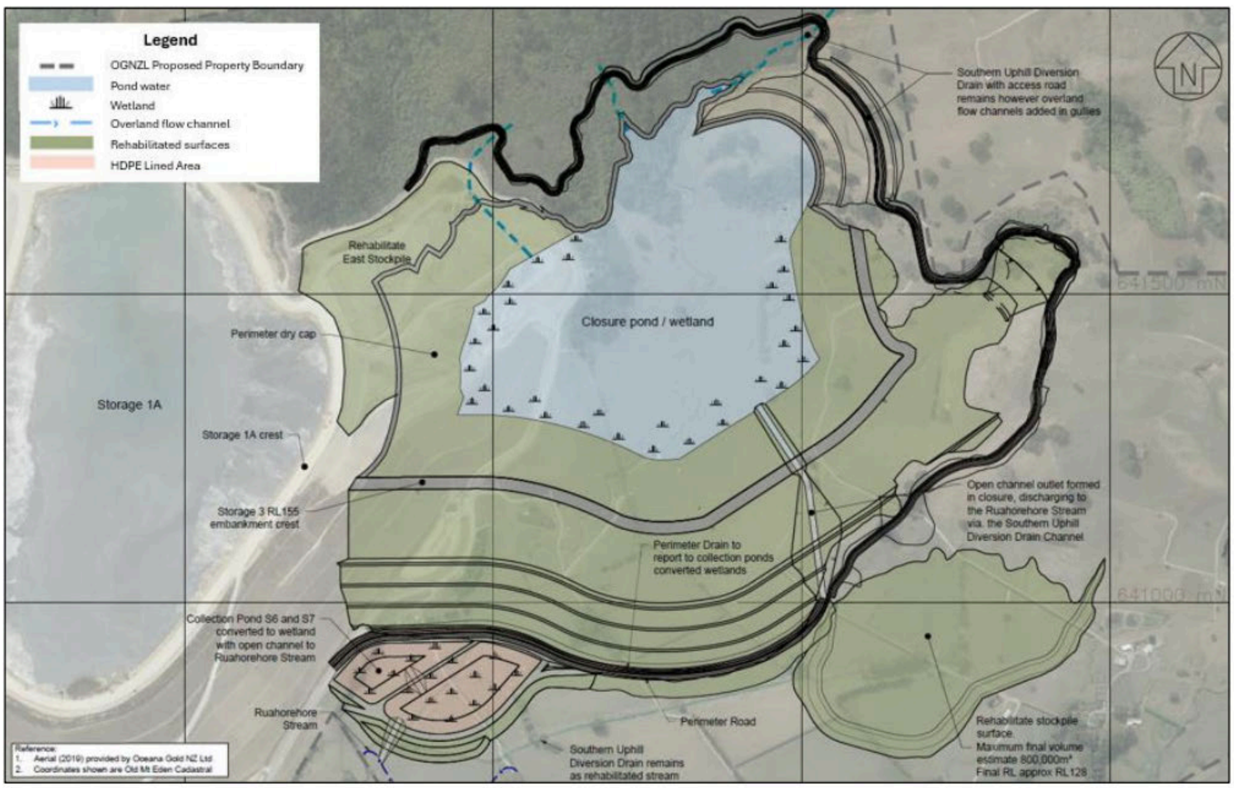

Figure 2-77: TSF3 RL 155 Closure Layout (EGL (2025c))

Figure 2. According to the application, TSF3 will have a permanent water cover after closure in order to prevent oxidation of the tailings and the generation of acid mine drainage. Permanent water covers are not recommended by the mining industry due to their detrimental impact on mine stability. Figure from OceanaGold (2025a).

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August 22, 2025

The Chair, The Fast Track Panel
Waihi North Project

To the Chair:

I have reviewed the four reports by Denis Tegg with the following titles:

1) "Critique: Environmental and Socio-Economic Impacts of a Tailings Dam Breach"
2) "Lessons from the Waitekauri (Golden Cross) Landslide for the Oceana Gold Waihi Tailings Storage Facility Fast Track Application"
3) "Re-evaluation of Hikurangi Subduction Zone Seismic Hazard to Waihi Tailings Storage Facilities"
4) "The Te Puninga and Kerepehi Faults - Seismic Design Safety of Waihi Goldmining Tailings Dams"

I am summarizing the respective conclusions of each report as follows:

1) The application for the Waihi North Project should consider all of the potential environmental and socioeconomic impacts of the failure of the tailings storage facility from the toe of the facility to the ocean.
2) The application for the Waihi North Project should fully incorporate the lessons learned from the Waitekauri (Golden Cross) landslide, including the importance of geotechnical site characterization and foundation stability, hydrological vulnerability and water management, seismic hazard and liquefaction susceptibility, the potential for a "perfect storm" scenario of compounding natural hazards, and long-term environmental and financial liabilities.
3) The application for the Waihi North Project should re-evaluate the Maximum Credible Earthquake based upon the potential for a mega-earthquake along the Hikurangi subduction zone.
4) The application for the Waihi North Project should re-consider the seismic design based upon new studies regarding the seismic potential of the Te Puninga and Kerepehi faults.

The quality of these reports shows that Mr. Tegg has a deep understanding of the issues addressed in his reports.

I am in full agreement with the conclusions reached by Mr. Tegg.

Steven H. Emerman

BEFORE THE FAST-TRACK APPROVALS PANEL

In the matter of the Fast-Track Approvals Act 2024

And

In the Matter of applications by Oceana Gold (New Zealand) Limited for various resource consents relating to the Waihi North Project (Wharekirauponga Underground Mine)

And

In the matter of the submission on the above applications

by Coromandel Watchdog of Hauraki Inc

Brief of evidence of Denis Charles Tegg

Dated: 23 August 2025

Evidence of Denis Charles Tegg:

1. Introduction

1.1 My full name is Denis Charles Tegg.

1.2 I hold a Bachelor of Arts degree and a Bachelor of Laws degree from Otago University.

1.3 I practiced law in Thames for 45 years between 1974 and 2019, with a satellite office in Whangamata for a decade.

1.4 I was the elected representative for Thames Coromandel on the Waikato Regional Council between 2019 and 2022

1.5 Throughout my legal career I have taken a keen interest in proposals for development within the conservation estate on the Coromandel Peninsula, including scores of applications for exploration and mining consents.

1.6 In the late 1990's I was the architect of a Private Members Bill introduced to Parliament by Judith Tizard, MP which sought limitations on mining within the conservation estate north of Te Aroha. The Bill was referred to a Select Committee after significant public and iwi support, but it did not pass in its original form.

1.7 Its influence led to amendments in the Crown Minerals Act 1991 in 1997, which added protections under Schedule 4, prohibiting above ground mining on conservation land and coastal areas north of the Kopu-Hikuai Road (State Highway 25).

1.8 These Schedule 4 provisions relating to the Coromandel Peninsula have remained intact in New Zealand law.

1.9 In 1996 I was instructing solicitor in *Coromandel Peninsula Watchdog Inc v Hauraki District Council & Coeur Gold New Zealand Ltd* — High Court (Hamilton Registry), Hammond J, M301/96, 19 December 1996 This was a judicial review challenging the Council's decision under the Building Act 1991 to grant building consents for remedial works to the Golden Cross/Waitekauri tailings dam following stability concerns and a major landslip under the dam. The Watchdog group argued the Council misapplied the Building Act and failed to properly consider safety risks. The High Court reviewed whether the Council acted lawfully in issuing consents for buttressing and dam strengthening, balancing environmental and seismic safety issues with statutory compliance.

1.10 I have read the conditions for resource consents proposed by Thames Coromandel District Council, Hauraki District Council and Waikato Regional Council

1.11 I do not present myself as an expert in the seismic safety of tailings dams.

1.12 However, I have developed skills in reviewing and analysing technical documents, and in identifying inconsistencies or gaps between the conclusions or assumptions of witnesses and the findings available in peer-reviewed literature.

1.13 It is within this context that I present the following evidence for the Panel's consideration.

1.14 I have also generally reviewed the first iteration of consent conditions. I have not reviewed, but seek an opportunity to review, the latest iteration of consent conditions, and related documents. Unfortunately these arrived too late in preparation of my evidence.

2. Scope of Evidence

2.1 My evidence is presented in 4 Sections:

A. Re-evaluation of Te Puninga and Kerepehi Faults Seismic Risk to Waihi Tailings Storage Facilities

B. Re-evaluation of Hikurangi Subduction Zone Seismic Risk to Waihi Tailings Storage Facilities

C. Lessons from Waitekauri Tailings Dam Landslide 1996

D. Environmental and Socio-Economic Impacts Downstream of Paeroa of a Tailings Dam Breach

3. Section A

Re-Evaluation of Te Puninga and Kerepehi Faults - Seismic Risk to Waihi Tailings Storage Facilities

3.1 Executive Summary

3.1.1 This section provides an evaluation of Oceana Gold (OG) documents concerning seismic and liquefaction risk for the proposed Waihi goldmining tailings dam expansion. OG's assessment fundamentally relies on seismic hazard data (GNS 2017) that has been significantly superseded by more recent, un-cited research. The studies by Villamor et al. (2024) and Dempsey et al. (2020) introduce critical updates regarding the Te Puninga Fault's independence and increased magnitude, the potential underestimation of the Kerepehi Fault's slip rate, the credible risk of larger multi-fault ruptures (up to Mw 7.45), and pronounced basin amplification effects within the Hauraki Rift.

3.1.2 These new insights collectively suggest higher ground motions and an increased liquefaction potential for both the tailings and surrounding infrastructure than implicitly or explicitly considered by OG. Consequently, OG's conclusions regarding the robustness of risk assessment, the "highly unlikely" probability of dam breach, and the dismissal of distant Hikurangi mega-quakes as non-credible risks require rigorous re-evaluation (See Section B). This section recommends the mandatory incorporation of these recent studies, a comprehensive re-assessment of ground motion parameters and of InSAR satellite data on land movement, and a detailed re-evaluation of liquefaction potential under updated seismic loading conditions to ensure the highest standards of seismic design safety are met.

3.2 Introduction

3.2.1 This section presents a critique of Oceana Gold (New Zealand) Limited's (OGNZL) consent documents concerning the seismic design safety of their large-scale goldmining tailings dams near Waihi, New Zealand. The evaluation specifically targets the assessment of earthquake and liquefaction risks within sections 3.2, 3.3, 4.2.6, 5.0, and 7.1.2 of the submitted documentation. A central tenet of this review involves the integration and rigorous evaluation of OGNZL's claims against recent, pertinent research from Dempsey et al. (2020) and Villamor et al. (2024). These pivotal studies do not appear to have been cited in OGNZL's documents and postdate the technical assessments referenced therein.

3.3 Review of Seismic Hazard Assessment (Oceana Gold Sections 3.2 & 3.3)

3.3.1 Oceana Gold's documents [1] articulate the seismic hazard for the Waihi site, primarily drawing upon a GNS Science assessment from 2017. This assessment identifies the Kerepehi Fault System, situated 21 km from the site, as the Controlling Maximum Earthquake (CME). The largest rupture scenario for this system is described as a Mw 7.3 event, spanning approximately 81 km with an estimated 3.6 meters of normal (dip-slip) fault displacement, occurring with a recurrence interval of about 10,000 years.[1] The Hikurangi Subduction Zone, located over 200 km distant from

Waihi, is acknowledged as capable of generating Mw 9 earthquakes. However, its ground motions are considered to be attenuated over this distance and are therefore dismissed as not a significant risk to the TSFs.[1] OGNZL also notes that the 2022 National Seismic Hazard Model (NSHM) indicates higher numbers than the 2017 study but asserts that these changes "do not make a material difference" to the assessed performance of the Tailings Storage Facilities (TSFs).[1]

3.4 Critique based on Villamor et al. (2024) Findings

3.4.1 Villamor et al. (2024) provides a critical and more recent update to the understanding of seismic sources in the Waihi region, particularly concerning the Te Puninga Fault.

3.4.2 The study definitively establishes the Te Puninga Fault (TPF) as an independent seismic source, a significant reclassification from its previous consideration as merely a segment of the nearby Kerepehi Fault (KF).[1] This re-evaluation is based on new, detailed mapping and field data. The research further provides a new net slip rate for the TPF of 0.25 mm/yr, a value slightly higher than previously assumed.[1] The estimated characteristic earthquake magnitude for the TPF is Mw 6.9 ± 0.35 [1], with a derived recurrence interval for TPF ruptures ranging from 3000 to 11,500 years.[1] New Peak Ground Acceleration (PGA) and Modified Mercalli Intensity (MMI) estimates for the TPF are also presented, indicating values slightly larger than prior studies.[1] For a Mw 6.9 event, specific towns in the region are projected to experience significant shaking: Morrinsville MMI 9.7 ± 1.02, Te Aroha MMI 8.9 ± 1.04, Hamilton MMI 7.9 ± 1.03, and Tauranga MMI 6.6 ± 1.04.[1]

3.4.3 The recognition of the Te Puninga Fault as an independent, active source with a substantial magnitude (Mw 6.9) and a higher slip rate than previously thought implies that the cumulative seismic hazard from proximal faults to Waihi (Kerepehi and Te Puninga) is potentially greater than what was assessed in the 2017 GNS study. The 2017 assessment might have treated the TPF as part of the KF, thereby potentially underestimating its individual contribution or its complex interaction with the Kerepehi Fault. This suggests that the seismic input parameters currently utilized for the dam design may be non-conservative. The proximity of both the Kerepehi Fault (21 km) and the newly characterised Te Puninga Fault means that the Waihi TSFs are exposed to potentially higher and more intricate ground motions than are currently accounted for in the consent documents.

3.4.4 Furthermore, Villamor et al. (2024) states that "Comparisons of geomorphic expression between the two faults suggest that the slip rate currently assigned to the Kerepehi Fault could be underestimated".[1] If the Kerepehi Fault's slip rate is indeed underestimated, it directly implies a higher frequency of large earthquakes or potentially larger magnitudes than are currently modeled by OGNZL. This directly impacts the probabilistic seismic hazard analysis (PSHA) for the Waihi site, potentially increasing the ground motion values for various return periods and calling into question the robustness of OGNZL's conclusions about seismic risk, as a fundamental input parameter for the controlling fault is potentially non-conservative.

3.4.5 Villamor et al. (2024) also explicitly discusses the potential for multi-fault ruptures, a scenario where the Te Puninga Fault could co-rupture with other regional faults such as the Kerepehi, Mangatangi, Aka Aka, and Pokeno faults. Such events are estimated to generate earthquakes of Mw 7.25–7.45, with recurrence intervals ranging from 5656 to 10398 years.[1] While OGNZL's 2017 GNS study mentions a Mw 7.3 for a full Kerepehi rupture [1], the explicit identification and detailed discussion of a broader multi-fault system with potentially larger magnitudes (Mw 7.25-7.45) in Villamor et al. (2024) represents a more severe scenario. The 2016 Kaikoura earthquake (Mw 7.8) serves as a recent, compelling example of complex, multi-fault ruptures [1], underscoring the critical importance of considering such scenarios in seismic design. OGNZL's assertion that NSHM 2022 updates "do not make a material difference" [1] must be rigorously re-examined in light of these specific multi-fault rupture magnitudes and their associated recurrence intervals. The design basis earthquake (Safety Evaluation Earthquake, SEE) for the Waihi TSFs should explicitly account for these larger, more complex multi-fault rupture scenarios, which could generate ground motions exceeding those derived from a single-fault Mw 7.3 Kerepehi event.

3.5 Critique based on Dempsey et al. (2020) Findings

3.5.1 Dempsey et al. (2020) provides physics-based ground motion simulations that highlight crucial regional effects not typically captured by conventional empirical models.

3.5.2 The study demonstrates that the Hauraki Rift and Hamilton/Waikato basins significantly amplify long-period (>1s) shaking by a factor of two to three.[1] This amplification is observed at various locations; for instance, Hamilton experiences two to three times higher pseudo-spectral acceleration (pSA) at 2 seconds than Huntly [1], and Ngātea shows pSA at 2 seconds averaging 0.5g compared to 0.25g at Matamata.[1] For Waihi specifically, a Mw 7.3 Kerepehi Fault rupture with a southern hypocentre is simulated to result in MMI 6.9 [6.3, 7.6], PGA 0.22g [0.15, 0.31g], and PGV 19.1 cm/s [12.3, 29.7 cm/s].[1]

3.5.3 OGNZL's seismic hazard assessment [1] provides PGA values (e.g., 0.23g for Mw 7.3 CME) for rock conditions and generally mentions amplification through soil profiles and embankments. However, it does not explicitly detail the potential for significant basin amplification of long-period ground motions as identified by Dempsey et al. (2020). The Waihi site is situated within the broader Hauraki Rift region, which is characterised by deep sedimentary basins. Long-period shaking is particularly damaging to large, flexible structures such as tailings dams. If the TSFs are founded on or adjacent to such basin structures, the actual ground motions experienced could be significantly higher, especially at longer periods, than implied by a simple PGA value or standard site amplification factors. Therefore, the seismic design of the TSFs needs to explicitly consider the amplified long-period ground motions due to basin effects, which may not be adequately captured by the 2017 GNS study or standard NSHM models if they do not fully resolve these shallow basin structures.

3.5.4 OGNZL's documents state that the Hikurangi Subduction Zone (Mw 9, >200 km distant) is attenuated and "not a credible risk".[1] (see Section B on the Hikurangi Subduction Zone) However, Dempsey et al. (2020) discusses the use of Mw 9.0 Cascadia megathrust earthquake simulations as input for modeling the structural response of buildings in Seattle.[1] While Dempsey's study does not directly model Hikurangi for Waihi, this discussion highlights that distant mega-quakes are considered relevant for structural analysis, especially concerning their long-period shaking content. While ground motions from a distant Mw 9 Hikurangi event would indeed be attenuated in amplitude, their long-period content could still be significant, particularly if amplified by the Hauraki Rift basin. Large-scale structures like tailings dams are inherently sensitive to long-period shaking. Dismissing this risk as "not credible" without a detailed assessment of long-period spectral accelerations and their potential amplification by local basin effects, even from distant sources, is not aligned with best practice for critical infrastructure. The argument of simple "attenuation" may be overly simplistic, neglecting the unique characteristics of mega-quakes and basin responses. A comprehensive assessment should therefore include scenario-based ground motion simulations for a Hikurangi megathrust event, specifically evaluating long-period shaking and potential basin amplification at the Waihi site.

3.6 Assessment of Robustness of Oceana Gold's Conclusions

3.6.1 Given the compelling findings from Villamor et al. (2024) and Dempsey et al. (2020), Oceana Gold's seismic hazard conclusions, which are based on a 2017 GNS study, do not appear fully robust. The emergence of the Te Puninga Fault as an independent, significant seismic source, the potential underestimation of the Kerepehi Fault's slip rate, and the explicit identification of larger multi-fault rupture scenarios (up to Mw 7.45) collectively introduce higher seismic demands than previously acknowledged. Furthermore, the significant basin amplification effects identified by Dempsey et al. (2020) imply that the ground motions experienced at the Waihi site, particularly at long periods, could be substantially higher than the PGA values derived from a 2017 study. The assertion that NSHM 2022 updates "do not make a material difference" [1] is questionable without a detailed re-evaluation against these specific new data points.

3.6.2 Table 1: Comparative Seismic Hazard Parameters for Waihi Region

Source/Study	Controlling Fault(s)	Magnitude (Mw)	Recurrence Interval (years)	PGA at Waihi (g)	Key Characteristic/Implication
Oceana Gold (GNS 2017)	Kerepehi Fault (CME)	7.3	10,000	0.23 (for SEE)	Primary design basis; assumes Hikurangi attenuated.
Villamor et al. (2024)	Te Puninga Fault (Independent)	6.9 ± 0.35	3,000-11,500	Slightly larger than prior	New independent source, higher slip rate than thought.
Villamor et al. (2024)	Kerepehi Fault	Underestimated slip rate	-	Potentially higher	Suggests KF hazard may be higher than currently assigned.
Villamor et al. (2024)	Multi-fault (Kerepehi-Te Puninga system)	7.25-7.45	5,656-10,398	Potentially higher	Credible larger, more complex rupture scenarios.

Dempsey et al. (2020)	Kerepehi Fault	7.3	-	0.22 (mean)	Physics-based simulation, highlights basin amplification.
Dempsey et al. (2020)	Hauraki Rift Basin	-	-	Factor of 2-3 amplification (long-period)	Significant amplification of long-period shaking.
Hikurangi Subduction Zone	9.0	-	-	Attenuated (OG) / Potentially significant long-period (Critique)	OG dismisses; critique suggests re-evaluation for long-period effects.

3.7 Assessment of Tailings Liquefaction Risk (Oceana Gold Section 4.2.6)

3.7.1 Oceana Gold's documents [1] characterise the tailings profile within the impoundments, noting that the material generally comprises cohesive low plasticity sandy silt and clayey silt, with occasional thin lenses of cohesionless (non-plastic) silt/sand material.[1] The fine-grained nature of these tailings is stated to result in a low permeability profile, with values estimated to reduce to less than 1E-8 m/s with consolidation.[1] Vane shear strengths are reported to be generally greater than 30 kPa around the impoundment perimeter, increasing to over 90 kPa at 17 meters depth, indicating a firm-stiff cohesive soil.[1] The pore water within the tailings is described as being in a sub-hydrostatic state. Critically, OGNZL states that while the tailings are saturated or partially saturated, "they can liquefy or cyclically soften in an earthquake where the shaking is equal or greater than that expected every 150 years on average".[1] However, a key design claim is that the embankments themselves are explicitly stated to be "NOT liquefiable and are designed to hold back a full profile of liquefied tailings".[1]

3.8 Detailed Critique using Dempsey et al. (2020) Data

3.8.1 Dempsey et al. (2020) provides specific ground motion intensity measures (IMs) that are highly relevant to liquefaction triggering, particularly within the Hauraki Depression, the broader geological context where the Waihi TSFs are located.

3.8.2 For a Mw 7.3 Kerepehi Fault rupture, Dempsey et al. (2020) simulates PGA values of 0.4–0.5g throughout the Hauraki Depression.[1] This is explicitly noted as being "larger than that associated with damage to stop-banks during 2010–11 Canterbury earthquake sequence (>0.2g)".[1] Furthermore, Cumulative Absolute Velocity (CAV) values are shown to exceed 2.0 g.s for rivers protected by stop-banks in the Hauraki Depression, and 1.0 g.s for parts of the Waikato River.[1] Numerical modeling cited in Dempsey et al. (2020) indicates that CAV values exceeding 2.0 g.s can lead to "settlement up to 0.6 m for very thick (~10 m liquefiable layers") .[1]

> 3.8.3 **Specifically for Waihi Dempsey et al. (2020) reports a simulated PGA of 0.22g [0.15, 0.31g] and CAV of 1.35 g.s [1.21, 1.49 g.s] for a Mw 7.3 Kerepehi Fault event.**[1]

3.8.4 OGNZL states that the tailings can liquefy with shaking "equal or greater than that expected every 150 years on average".[1] However, Dempsey et al. (2020) provides ground motions for a Mw 7.3 Kerepehi Fault event, which has a recurrence interval of approximately 10,000 years [1]. Even for this rarer event, Dempsey predicts a PGA of

0.22g and CAV of 1.35 g.s at Waihi.[1] More critically, in the broader Hauraki Depression, Dempsey's study shows PGA values of 0.4-0.5g and CAV values exceeding 2.0 g.s.[1] While Waihi's specific location close to the Hauraki Depression might experience slightly lower values than the peak regional values, the proximity to the Kerepehi Fault (21 km) and the potential for basin amplification [1] suggest that the actual seismic demand on the tailings and foundation could be significantly higher than the 150-year threshold mentioned by OGNZL for liquefaction initiation. The question therefore arises whether the "150 years on average" threshold is sufficiently conservative given the actual seismic environment and the potential for more severe, albeit less frequent, ground motions. The current liquefaction assessment may not fully capture the potential for widespread liquefaction within the tailings and underlying foundation soils under the updated, more severe seismic loading scenarios derived from Dempsey et al. (2020) and Villamor et al. (2024).

3.8.5 OGNZL's tailings are described as sandy silt/clayey silt with occasional silt/sand lenses.[1] This description aligns with the "sandy, silty deposits" susceptible to liquefaction mentioned by Dempsey et al. (2020), which also highlights the softening of "soft peat deposits and organic silts" leading to "settlement and slumping of stop-banks due to the reduced bearing capacity of the local soils, and lateral spreading induced cracking and extension".[1] While OGNZL states that the embankments themselves are non-liquefiable and designed to contain liquefied tailings [1], the broader implications of widespread liquefaction in the *foundation soils* beneath the dam or in the surrounding Hauraki Plains (including critical infrastructure like stop-banks protecting Paeroa) are not explicitly detailed in OGNZL's liquefaction section. Significant settlement, slumping, or lateral spreading of foundation soils could compromise the dam's integrity or lead to cascading failures of critical infrastructure (e.g., roads, bridges, flood defenses) even if the dam's embankment itself remains intact. Therefore, the liquefaction risk assessment needs to extend beyond just the tailings body to a detailed evaluation of the liquefaction potential and associated ground deformations (settlement, lateral spreading) of the natural foundation soils beneath the dam and critical downstream infrastructure, considering the elevated ground motions and CAV values from Dempsey et al. (2020).

3.9 Evaluation of Adequacy of Dam's Design to Contain Liquefied Tailings

OGNZL states that the embankments are "NOT liquefiable and are designed to hold back a full profile of liquefied tailings".[1] This is a crucial design philosophy for tailings dams. However, the robustness of this design claim needs to be re-evaluated against the updated seismic parameters. If the actual seismic loads (PGA, CAV, long-period shaking) are higher than the original design basis, or if the extent and severity of tailings liquefaction (e.g., flow liquefaction versus cyclic mobility) are underestimated, the ability of the non-liquefiable embankment to contain the liquefied mass could be compromised. This is particularly relevant if the foundation soils themselves undergo significant deformation, which could impact the embankment's stability and containment capacity.

3.10 Critique of General Tailings Dam Failure Discussion (Oceana Gold Section 5.0)

3.10.1 Oceana Gold's discussion [1] on tailings dam failures globally, in comparison to the Waihi TSFs, emphasises that the Waihi operation utilises the downstream construction method (earth and rockfill) rather than the higher-risk upstream method (where dams are constructed of tailings themselves), which has been prevalent in many global failures.[1] OGNZL asserts that their embankments "will not liquefy and have good resistance to earthquake loadings" [1] and that other potential failure modes are managed through "proper design, construction, operation, monitoring and surveillance".[1] The company also highlights that its parent corporation has a policy to avoid constructing new upstream TSFs.

3.11 Commentary on Best Practice and Robust Conclusions

3.11.1 OGNZL's commitment to the downstream construction method, which leverages readily available mine overburden [1], is indeed aligned with best practice for enhancing the stability and reducing the liquefaction risk of the embankment structure itself. This represents a significant advantage over upstream construction methods that have been associated with a greater number of failures globally.

3.11.2 However, the claim of "good resistance to earthquake loadings" [1] and that the embankments "will not liquefy" [1] is a strong assertion that requires re-validation. Its robustness hinges entirely on the accuracy and comprehensiveness of the seismic hazard inputs. As detailed in this section, the seismic hazard assessment presented by OGNZL (based on GNS 2017) potentially underestimates ground motions due to several factors. These include the independent nature and updated parameters of the Te Puninga Fault (Villamor et al., 2024), the potential underestimation of the Kerepehi Fault slip rate (Villamor et al., 2024), the credibility of larger multi-fault rupture scenarios (Mw 7.25-7.45) (Villamor et al., 2024), and the significant basin amplification effects (Dempsey et al., 2020) that can increase long-period shaking. If the actual seismic demand (PGA, MMI, CAV, long-period spectral accelerations) from these updated sources and effects is higher than the original design basis, then the "good resistance" and "non-liquefiable" claims for the embankment need to be rigorously re-validated through updated stability and deformation analyses. A design considered robust against a Mw 7.3 Kerepehi event (from the 2017 GNS study) might not be sufficiently robust against a Mw 7.45 multi-fault rupture with the added complexities of basin amplification effects. The quantitative assessment needs to be re-anchored to the most current and comprehensive seismic hazard data.

3.11.3 Furthermore, while OGNZL's discussion focuses on the embankment's non-liquefiable nature, a holistic risk assessment for "failure of tailings storage facilities" [1] should also explicitly acknowledge the potential for ground deformation (liquefaction-induced settlement, lateral spreading) in the *underlying foundation soils* or *surrounding infrastructure* (e.g., stop-banks) under the updated seismic demands. Dempsey et al. (2020) highlights this risk in the Hauraki Depression [1], indicating that even if the dam itself does not "fail" in a catastrophic sense, severe damage to surrounding infrastructure due to ground deformation could lead to significant environmental and social consequences.

3.12 Review of Tailings Technology Options (Oceana Gold Section 7.1.2)

3.12.1 Oceana Gold's documents [1] include a discussion on "Thickened Tailings" technology. The document correctly identifies several advantages of thickened tailings compared to conventional slurry tailings, such as a smaller footprint, higher strength, reduced water usage, and lower water evaporation losses.[1] However, OGNZL concludes that thickened tailings are "not suited to areas of high rainfall where earthquakes are possible".[1] The reasons cited for this unsuitability include the necessity for separate water storage ponds (which could lead to a larger overall footprint), the potential for erosion during heavy rainfall events, and their susceptibility to liquefaction or strength loss, which would then require extensive underdrainage and higher perimeter embankments.[1] The high capital costs associated with this technology are also noted as a deterrent.

3.13 Critique of Suitability and Design Requirements for Thickened Tailings

3.13.1 OGNZL's assessment that thickened tailings are "not suited" for the Waihi environment, characterised by high rainfall and earthquake activity, is generally consistent with established geotechnical earthquake engineering principles. The challenges of managing water in high rainfall environments when using thickened tailings, combined with their inherent susceptibility to liquefaction under seismic loading, are well-recognised within the field.

3.13.2 The updated seismic hazard data from Dempsey et al. (2020) and Villamor et al. (2024) further reinforces OGNZL's conclusion regarding the unsuitability of thickened tailings at Waihi. OGNZL states that thickened tailings "can also be susceptible to liquefaction or strength loss, requiring underdrainage to reduce the risks of liquefaction and the perimeter embankment to be higher to contain any earthquake induced slumping of the tailings".[1] The updated seismic hazard data, which indicates potentially higher ground motions (PGA, MMI, CAV) and long-period shaking, as well as the credibility of larger multi-fault ruptures (Mw 7.25-7.45), would exacerbate the liquefaction potential of thickened tailings. These elevated seismic demands would make the design requirements for underdrainage and perimeter embankments even more stringent and potentially economically unfeasible or technically challenging to achieve the desired safety factors. Therefore, the new seismic data strengthens the argument against using thickened tailings at Waihi, underscoring the prudence of OGNZL's current approach with conventional slurry tailings and robust downstream embankments.

3.14 Commentary on Catastrophic Failure and Risk Conclusions

3.14.1 Oceana Gold's Dam Breach and Impact Classification Assessment [1] concludes that the proposed Storage 3 TSF has a "HIGH Potential Impact Classification (PIC)".[1] This classification is primarily driven by a "Rainy Day breach scenario" associated with a 1 in 1,000-year return period flood. This hypothetical scenario is projected to lead to "catastrophic" impacts on major infrastructure and the natural environment, and a "major" impact on residential dwellings and community recovery time, which is assessed in "years".[1] The scenario also estimates an incremental Population at Risk (PAR) of 200 and a Potential Loss of Life of 2.[1] Despite these severe consequences, OGNZL states: "The risk of a breach into Paeroa is extremely low as a 1 in 1,000 year flood is unlikely and a breach of the TSFs is highly unlikely".[1]

3.15 Evaluation of "Catastrophic" Failure and "Highly Unlikely" Breach

3.15.1 OGNZL's assessment of "catastrophic" consequences for a 1 in 1,000-year rainfall event breach is a stark and appropriate recognition of the severe impacts that such a failure would entail.[1] This level of consequence correctly drives the "High Potential Impact Classification" for the facility.

3.15.2 However, the assertion that "a breach of the TSFs is highly unlikely" and the risk is "extremely low" [1] requires critical re-evaluation. While a 1 in 1,000-year flood is indeed a rare hydrological event, the probability of a *seismically-induced breach* or a *combined seismic-hydrological event* triggering a breach is a separate and crucial consideration. OGNZL's "Sunny Day" breach scenario explicitly mentions "instability of the embankment triggered by strong earthquake shaking" as a potential failure mode.[1] The updated seismic hazard information from Villamor et al. (2024) and Dempsey et al. (2020) indicates a more active and potentially more severe seismic environment than OGNZL's 2017 GNS basis. Specifically, the independent Te Puninga Fault (Mw 6.9) and the potential underestimation of the Kerepehi Fault slip rate (Villamor et al., 2024), coupled with the credible multi-fault rupture scenarios (Mw 7.25-7.45) (Villamor et al., 2024), suggest a higher seismic demand. Furthermore, the significant basin amplification effects (Dempsey et al., 2020) could lead to higher ground motions (PGA, CAV) and an increased liquefaction potential for both the tailings and surrounding soils. If these updated seismic events, which are not "extremely low" probability over the dam's lifespan, can trigger liquefaction of the tailings (as acknowledged by OGNZL [1]) or lead to significant ground deformation of the foundation, the probability of a breach (even a partial one) might be higher than implied by the term "highly unlikely." A seismic event could also compromise the dam's ability to withstand subsequent hydrological loading, creating a complex failure pathway. Therefore, the probability assessment for dam breach needs to integrate the full spectrum of updated seismic hazard scenarios, including the potential for earthquake-induced liquefaction and ground deformation, and consider their potential to trigger or exacerbate breach mechanisms. The current "highly unlikely" conclusion may be overly optimistic given the updated understanding of seismic risk.

3.15.3 It is concerning that the evidence presented by Oceana Gold to the Fast Track Approval Panel lacks a comprehensive assessment of land movement rates and extent across its existing Waihi gold mining operation, including the open pit, waste dumps, and tailings dam. This constitutes a significant evidentiary gap, particularly given the readily available and highly accurate InSAR (Interferometric Synthetic Aperture Radar) satellite data. Providers like Satsense, (https://satsense.com/) routinely collect and process this information. Earth Sciences New Zealand (https://www.gns.cri.nz/) hold licences for New Zealand-specific data and may be an additional source.

InSAR technology offers millimetre-level precision in measuring vertical ground deformation, and to a lesser extent, horizontal movement, making it an indispensable tool for monitoring the stability of large-scale infrastructure. Mining companies and regulatory bodies globally routinely utilise InSAR data for critical assessments such as slope stability in open pits, settlement of waste rock dumps, and the integrity of tailings dam embankments. This case study from Wigan in the UK relating to mining operations illustrates the essential nature of this data in consent hearings. (https://satsense.com/case-studies/Monitoring-The-Impact-Of-Mining-Activities)

For the Panel to make a robust and informed decision regarding the consent application and the long-term safety of the expanded operations, this vital and routinely available land movement data is essential for understanding the dynamic geological and geotechnical performance of the Waihi site.

3.16 Conclusions and Recommendations

3.16.1 Oceana Gold's approach to tailings dam design and safety management at Waihi demonstrates a commitment to the use of downstream embankments, and an adherence to the New Zealand Dam Safety Guidelines (NZDSG). The identification of a "High Potential Impact Classification" for the Storage 3 TSF and the acknowledgment of "catastrophic" consequences for a breach event correctly reflect a responsible understanding of the potential severity.

3.16.2 However, a critical review reveals a significant concern: the underlying seismic hazard assessment, which forms the very foundation of the risk evaluation, is based on data that has been substantially updated by recent, un-cited research. This temporal gap introduces material concerns regarding the robustness and conservatism of the current risk conclusions.

3.17 Summary of Key Findings and Areas of Concern

3.17.1 **Underestimated Seismic Hazard:** The 2017 GNS study referenced by OGNZL appears to underestimate the regional seismic hazard. Villamor et al. (2024) establishes the Te Puninga Fault as an independent, active source (Mw 6.9 ± 0.35) and suggests that the Kerepehi Fault's slip rate may be underestimated. Both of these faults are geographically proximal to the Waihi site.

3.17.2 **Unaccounted Multi-Fault Ruptures:** OGNZL's assessment does not fully incorporate the credible multi-fault rupture scenarios (Mw 7.25-7.45) identified by Villamor et al. (2024). These scenarios could generate more severe ground motions than are currently considered in the design basis.

3.17.3 **Neglected Basin Amplification:** Dempsey et al. (2020) demonstrates significant (factor of 2-3) long-period shaking amplification within the Hauraki Rift due to deep basin effects. This critical phenomenon, which is highly relevant to the dynamic response of large structures like TSFs, does not appear to be explicitly integrated into OGNZL's current seismic design parameters.

3.17.4 **Re-evaluation of Hikurangi Risk:** The dismissal of the Mw 9 Hikurangi megathrust as "not a credible risk" solely due to distance is an oversimplification. Attenuated long-period motions from such events, potentially amplified by local basins, could still pose a significant and damaging hazard to large, sensitive structures. (see Section B)

3.17.5 **Liquefaction Risk Underestimated:** While OGNZL acknowledges the tailings' liquefaction potential (at shaking levels exceeding a 150-year Average Recurrence Interval) and states that the embankments themselves are non-liquefiable, the seismic demands derived from updated studies (e.g., Dempsey's PGA of 0.22g and CAV of 1.35 g.s at Waihi for a Mw 7.3 Kerepehi event, and even higher regional values) suggest more severe liquefaction triggering conditions. The potential for widespread liquefaction and associated ground deformation in the underlying foundation soils and surrounding critical infrastructure (e.g., flood stop-banks) under these updated loads requires a more explicit and detailed assessment.

3.17.6 **Questionable "Highly Unlikely" Breach Probability:** The conclusion that a dam breach is "highly unlikely" is questionable given the updated understanding of seismic triggers, including earthquake-induced liquefaction and ground deformation. These phenomena could initiate or exacerbate failure mechanisms, potentially in combination with hydrological events, thereby increasing the overall probability of a breach.

3.17.7 **Lack of Highly Accurate InSAR Land Movement data** This constitutes a significant evidentiary gap. This data is routinely utilised for critical assessments such as slope stability in open pits, settlement of waste rock dumps, and the integrity of tailings dam embankments.

3.18 Specific, Actionable Recommendations

3.18.1 To ensure the Waihi goldmining tailings dams meet the highest standards of seismic design safety and align with contemporary best practice, the following recommendations are put forth:

3.18.2 **Mandatory Incorporation of Recent Research:** OGNZL must formally incorporate and re-evaluate its seismic hazard and risk assessments based on the comprehensive findings of Dempsey et al. (2020) and Villamor et al. (2024). These publications provide the most current and regionally specific understanding of seismicity.

3.18.3 **Updated Seismic Hazard Assessment:**

Conduct a comprehensive re-assessment of ground motion parameters for the Waihi site. This assessment must explicitly account for:

- The independent Te Puninga Fault and its updated seismic parameters (Mw 6.9, slip rate, recurrence interval).
- The potential underestimation of the Kerepehi Fault's slip rate, as suggested by recent geomorphic comparisons.
- The credible multi-fault rupture scenarios (Mw 7.25-7.45) involving the Te Puninga and Kerepehi fault systems, and their associated ground motions.
- Detailed basin amplification effects for long-period ground motions, utilizing physics-based simulations as demonstrated by Dempsey et al. (2020), specifically considering the Waihi site's location within the Hauraki Rift.
- Re-evaluate the Hikurangi Subduction Zone mega-quake risk. This re-evaluation should focus on the potential for significant long-period ground motions and their amplification by local site conditions and basin effects, rather than solely relying on a distance-based attenuation argument.
- Obtain and present to the Panel InSAR (Interferometric Synthetic Aperture Radar) satellite data for the present and proposed future mining operation locations.

3.18.4 **Comprehensive Liquefaction Re-evaluation:**

- Perform a detailed re-evaluation of the liquefaction potential for the tailings within the impoundments under the full spectrum of updated seismic loading conditions (PGA, CAV, duration, spectral content). This assessment should consider the full range of potential ground motions derived from the re-assessed seismic hazard.
- Extend the liquefaction assessment to include the natural foundation soils directly beneath the dam and critical surrounding infrastructure (e.g., flood stop-banks, roads, bridges in Waihi and Paeroa townships). This expanded assessment should quantify potential ground deformations such as settlement and lateral spreading and thoroughly evaluate their impact on dam stability and potential downstream consequences.

3.18.5 **Integrated Risk Assessment:**

- Review existing dam design and operational procedures to ensure enhanced resilience against combined extreme events, such as a significant seismic event occurring immediately prior to or concurrently with a major rainfall event.
- Re-assess the probability of dam breach. This re-assessment must explicitly incorporate the latest InSAR satellite data and the potential for earthquake-induced failure mechanisms (e.g., liquefaction-induced instability, ground deformation) as direct triggers or exacerbating factors, rather than solely focusing on hydrological overtopping or assuming a "highly unlikely" breach probability without full consideration of seismic interactions.

3.18.6 **Transparency and Documentation:**

- Ensure all updated assessments, methodologies, and conclusions are clearly documented and made accessible for independent peer review. This practice will align with the rigorous standards set forth by the NZDSG and the Global Industry Standard on Tailings Management, promoting accountability and confidence in the safety measures.

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3. Ground motion simulation of hypothetical earthquakes in the upper North Island of New Zealand. *New Zealand Journal of Geology and Geophysics*, *64*(4), 570-588. DOI: 10.1080/00288306.2020.1842469

4. Section B

Re-evaluation of Hikurangi Subduction Zone Seismic Risk to Waihi Tailings Storage Facilities

4.1 Executive Summary

4.1.1 This section presents a critical re-evaluation of the seismic hazard posed by the Hikurangi Subduction Zone (HSZ) to the Waihi Tailings Storage Facilities (TSFs). While Oceana Gold's current Maximum Credible Earthquake (MCE) assessment for Waihi focuses on a closer, moderate event, the analysis herein indicates that this approach appears to underestimate the credible risk from distant Mw 9 Hikurangi mega-thrust earthquakes. Scientific evidence confirms the HSZ's capacity for such large events, and while peak ground motions attenuate over distance, damaging long-period ground motions persist and can be significantly amplified by local basin effects. Tailings Storage Facilities, being large, flexible earth structures, are inherently vulnerable to these long-period motions and the associated risk of liquefaction. A robust seismic hazard assessment, aligned with New Zealand and international best practices, necessitates a more comprehensive consideration of these complex seismic phenomena.

4.2 Introduction: Context and Objectives

4.2.1 Purpose of the Re-evaluation

4.2.2 This section provides a comprehensive re-assessment of the seismic hazard posed by the Hikurangi Subduction Zone to the Waihi Tailings Storage Facilities (TSFs). It critically examines the prevailing assumption that distant mega-thrust earthquakes from the HSZ pose a non-credible risk to the TSFs solely due to attenuation. The section also evaluates Oceana Gold's current seismic hazard assessment considering contemporary international and New Zealand best practices for dam safety.

4.2.3 Overview of the Hikurangi Subduction Zone (HSZ)

4.2.3.1 The Hikurangi Subduction Zone is recognised as potentially the largest source of earthquake and tsunami hazard in New Zealand.[1] This active plate boundary, located off the East Coast of the North Island, is where the Pacific tectonic plate subducts beneath the Australian tectonic plate.[1] A large team of national and international scientists are actively engaged in studying the HSZ to understand the frequency and magnitude of potential earthquake events.[1] For instance, GNS Science has developed an Mw 8.9 scenario that serves as a "serious and credible basis" for national response planning, acknowledging the zone's capacity for large, tsunamigenic events.[3] The Hikurangi margin exhibits diverse slip styles along its length, ranging from recurring great (Mw > 8.0) earthquakes in the southern Hikurangi to shallow slow slip events and aseismic creep in the central and northern sections.[2] Historical events, such as the Mw ~7.0 tsunami earthquakes in 1947 offshore Poverty Bay and Tokomaru Bay, further demonstrate the zone's potential for significant seismic activity.[4]

4.2.4 Introduction to Waihi TSFs and their Critical Importance

4.2.4.1 The Waihi Operation encompasses existing Tailings Storage Facilities, specifically Storage 1A and Storage 2, with a new Storage 3 facility also proposed.[5] These facilities are designed as earth/rock-fill water-retaining structures, serving a critical role in managing the fine-grained waste materials, known as tailings, discharged from the mining process.[6] The integrity of these structures is paramount, as their failure, particularly due to seismic activity, carries the potential for significant environmental pollution and poses severe safety risks to downstream communities.[7] Tailings can contain hazardous substances, including cyanide and potentially acid-forming materials, which, if released, would severely contaminate surrounding rivers, streams, and land (see Section D on these issues) .[6]

4.2.3 Query Context

4.2.3.1 The central concern of this re-evaluation stems from a challenge to the dismissal of distant Hikurangi mega-quakes as "non-credible risks" for the Waihi TSFs. The HSZ, despite being over 200 km distant from Waihi, is acknowledged as capable of generating Mw 9 earthquakes. The prevailing view is that ground motions from such events are sufficiently attenuated over this distance to be dismissed as insignificant risks to the TSFs. This section directly addresses this perspective by providing a comprehensive critique of the underlying assumptions.

4.3 Characteristics of Distant Megathrust Earthquake Ground Motions

4.3.1 Hikurangi Subduction Zone's Mw 9 Potential - Evidence and Scenarios for Great Earthquakes

4.3.1.1 The Hikurangi margin is a globally significant focus for subduction zone research, with extensive investigations advancing the understanding of its megathrust slip behavior.[2] Paleoseismic studies have revealed a history of recurring great earthquakes (Mw > 8.0), particularly in the southern Hikurangi region.[2] This geological evidence is supported by contemporary scientific assessments. GNS Science, New Zealand's leading earth science research institute, has developed an Mw 8.9 scenario as a "serious and credible basis" for national response planning, explicitly acknowledging the zone's potential for large, tsunamigenic events.[3] The ongoing subduction of the Pacific Plate beneath the North Island is a fundamental process that can cause such large earthquakes, akin to those observed in Japan or Indonesia.[1]

4.3.2 Tectonic Setting and Slip Behaviour

4.3.2.1 The HSZ accommodates the westward subduction of the Pacific Plate beneath the North Island of New Zealand.[2] This dynamic tectonic setting results in a spectrum of slip behaviours along the megathrust fault, ranging from large tsunami-genic earthquakes to slow slip events (SSEs) and aseismic creep.[2] The variability in slip behaviour is influenced by heterogeneous properties of the plate boundary zone, including factors such as sediment thickness, the compressional nature of the overriding plate, and the roughness of the incoming plate.[2] While SSEs are characterized by slow, unnoticeable ground movements over weeks to months, the underlying driving forces for these events are considered to be the same as those for large, damaging, tsunamigenic subduction zone earthquakes.[1] This indicates a fundamental connection between the more frequent SSEs and the potential for rare, but devastating, megathrust ruptures.

4.3.3 The "Credibility" of Mw 9 Events

4.3.3.1 The assertion that Mw 9 Hikurangi events are "non-credible risks" solely due to distance, as implied in Oceana Gold's assessment, requires careful examination. The scientific community, as evidenced by GNS Science's development of an Mw 8.9 scenario for response planning, considers such large events a "serious and credible basis" for hazard assessment.[3] Furthermore, peer-reviewed studies confirm the occurrence of recurring great (Mw > 8.0) earthquakes in the southern Hikurangi.[2] In seismic hazard assessment, "credible" refers to events that are physically possible and possess a non-negligible probability of occurrence within a relevant timeframe, even if they are infrequent. Given the geological evidence and the consensus among leading scientists regarding the HSZ's potential, an Mw 9 event, while rare, is scientifically plausible and must be considered in a robust hazard assessment for critical infrastructure. Dismissing such an event based *solely* on distance, without a comprehensive evaluation of the unique characteristics of large magnitude, long-period ground motions, represents an oversimplification of the seismic hazard.

4.4 Attenuation and Long-Period Ground Motion

4.4.1 Mechanisms of Ground Motion Attenuation over Long Distances

4.4.1.1 Ground motion generally diminishes in intensity with increasing distance from the seismic source. However, the characteristics of this attenuation for megathrust subduction earthquakes can vary significantly depending on the method used to measure distance, such as fault distance versus equivalent hypocentral distance.[11]

4.4.2 Magnitude Saturation for Peak Ground Motions vs. Persistence of Long-Period Energy

4.4.2.1 For very large earthquakes, specifically those with moment magnitudes (Mw) greater than 8.3, strong ground motion parameters like Peak Ground Acceleration (PGA) can exhibit "magnitude saturation" when fault distance is used in calculations.[11] This phenomenon means that PGA may not increase proportionally or significantly with increasing magnitude beyond Mw 8.3. For example, the mean intensity of maximum ground motions from the Mw 9.0 Tohoku earthquake was roughly similar to that from the Mw 8.3 Tokachi-oki earthquake when fault distance was considered.[11] This implies that a Mw 9 event might not necessarily produce significantly higher *peak* accelerations at a given distance compared to a slightly smaller, but still large, event.

4.4.2.2 Crucially, this magnitude saturation primarily applies to peak ground acceleration and does *not* extend to the duration or the long-period content of ground motions.[11] Long-period ground motions, characterised by periods of 1 second or longer, attenuate much more slowly with distance compared to higher-frequency motions.[13] The duration of strong shaking also increases substantially with earthquake magnitude; a megathrust earthquake can result in shaking lasting for several minutes, a duration far exceeding that of smaller events.[12]

4.4.3 Distinct Characteristics of Long-Period Ground Motions from Distant Subduction Events

4.4.3.1 Ground motions generated by distant, large-magnitude earthquakes are typically dominated by long-period components and exhibit significantly longer durations.[12] For instance, the 2011 Mw 9.0 Tohoku earthquake produced strong ground motions with durations exceeding 100 seconds and dominant periods ranging from 0.75 s to 1.25 s at distant sites.[15] This contrasts sharply with the predictions of most existing attenuation relationships and building codes, which often specify predominant periods shorter than 0.6 seconds.[16] The response spectrum for distant earthquakes shifts towards a longer period range, a critical characteristic that needs careful consideration in seismic hazard assessments.[16]

4.4.3.2 The simple assertion that "ground motions are considered to be attenuated over this distance" for the Hikurangi risk to Waihi, as stated in the Oceana Gold’s report, is a fundamental misrepresentation of the behaviour of long-period ground motions from megathrust events. The critical point is that different frequency components of seismic waves attenuate at different rates. Long-period waves, which are particularly relevant for large and flexible structures, attenuate much more slowly and can persist for extended durations over vast distances. Therefore, a statement of general attenuation, without specifying which ground motion parameters (e.g., PGA versus long-period spectral acceleration, or duration) are being considered, and without accounting for the type of structure at risk (flexible TSFs), constitutes an oversimplification that can lead to a significant underestimation of the actual hazard. The phenomenon of magnitude saturation for peak accelerations further underscores that focusing solely on PGA for very large events can be misleading, as the area affected by strong shaking and the duration of shaking increase substantially with magnitude, even if the peak acceleration does not.

4.5 Ground Motion Prediction Equations (GMPEs) for Subduction Zones

4.5.1 Ground Motion Prediction Equations (GMPEs) are fundamental inputs for any seismic hazard assessment. These equations are developed to predict ground motion parameters (such as peak ground acceleration and spectral acceleration) based on earthquake magnitude, distance, and site conditions. Current GMPEs cover a wide range of magnitudes, up to Mw 9.1, and distances, often up to 300 km.[11] However, a significant challenge arises because conventional GMPEs and standard building codes frequently do not adequately capture the unique spectral shape and the dominance of long-period components characteristic of ground motions from distant subduction earthquakes.[16] This deficiency means that models designed for typical crustal earthquakes or closer events may not accurately represent the hazard from a distant megathrust.

4.5.2 New Zealand-specific GMPEs are under development, aiming to predict parameters like peak ground acceleration and pseudo spectral acceleration for periods ranging from 0.01 to 10 seconds, for moment magnitudes of 4.0 to 8.0, and rupture distances up to 400 km for shallow crustal earthquakes.[18] The challenge lies in adapting or applying these, or other international models, to accurately characterise ground motions from the Hikurangi Subduction Zone at distances relevant to Waihi.

4.5.3 If standard GMPEs, which may have informed Oceana Gold's assessment, do not accurately represent the long-period characteristics of distant subduction events, then any assessment relying exclusively on them would be inherently flawed for structures vulnerable to long-period motions. A robust assessment for Waihi must therefore either utilise or adapt GMPEs specifically validated for distant megathrust events and long-period motions or undertake site-specific ground motion simulations that explicitly account for these unique characteristics, rather than relying on generalised attenuation curves that might primarily reflect peak ground acceleration.

Table 1 provides a summary of key seismic parameters for the Hikurangi Subduction Zone and their relevance to the Waihi site.

4.6 Table 1: Key Seismic Parameters of Hikurangi Subduction Zone and Waihi Site

Parameter	Data	Relevance to Waihi TSFs
Source	Hikurangi Subduction Zone	Largest potential earthquake source for New Zealand.[1]
Potential Maximum Magnitude	Mw 8.9 - Mw 9.0+	Scientifically credible magnitude for response planning and recurring great earthquakes.[2]
Distance to Waihi	~200+ km	Distance over which ground motions attenuate, but long-period components persist.[13]
Dominant Period of Expected Ground Motion (at Waihi)	>1.0 second (Long-Period)	Critical for resonance with large, flexible structures like TSFs.[13]
Expected Duration of Strong Shaking (at Waihi)	Several minutes	Prolonged cyclic loading increases liquefaction potential and cumulative damage.[12]
Key Hazard Type	Megathrust earthquake, tsunamigenic potential	Capable of generating the world's largest earthquakes and tsunamis.[1]

Relevant Ground Motion Parameters for TSFs	Long-period spectral acceleration, Peak Ground Velocity (PGV), Ground Displacement, Duration	These parameters are more indicative of damage to TSFs than Peak Ground Acceleration (PGA) alone.[8]

4.7 Seismic Vulnerability of Tailings Storage Facilities

4.7.1 Susceptibility to Long-Period Ground Motions

4.7.1.1 Resonance Effects in Large, Flexible Structures

Large-scale structures, including high-rise buildings, long-span bridges, oil storage tanks, and critically, large, flexible earth structures such as tailings dams, are particularly susceptible to the effects of long-period ground motions.[13] This heightened vulnerability arises because the natural vibration periods of these massive structures often align with the dominant periods of seismic waves generated by distant mega-thrust earthquakes. When these periods match, a phenomenon known as resonance occurs, leading to significantly amplified structural responses and potentially increased damage.[13] The New Zealand Dam Safety Guidelines (NZSOLD) 2023 specifically highlight that tailings dams are "particularly susceptible to the effects of long-period ground motions".[20]

4.7.1.2 Impact on Structural Integrity and Deformation

Long-period ground motions can induce substantially larger peak ground velocities (PGV) and ground displacements compared to peak ground accelerations (PGA).[13] This translates to an increased response in the low-frequency region of the response spectrum, which for dams, can result in significant soil displacements, shear strains, and the potential for excessive deformation, cracking, and overall instability.[8]

While the general concept of long-period vulnerability applies to a wide range of large structures, tailings dams possess unique characteristics that amplify this risk. They are flexible earth structures.[6] The NZSOLD guidelines explicitly state that TSFs are "particularly susceptible to the effects of long-period ground motions".[20] This means that a generic Maximum Credible Earthquake (MCE) assessment, even if it considers some level of shaking, might fail to capture the specific dynamic response of a TSF to long-period, long-duration shaking. Such shaking can induce cumulative damage and large deformations that are not solely dependent on peak acceleration, making a tailored assessment essential.

4.8 Basin Amplification Effects at Distant Sites

4.8.1 Mechanisms of Seismic Wave Amplification in Sedimentary Basins

4.8.1.1 Sedimentary basins are geological formations that can significantly modify and amplify seismic ground motions, especially the long-period components.[13] This amplification occurs through several mechanisms, including the generation of basin-generated surface waves, complex interactions with the basin's geometry and stratigraphy, and waveguide effects that trap and channel seismic energy.[13] The presence of thick, soft upper clay layers within a basin can further enhance this amplification.[13] These effects can lead to "unusually high long-period ground motions over large regions," as famously demonstrated by the 1985 Michoacán earthquake, where Mexico City, located 400 km from the epicenter, experienced widespread destruction due to basin amplification of long-period motions.[13]

4.8.2 Potential for Localised Amplification at Waihi

4.8.2.1 While specific geological details of the Waihi site's basin characteristics are not extensively provided in the available information, there is the potential for ground motions to be "amplified by local basins." Mining areas frequently involve altered ground conditions, extensive unconsolidated fill, or underlying geological structures that can behave as sedimentary basins. These conditions could contribute to localised amplification of seismic waves.

4.8.2.2 The dismissal of distant Hikurangi events due to attenuation is further challenged by the potential for basin amplification. Even if ground motions attenuate over the 200+ km distance from the Hikurangi Subduction Zone, local geological conditions at Waihi—such as the presence of a sedimentary basin, engineered fill, or specific soil profiles—could re-amplify the attenuated long-period waves. This re-amplification effectively negates some of the distance-related attenuation for the critical long-period components. Consequently, the actual ground motion experienced by the TSF could be significantly higher than a simple distance-attenuation model might suggest, particularly for the frequencies most damaging to the dam structure. This compounding risk underscores the need for detailed site-specific investigations.

4.9 Liquefaction Hazard in Tailings Materials

4.9.1 Conditions and Mechanisms Leading to Liquefaction

4.9.1.1 Liquefaction is a critical seismic hazard characterised by a sudden loss of stiffness and strength in saturated granular soils, triggered by the cyclic loading effects of an earthquake.[19] This loss of strength results from a rapid build-up of porewater pressure within the soil, which, if it approaches the confining pressure, causes the effective stress to drop to near zero. When this occurs, the soil temporarily behaves as a heavy liquid.[19] Tailings materials, often fine-grained, angular, and deposited in a loose, water-rich slurry state, are inherently highly susceptible to liquefaction.[7] This susceptibility makes liquefaction a primary cause of tailings dam failures during seismic events.[8]

4.9.2 Consequences of Liquefaction-Induced Flow Slides and Instability

4.9.2.1 The most catastrophic consequence for TSFs subjected to seismic loading is flow liquefaction of the impounded tailings or the dam's foundation materials.[7] As previously discussed, distant mega-thrust earthquakes, with their characteristic long duration and dominant long-period content, are highly effective at generating the sustained cyclic loading necessary to trigger liquefaction in susceptible, loose, saturated tailings.[12] A liquefaction-induced failure typically results in a sudden and rapid loss of shear strength, leading to a flow slide where the liquefied tailings mass flows like a viscous fluid, causing catastrophic dam collapse and uncontrolled release of the impounded material.[19] Historical examples, such as the Mochikoshi dams in Japan during the 1978 Mw 7 earthquake, illustrate this danger, where one dam failed during the main shaking and another 24 hours later due to liquefaction.[19] The NZSOLD guidelines explicitly identify liquefaction and lateral spreading as "significant concerns for tailings dams" that require thorough assessment.[20]

4.9.2.2 The fact that liquefaction can manifest not only during the peak shaking but also *after* the main seismic event, as observed in the Mochikoshi dam failure where one dam failed 24 hours later, highlights a critical aspect of this hazard.[19] This delayed or cumulative failure mode underscores that the long duration of shaking from a distant mega-thrust event can be particularly problematic for liquefaction. Even if peak accelerations are not extreme due to distance-related attenuation, the *prolonged cyclic loading* at long periods can be highly effective in building up pore pressures and triggering liquefaction in susceptible tailings materials. This cumulative effect over an extended duration, rather than just instantaneous peak shaking, is a critical consideration often overlooked in simplified seismic assessments. While Oceana Gold states that consolidated tailings become "essentially soils with inherent shear strength" and that the risk of release is "almost inconceivable" after cessation of deposition [6], this statement, while potentially valid for static conditions, may not adequately address the dynamic liquefaction potential under prolonged seismic loading, especially if the consolidation is not uniform or complete throughout the tailings mass.

Table 3 provides a matrix summarising the various vulnerability mechanisms of tailings dams to seismic loading and their relevance to a distant Hikurangi Mw 9 event.

4.10 Table 3: Tailings Dam Vulnerability Matrix to Seismic Loading

Vulnerability Mechanism	Description/Cause	Potential Failure Mode(s)	Relevance to Hikurangi Mw 9 Event
Long-Period Resonance	Natural period of large TSFs aligns with long-period waves from distant mega-quakes.[8]	Excessive deformation, cracking, loss of freeboard, overtopping, internal erosion.	Highly relevant, as Mw 9 events generate significant long-period energy over long distances.[12]
Basin Amplification	Local geological structures (basins, soft soils) amplify specific frequency ranges of seismic waves.[13]	Increased ground motion intensity at site, leading to exacerbated direct impacts and liquefaction triggering.	Highly relevant, as Waihi may have local basin effects that amplify distant long-period waves.[13]
Liquefaction of Tailings	Loss of strength in saturated, loose tailings due to cyclic loading.[7]	Flow slide, complete dam collapse, massive release of tailings.	Highly relevant, primary failure mode for TSFs from distant, long-duration events.[19]
Liquefaction of Foundation Soils	Loss of strength in saturated, loose foundation soils beneath the dam.[19]	Foundation failure, lateral spreading, dam instability.	Relevant, if foundation materials are susceptible.[20]
Long-Duration Shaking Effects	Cumulative pore pressure build-up and degradation	Increased likelihood of liquefaction,	Highly relevant, Mw 9 events are characterized by

	of strength over extended shaking.[12]	progressive failure, delayed failure.	very long durations.[12]

4.11 Critique of Oceana Gold's Seismic Hazard Assessment for Waihi TSFs

4.11.1 Summary of Oceana Gold's Stated Seismic Design Basis

4.11.1.1 Oceana Gold states that the Waihi embankments have been designed to resist the effects of earthquake shaking from a Maximum Credible Earthquake (MCE).[6] This MCE has been "conservatively assessed to be a magnitude MW 7 earthquake at a distance of nine kilometres from the site".[6] Oceana Gold dismisses distant Hikurangi mega-quakes (Mw 9, over 200 km distant) as "non-credible risks" due to the assumption that their ground motions are sufficiently attenuated over such distances.

4.11.1.2 The concept of relying on a single MCE, particularly one focused on a near-field, moderate magnitude event (Mw 7 at 9 km), for a site like Waihi within a seismically active region like New Zealand, represents a simplification. A single MCE, especially when defined by its proximity and a magnitude that primarily drives peak ground acceleration, may not adequately capture the full spectrum of seismic hazards. This includes the unique characteristics of distant, large-magnitude, long-duration, long-period ground motions.[12] While a Mw 7 at 9 km would produce high peak ground accelerations, its frequency content and duration would differ significantly from a Mw 9 event occurring over 200 km away. A truly robust assessment for critical infrastructure like TSFs should consider multiple credible scenarios, including those that challenge the "closest large event" paradigm, especially given the known vulnerability of TSFs to long-period motions and liquefaction. The dismissal of Mw 9 Hikurangi events as "non-credible" based on this limited MCE suggests a potential gap in their hazard characterisation.

4.11.2 Re-evaluation of Distant Hikurangi Risk to Waihi

4.11.2.1 Based on the analysis presented in this section, a Mw 9 Hikurangi event, despite its distance of over 200 km from Waihi, is scientifically credible.[2] While peak ground accelerations from such an event would indeed be attenuated over this distance [11], the long-period components of ground motion would persist with significant energy.[12] These long-period motions are precisely the type of seismic input to which large, flexible structures like TSFs are particularly vulnerable.[8] Furthermore, local geological conditions at Waihi, such as the presence of sedimentary basins or engineered fill, could significantly amplify these long-period waves.[13] This amplification could lead to damaging ground motions characterised by high peak ground velocities, large ground displacements, and prolonged durations, which may not be adequately captured by an MCE defined as a Mw 7 earthquake at 9 km. The dismissal of a Mw 9 Hikurangi megathrust as "not a credible risk" solely due to distance is, therefore, an oversimplification. Scientific literature and historical precedents clearly demonstrate that distant mega-thrust events can cause significant damage to large, flexible structures due to long-period ground motions, even at distances of hundreds of kilometres. The 1985 Michoacán earthquake (Mw 8.0), which caused widespread destruction in Mexico City 400 km away due to basin amplification of long-period motions, serves as a compelling example.[13] This historical event underscores that distance alone is an insufficient criterion for dismissing a significant seismic hazard.

4.12 Adherence to Best Practices and Robustness

4.12.1 The New Zealand Dam Safety Guidelines (NZSOLD) 2023 provide detailed guidance for seismic hazard assessment for dams, including specific considerations for tailings dams.[20] For dams classified with a high Potential Impact Classification (PIC), which TSFs like Waihi are likely to be given the severe consequences of failure, the Safety Evaluation Earthquake (SEE) requires consideration of at least a 1 in 2,500 Annual Exceedance Probability (AEP) ground motion.[20] Crucially, NZSOLD explicitly states that "long-period ground motions can be a concern for tailings dams" because they are "particularly susceptible to the effects of long-period ground motions, which are often generated by distant large magnitude earthquakes".[20] The guidelines also emphasize the need for a "thorough assessment of liquefaction and lateral spreading potential".[20]

4.12.2 The Oceana Gold report's stated MCE (Mw 7 at 9 km) [6] and the dismissal of distant Mw 9 events appear to fall short of the comprehensive requirements outlined in NZSOLD 2023. This is particularly evident regarding the explicit consideration of long-period ground motions from distant large magnitude events and their specific impact on TSFs. Furthermore, the B.04-EGL-Tailings-Storage-Facility.pdf report explicitly states that details on seismic hazard assessment concerning the Hikurangi Subduction Zone and long-period ground motions are "unavailable".[5] This represents a significant gap in transparency and detailed information for a critical infrastructure project. While Oceana Gold mentions ongoing monitoring and independent peer review [5], the publicly available information suggests their MCE might not fully encompass the complex seismic hazard environment as understood by current best practices.

4.12.3 The NZSOLD 2023 guidelines are the authoritative national standard for dam safety in New Zealand.[20] Their explicit mention of long-period ground motions from *distant large magnitude earthquakes* as a specific concern for *tailings dams* directly contradicts Oceana Gold's dismissal of the Hikurangi risk based on distance. This indicates that Oceana Gold's assessment, as presented in the available documents, may not fully align with the most current and comprehensive best practices for seismic hazard assessment for TSFs in New Zealand. This is not merely a scientific disagreement but a potential issue of alignment with regulatory guidance, implying that the assessment might not be considered "robust" in the context of modern dam safety standards. The lack of detailed information on this specific aspect in their public reports further raises concerns about the completeness and transparency of their assessment.

Table 2 provides a comparison of Oceana Gold's stated MCE approach against the NZSOLD 2023 guidelines for High PIC dams.

4.13 Table 2: Comparison of Oceana Gold's MCE vs. NZSOLD Guidelines for High PIC Dams

Parameter	NZSOLD 2023 Requirements (for High PIC Dams)	Oceana Gold's Stated Approach (for Waihi TSFs)
Dam Classification (PIC)	High (based on consequence of failure)	(Likely High, based on consequence of failure of TSFs)
Operating Basis Earthquake (OBE) Return Period	1 in 150 AEP	Not explicitly stated in available information
Safety Evaluation Earthquake (SEE) Return Period	At least 1 in 2,500 AEP (not exceeding 1 in 10,000 AEP) [20]	Mw 7 at 9 km [6] (Implied MCE, not explicitly tied to a return period in available information)
Specific Consideration for Long-Period Ground Motions	"Careful consideration" due to TSF susceptibility	Dismissed due to "attenuation over distance" [User Query]

	to distant large magnitude events [20]	
Specific Consideration for Liquefaction/Lateral Spreading	"Thorough assessment" due to TSF susceptibility [20]	Tailings consolidate to "inherent shear strength" [6], implying static stability focus; dynamic liquefaction potential under MCE not explicitly detailed.
Consideration of Distant Large Magnitude Events	Explicitly mentioned as generators of concerning long-period motions [20]	Dismissed as "non-credible risks"

4.14 Potential Consequences of a Hikurangi Mw 9 Event at Waihi

4.14.1 Direct Impacts on TSF Structural Integrity

4.14.1.1 A Mw 9 Hikurangi event, even at a distance of over 200 km, could induce significant and sustained deformations in the Waihi TSF embankments due to the persistence and potential amplification of long-period ground motions.[8] This prolonged dynamic loading can lead to various forms of structural distress, including cracking of the embankment materials and a reduction in the dam's freeboard (the vertical distance between the water level and the crest of the dam).[6] Such damage could potentially result in overtopping of the dam, particularly if combined with heavy rainfall events, which the TSFs are designed to contain up to a 1200 mm rainstorm plus 1.0 m freeboard.[6] Furthermore, internal erosion, a process where fine particles within the dam body are washed out through cracks or permeable zones, could compromise the overall stability and integrity of the structure.[21]

4.14.2 Risk of Liquefaction-Induced Failure

4.14.2.1 The most catastrophic consequence for TSFs from seismic loading is flow liquefaction of the impounded tailings or the dam's foundation materials.[7] As discussed, distant mega-thrust earthquakes, characterised by their long duration and dominant long-period content, are highly effective at generating the sustained cyclic loading necessary to trigger liquefaction in susceptible, loose, saturated tailings.[12] A liquefaction-induced failure would result in a sudden and rapid loss of strength, causing the liquefied tailings mass to behave as a heavy liquid and leading to a flow slide.[19] This type of failure can be immediate during strong shaking or delayed, occurring hours or even a day after the main seismic event, as observed in the Mochikoshi dams case.[19]

4.14.3 Environmental and Safety Implications

4.14.3.1 The release of tailings from a TSF failure would have severe and widespread consequences. (see Section D) Tailings often contain hazardous substances, such as cyanide used in gold extraction and potentially acid-forming materials.[6] Their uncontrolled release would lead to significant environmental contamination of surrounding rivers, streams, and land, resulting in devastating long-term ecological impacts.[6] Beyond environmental damage, a flow slide of liquefied tailings poses an immediate and direct threat to human life and property. Such flows can travel significant distances, as exemplified by the Mochikoshi dam failure where tailings flowed over 800 meters.[19] This would endanger downstream communities, critical infrastructure, and agricultural land, potentially leading to significant casualties and extensive property damage.[7] The remediation of a large-scale tailings release is an extremely complex, costly, and time-consuming undertaking, often requiring decades and imposing lasting socio-economic burdens on the affected regions.

4.15 Recommendations for Enhanced Seismic Risk Management

To ensure the long-term safety and robustness of the Waihi Tailings Storage Facilities against the full spectrum of credible seismic hazards, particularly from the Hikurangi Subduction Zone, the following recommendations for an enhanced seismic risk management framework are proposed:

4.15.1 Propose a Comprehensive Seismic Hazard Assessment Framework for Waihi TSFs

- **Probabilistic Seismic Hazard Analysis (PSHA):** A site-specific PSHA should be conducted that explicitly includes the Hikurangi Subduction Zone as a major seismic source. This analysis should incorporate the latest research on the HSZ's Mw 9 potential and its diverse slip behaviors.[1] PSHA is essential as it combines contributions from all seismic sources to provide a comprehensive model of the earthquake hazard for the dam site, moving beyond a single deterministic MCE.[21]
- **Scenario-Based Ground Motion Modeling:** Detailed ground motion scenarios for a Mw 9 Hikurangi event at a distance of over 200 km should be developed. These scenarios must focus on ground motion parameters critical for TSF performance, including long-period spectral accelerations, peak ground velocities, and ground displacements, rather than solely peak ground acceleration.[13] This requires the use of advanced ground motion prediction equations (GMPEs) or numerical simulations

specifically calibrated to accurately capture long-period attenuation and the unique characteristics of distant subduction zone earthquakes.[16]

- **Site-Specific Response Analysis:** Comprehensive site response analyses are necessary to quantify the potential amplification of long-period motions by local geological conditions and engineered fill at the Waihi TSF site. This analysis should account for complex 3D basin effects, which can significantly alter the ground motion experienced at the surface.[13]
- **Non-linear Dynamic Analysis (NDA):** Non-linear dynamic analyses should be performed using sophisticated numerical models (e.g., finite element models) with appropriate constitutive models that accurately represent the behaviour of tailings materials under dynamic loading.[7] These analyses should simulate the TSFs' response to the derived long-period, long-duration ground motions, explicitly assessing deformation, pore pressure generation, and liquefaction potential under these specific loading conditions.[8]
- **Liquefaction Vulnerability Assessment:** A thorough and detailed assessment of liquefaction susceptibility is imperative for all potentially liquefiable materials within the TSFs and their foundations. This assessment must consider both the effects of peak shaking and the cumulative effects of long-duration shaking, which are particularly effective at triggering liquefaction.[19] This should include advanced laboratory testing of tailings materials to accurately characterize their dynamic properties.[7]

4.15.2 Emphasise Transparent Reporting and Ongoing Monitoring

4.15.2.1 All methodologies, assumptions, and results of the seismic hazard assessment should be clearly documented and made publicly available. This transparency is crucial for facilitating independent review by experts and fostering confidence among stakeholders and the public.[5] Furthermore, the existing comprehensive monitoring and surveillance program for the TSFs should be continuously maintained and enhanced. This includes integrating real-time data from instrumentation with 3D models to enable proactive risk management, particularly in response to seismic events or heavy rainfall.[5] While Oceana Gold's adoption of digital transformation for tailings management is a positive step [26], its effectiveness is contingent upon being underpinned by a truly robust and comprehensive seismic hazard assessment.

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5. Section C

1 Lessons from the Waitekauri (Golden Cross) Landslide for the Oceana Gold Waihi Tailings Storage Facility Fast Track Application

5.1. Introduction: Informing Critical Infrastructure Decisions

5.1.1. This section aims to extract and articulate essential lessons from the Waitekauri (Golden Cross) landslide, a significant historical event in New Zealand's mining landscape. These lessons are presented to directly inform the Fast-Track Panel's evaluation of the proposed Oceana Gold Waihi Tailings Storage Facility (TSF) expansion, with a particular focus on mitigating the inherent risks of dam breach due to seismic activity and extreme rainfall events.

5.1.1. Tailings storage facilities represent some of the largest engineered structures globally, designed for the long-term containment of vast quantities of mining waste, often requiring integrity "in perpetuity".[1] Despite their critical function, the failure rates of TSFs are notably higher than those of conventional water dams. Global estimates indicate a failure rate of approximately 1.2% for TSFs over the past century, significantly exceeding the 0.01% rate for water retention dams.[2] A substantial majority, over 90%, of these failures are attributed to active tailings dams.[4] This pronounced disparity underscores the imperative for exceptionally robust risk assessment, conservative design, and vigilant management, particularly in regions characterised by high seismicity and intense rainfall, such as the Coromandel Peninsula. The potential for catastrophic environmental damage, loss of life, and immense economic burden resulting from a tailings dam failure necessitates the application of the highest standards of due diligence and engineering practice.[1]

5.2 The Waitekauri (Golden Cross) Landslide: A Foundational Case Study

5.2.2 Historical Overview of Golden Cross Mine and its Tailings Facility

5.2.2.1 The Golden Cross gold mine is situated approximately eight kilometres northwest of Waihi, nestled within the Waitekauri Valley at the base of the Coromandel Peninsula.[9] The mine operated in two distinct phases: an initial period of gold mining activity from 1892/1895 to around 1917, and a more modern operation that commenced in 1991 and concluded in 1998.[10]

5.2.2.2 The geographical and geological setting of the Golden Cross site was a critical factor in its operational challenges. The area is characterised as a "sensitive high rainfall environment".[13] Crucially, the site's stability was significantly complicated by the presence of a "large ancient landslide underlying most of the tailings dam and waste rock".[15] This pre-existing geological instability meant that the tailings dam was constructed on a "slope of precarious stability".[16] The tailings dam itself was a substantial "large earth dam, approximately 70 m high," designed to retain an estimated 1.7 million cubic meters of tailings.[15] The downstream face of this dam was reportedly constructed from potentially acid-producing waste rock, which was encapsulated by a compacted layer of non-acid-producing andesitic material.[13]

5.2.2.3 The local geology of the Golden Cross site is composed of predominantly Miocene to Pliocene age andesitic and rhyolitic volcanics, which form a significant portion of the Coromandel Ranges. Key geological formations present at Golden Cross include the Omahia Andesite and the Union Volcanics. The Omahia Andesite is generally permeable, but exhibits "high permeability contrasts," meaning water flow through it can be highly variable. In contrast, the Union Volcanics are characterized by "high fracture permeability but low storativity," indicating that while water can move through fractures, the rock itself does not store large volumes of water.[15]

5.2.2.4 The repeated emphasis on the "large ancient landslide underlying most of the tailings dam" [15] and the "precarious stability" of the slope [16] points to a fundamental, inherent vulnerability of the site. Constructing a major long-term hydraulic structure like a TSF on such a known, large-scale geological instability introduces an elevated risk profile from the project's inception. This suggests that the initial site selection or the subsequent geotechnical understanding of the deep geological hazards was either insufficient or the long-term implications of building on an ancient landslide were underestimated.

5.2.2.5 The "sensitive high rainfall environment" [13] further exacerbates this, as water ingress directly impacts slope stability by increasing pore pressures. This highlights that for any proposed TSF, site selection and comprehensive pre-construction geological and geotechnical investigations are paramount. These investigations must extend well beyond the immediate dam footprint to thoroughly understand regional geological hazards, including ancient landslides and active fault lines. The principle that "the absence of identified structures in areas that have not been thoroughly investigated should not be used to conclude that structures do not exist" [17] is a critical guiding principle, emphasising the need for proactive, thorough, and potentially advanced investigation techniques to detect hidden geological weaknesses.

5.3 The 1996/1998 Landslide Event and its Immediate Consequences

5.3.1 In 1996, the Golden Cross mine faced a critical situation when a "major landslide under the Golden Cross tailings dam at Waitekauri near Waihi threatened to cause the dam to fail and spill its contents into the valley below". Evidence of ground movement had been observed as early as 1995 and 1996, manifesting as cracking in the shotcrete lining within the Southern Diversion Drain, ground cracking, the development of a tomo (a type of fissure) at the left abutment, and minor seepage zones.[15]

5.3.2 During the most active monitored period in the winter of 1996, recorded movement rates for the Lower Slide areas averaged between 2.8 to 4 mm per day, with daily rates occasionally surging up to 10 mm per day. Movement rates progressively decreased further upslope, indicating a "significant extension" of the landslide mass.[15] The instability was directly attributed to "water pressure" causing the ground beneath the pond to shift.[20] This aligns with the understanding that heavy rainfall is a common trigger for dam slides [21], as increased pore pressures reduce the effective stress and shear strength of the soil.[22]

5.3.3 The severity of the situation escalated to the declaration of a civil defence emergency. Ultimately, the Golden Cross mine was forced to cease operations permanently in 1998, a decision influenced by the landslip and prevailing low gold prices.[9] Coeur d'Alene Mines Corp., the operating company, recorded a substantial $53 million write-down in July 1996, indicating that the problem rendered the mine unprofitable and that the company could not recover its initial investment.[20] The company subsequently incurred nearly $30 million in costs for rectifying the problem.[9]

5.3.3 The direct link between "water pressure" [20] and the ground shift, coupled with the site's "high rainfall environment" [13], clearly establishes a causal relationship between hydrological conditions and geotechnical failure. High rainfall leads to increased pore water pressure, which in turn reduces the effective stress and shear strength of the soil, thereby triggering or reactivating landslides.[22] The pre-existing ancient landslide provided the susceptible failure plane, and water acted as the immediate trigger. The rapid movement rates (up to 10 mm/day) underscore the critical and urgent nature of such hydrological triggers. For the proposed Waihi TSF, this means that even with a seemingly stable foundation, extreme rainfall events pose a direct and severe threat to dam integrity by increasing pore pressures within the tailings and foundation, potentially leading to liquefaction or slope instability. The design must therefore robustly account for Probable Maximum Precipitation (PMP) [26] and its impact on pore water pressures, extending beyond mere dam overtopping prevention.

5.4 Engineering Response and Stabilisation Measures

5.4.1 The stabilisation of the Golden Cross landslide necessitated extensive "major drainage and earthworks".[15] A primary objective of these remedial works was the "lowering of piezometric levels within and around the head of the slide mass".[15] The methods employed to achieve this objective included the installation of "horizontal drainhole fans, pumping wells, and deep-subslide drainage".[15] Significant drainage was successfully achieved by strategically targeting the larger, relatively permeable andesite blocks within the Omahia Andesite geological formation.[15]

5.4.2 In addition to drainage, crack sealing earthworks were undertaken in two main areas of deformation where large cracks, up to 300 mm wide, had developed. The purpose of these works was to limit the ingress of surface runoff into the slide mass, thereby reducing the impact of rainstorm events by preventing the pressurization of tension cracks within the slide.[15]

5.4.3 Furthermore, the Tailings Storage Facility (TSF) itself was reconfigured as a wetland. This involved draining and rerouting water away from the TSF structure and planting native riparian vegetation.[11] This reconfiguration plan was initially part of the long-term post-closure strategy but its implementation was accelerated and brought forward due to the immediate instability of the dam.[11].

5.4.4 The extensive and costly stabilisation efforts at Golden Cross (exceeding $30 million) [9] were a reactive response to an existing catastrophic instability. The primary focus was on managing water (drainage, crack sealing, rerouting) and reconfiguring the TSF, essentially accelerating the planned closure. While these measures appear to have successfully stabilised the landslide at this time [15], this highlights the immense financial and operational burden of addressing a failure *after* it has occurred. The fact that the initial wetland reconfiguration plan was "brought forward" due to instability [11] underscores the reactive nature of the crisis management. For Oceana Gold at Waihi, this case study underscores the critical economic and safety imperative of *proactive*, highly conservative design and construction. Investing significantly in comprehensive geotechnical and hydrological studies, and incorporating robust, redundant drainage and stability measures *during* the initial design and construction phases, is demonstrably more cost-effective and safer in the long run than reacting to a catastrophic event.

5.5 Table 1: Chronology and Key Characteristics of the Golden Cross Landslide (1996-1998) and Stabilization Measures

Feature / Event	Description / Data	Source Snippets
Mine Operation Period (Modern)	1991-1998	10

Location	Waitekauri Valley, Coromandel Peninsula, 8 km NW of Waihi	9
Tailings Volume Retained	~1.7 million cubic meters	15
Dam Height	~70 meters	13
Key Geological Features	Underlain by a large ancient landslide; Omahia Andesite (permeable with high contrasts), Union Volcanics (high fracture permeability, low storativity)	15
Environmental Context	High rainfall environment, sensitive site	13
Triggering Event (1996)	Water pressure causing ground shift, exacerbated by high rainfall on a precariously stable slope	13
Landslide Movement Rates (Winter 1996)	Averaged 2.8-4 mm/day, up to 10 mm/day at times	15
Emergency Declared	Civil Defence Emergency	
Mine Status Post-Event	Forced permanent closure	9

Stabilization Costs	Over $30 million	[9]
Key Stabilization Methods	Major drainage (horizontal drainhole fans, pumping wells, deep-subslide drainage), crack sealing earthworks, water rerouting, TSF reconfiguration to wetland	[11]
Long-term Movement Post-Stabilization (Post-2001)	Reduced to 1.1-2.3 mm/yr	[15]

5.6 Critical Lessons Learned from Golden Cross for Tailings Dam Safety

5.6.1 The Paramountcy of Geotechnical Site Characterisation and Foundation Stability

5.6.1.1 The Golden Cross TSF was constructed on a site characterised by a "large ancient landslide" [15], inherently a "slope of precarious stability".[16] This pre-existing geological vulnerability meant the site was predisposed to instability from its inception. The underlying geological units, such as the Omahia Andesite and Union Volcanics, exhibit complex permeability characteristics.[15] While the Omahia Andesite is generally permeable, it possesses "high permeability contrasts," and the Union Volcanics are noted for "high fracture permeability but low storativity".[15] Such complexities can lead to unpredictable water flow patterns and localized pressure build-up within the ground.

5.6.1.2 General geotechnical principles affirm that the installation of a dam on a precariously stable slope can either initiate a new landslide or reactivate old failure surfaces.[16] Furthermore, insufficient bearing capacity of the underlying soil can precipitate critical failures, including punching shear or rotational shear failures.[16] The foundational problem at Golden Cross was not merely a design flaw of the dam itself, but the selection of a site with a pre-existing, large-scale ancient landslide.[15] This implies that the initial geological assessment either failed to fully identify the extent of this latent hazard or underestimated its long-term implications, especially when combined with the complex hydrogeological properties of the underlying rock. Landslides, particularly ancient ones, can be reactivated by changes in pore pressure or loading.[16]

5.6.1.2 This necessitates an approach that extends beyond standard geotechnical investigations focused solely on the dam footprint; it demands a comprehensive, regional understanding of rainfall patterns (both present and future projections due to climate change), geomorphology, historical geological processes, and deep subsurface conditions. The principle that "the absence of identified structures in areas that have not been thoroughly investigated should not be used to conclude that structures do not exist" [17] is a critical cautionary principle in this context. For the proposed Waihi TSF, this means geotechnical investigations must not only assess the immediate foundation of the dam but also conduct extensive regional studies. These studies must thoroughly identify any underlying ancient or active landslide features, previously unmapped fault lines, or complex hydrogeological conditions that could compromise long-term stability. This necessitates the use of advanced investigation techniques, such as high-resolution seismic imaging [27], to detect and characterize hidden geological weaknesses that traditional methods might miss.

5.6.2 Hydrological Vulnerability and Water Management

5.6.2.1 The Golden Cross site is situated in a "high rainfall environment" [13], a factor that proved pivotal in triggering the 1996 landslide. The instability was directly caused by "water pressure" shifting the ground beneath the dam.[20] This observation is consistent with global trends, where intense rainfall events are a significant trigger for tailings dam failures, with statistical studies indicating a concerning increase in such failures from 25% before 2000 to 40% after 2000.[29] This trend highlights a growing concern regarding hydrological risk in a changing climate.

5.6.2.2 The fundamental geotechnical mechanism at play is that increased water content leads to a rise in pore water pressure within the soil. This rise in pore pressure, in turn, reduces the effective stress and shear strength of the soil, making it highly susceptible to instability and liquefaction.[22] Tailings materials, due to their fine composition and inherently low hydraulic conductivity, consolidate slowly. This characteristic allows excess pore pressures to continuously build up within the dam, particularly in zones containing finer-grained "slimes".[22] The successful stabilisation of the Golden Cross landslide relied heavily on "major drainage works" and "crack sealing earthworks," specifically designed to limit surface runoff ingress and actively lower piezometric levels within the landslide mass.[15]

5.6.2.3 The observed global increase in tailings dam failures due to intense rainfall [29] is a critical trend. While the available information does not explicitly state climate change as the sole cause, the focus on "extreme rainfall event" aligns with projected climate change impacts, suggesting that historical rainfall data alone may no longer be sufficient for future risk assessment. The Golden Cross experience vividly demonstrates how water pressure, driven by high rainfall, can directly cause ground shift and instability.[20] This underscores that even with robust dam structures, inadequate water management can lead to catastrophic failure. The effectiveness of drainage systems [29] is paramount to regulating pore pressure and minimizing liquefaction risk.[29] Therefore, the design of the Waihi TSF must incorporate the most recent climate change projections for increased frequency and intensity of extreme rainfall events, not just historical averages. This necessitates more conservative estimates for Probable Maximum Precipitation (PMP) [26] and the implementation of robust, redundant, and continuously monitored surface water diversion and internal drainage systems capable of handling unprecedented volumes of water. The design must demonstrate how these systems will effectively maintain pore pressures below critical levels, especially in fine-grained tailings which retain water and consolidate slowly.

5.6.3 Seismic Hazard and Liquefaction Susceptibility

5.6.3.1 Tailings dams are intrinsically more susceptible to failure than conventional water dams, exhibiting a failure rate that is two orders of magnitude higher.[2] A major contributing factor to this elevated failure rate is seismic vulnerability, particularly the phenomenon of liquefaction. Tailings dams, especially those constructed using the upstream method, are highly prone to liquefaction-induced failures during seismic events.[2] Liquefaction occurs when the strength and stiffness of saturated soil abruptly drop to near zero as pore water pressure rapidly rises, causing the soil to behave like a heavy liquid.[23]

5.6.3.2 The 2015 Fundão dam collapse in Brazil serves as a critical modern case study that profoundly challenges traditional seismic design paradigms. This catastrophic event was preceded by *very small-magnitude earthquakes* (Mw 2.0-2.6) which acted as a "triggering mechanism" for a "liquefaction flow slide". This incident occurred despite the small magnitude of the seismic events, contradicting the long-held assumption that only larger quakes (e.g., above Mw 4.5) [32] pose a significant liquefaction risk. The Fundão dam was however an upstream-constructed facility, a method inherently prone to such failures.[31]

5.6.3.3 For the Waihi region, the seismic hazard should be significantly re-evaluated. (see Sections A and B) The Kerepehi Fault is an active normal fault capable of generating characteristic earthquakes ranging from Mw 5.5 to 7.0 for a single segment rupture, and potentially up to Mw 7.2-7.4 if all onshore segments rupture simultaneously.[33]

5.6.3.4 Furthermore, the Hikurangi Subduction Zone, located off the East Coast of the North Island, is identified as potentially the largest source of earthquake and tsunami hazard in New Zealand. This zone has the capacity to produce large (M > 7) to great (M > 8) "megathrust" earthquakes.[34] While "slow slip events" on this zone are not felt at the surface, they can trigger small earthquakes and are driven by the same underlying forces as large, damaging seismic events.[34]

5.6.4 The "Perfect Storm" Scenario: Compounding Natural Hazards

5.6.4.1 A critical concern is the potential for a "high-intensity tropical storm" to saturate the tailings, which, if followed quickly by an earthquake, could create a "liquefaction flow slide – a 'perfect storm'". This concept highlights a critical failure pathway where the interaction of multiple natural hazards creates a risk significantly greater than the sum of its individual parts. General understanding of earthquake impacts suggests that their consequences are amplified if communities or infrastructure are already under stress from climate change-exacerbated events such as drought and flooding.[37] The Kaikoura earthquake, which unleashed thousands of landslides, provides a stark example of the vulnerability of saturated slopes to seismic triggers.

5.6.4.2 The "perfect storm" concept is not merely a hypothetical worst-case; it represents a critical failure pathway where the interaction of multiple natural hazards creates a risk significantly greater than the sum of its parts. Individual hazard assessments (e.g., for earthquake, for rainfall) are insufficient if they do not account for their compounding effects. Extreme rainfall can lead to saturation of tailings, increasing pore pressure and reducing shear strength. A subsequent earthquake, even a small one, can then trigger liquefaction in these already weakened, saturated materials. This is a synergistic effect where one condition (saturation) dramatically amplifies the destructive potential of another (seismic shaking).

5.6.4.3 Therefore, Waihi's TSF design and risk assessment must explicitly model *cascading failure scenarios* where extreme rainfall amplified by more intense events due to climate change and seismic events occur in close temporal proximity. This requires advanced, integrated hydrogeological and geotechnical modeling that captures the dynamic changes in tailings properties (e.g., saturation, pore pressure) due to rainfall and then assesses the seismic response under those altered, more vulnerable conditions. This integrated approach is vital for true resilience.

5.6.5 Long-Term Environmental and Financial Liabilities

5.6.5.1 Tailings dams are unique structures that "must stand in perpetuity" [1], meaning their structural and environmental integrity must be maintained indefinitely, long after mining operations cease. The failure of these dams invariably leads to "long-term environmental damage with huge cleanup costs".[1] (see Section D) Tailings are not inert materials; they are "potentially toxic" [7] and frequently contain hazardous substances, including heavy metals and beneficiation agents.[3]

5.6.5.2 Contamination of surrounding soil, surface water, and groundwater represents a major and persistent risk.[39] Once contaminants migrate through the unsaturated zone into the groundwater zone, their rate of lateral movement increases by orders of magnitude, significantly extending the potential environmental impact spatially and temporally.[40] Acid Mine Drainage (AMD), a common pollutant from tailings dams, is caused by the oxidation of sulphide-bearing rock and can be enhanced by biological processes. This AMD can continue to adversely affect the environment for "hundreds of years".[41]

5.6.6.3 The Golden Cross case specifically highlighted deficiencies in financial provisioning for long-term liabilities. The mine's environmental bond was believed to be $12 million , yet the actual stabilisation costs exceeded $30 million.[9] This significant disparity strongly implies that taxpayers would likely bear most of the costs of a future failure. In New Zealand, the responsibility for long-term maintenance and damage repair following the expiry of water rights is "not prescribed by law" [41], meaning abandoned sites may, by default, become the responsibility of the Crown.[41] Furthermore, tailings can take "tens of years after mine closure to consolidate" [41], extending the period of vulnerability and the need for active management.

5.6.6.4 The concept of "perpetuity" for TSFs [1] combined with the multi-century duration of some environmental impacts like AMD [41] and the slow consolidation of tailings (tens of years) [41] reveals a profound intergenerational liability. The financial bond for Golden Cross ($12M) was clearly insufficient for the actual stabilization costs ($30M) [9], demonstrating a systemic underestimation of long-term liabilities. The absence of clear legal responsibility for post-closure maintenance in New Zealand [41] means that society, rather than the mining company, bears the ultimate, potentially perpetual, cost and risk. This implies that current financial and legal frameworks are grossly inadequate for the scale and duration of the environmental threat.

5.7 Application to Oceana Gold's Waihi Tailings Storage Facility and Future Planning

Updated Seismic Risk for Waihi (See Sections A and B)

5.7.1 Extreme Rainfall and Liquefaction Potential at Waihi

5.7.1.1 The Waihi TSF is designed to contain a 1200 mm rainstorm (Probable Maximum Precipitation, PMP) plus an additional 1.0 meter minimum freeboard [26], indicating that consideration has been given to extreme rainfall events. Tailings are pumped as a slurry into the impoundments [26], a deposition method that makes them potentially susceptible to seismic or flow liquefaction unless adequately compacted, consolidated, and desiccated.[2] While specific geotechnical properties of Waihi tailings are not detailed in all available information, general tailings characteristics often include fine-grained materials such as "silty clay material" with "low plasticity" [21], which are known to be prone to liquefaction. Tailings also typically exhibit low density and low shear modulus, contributing to a long natural vibration period of the dam body, which can increase their susceptibility to seismic liquefaction.[5]

5.7.1.2 Waihi's TSF employs various drainage systems, including underdrains beneath the tailings, an upstream cutoff drain, initial and downstream toe drains, gully subsoil drains, and leachate collection drains. Diversion drains are also in place to intercept clean surface runoff from adjacent hillsides.[26] Monitoring activities include measurements of supernatant decant pond water volumes and levels, as well as freeboard.[42]

5.7.1.3 While Waihi's TSF design includes provisions for Probable Maximum Precipitation [26], the Golden Cross experience [20] and broader literature [22] demonstrate that high rainfall can still lead to instability by increasing pore pressures and reducing effective stress, especially in fine-grained, low-permeability tailings. The effectiveness of drainage systems [29] is critical, but tailings' slow consolidation and low hydraulic conductivity [22] mean that excess pore pressures can accumulate. The presence of "silty clay material" [21] and "low plasticity" further suggests inherent liquefaction susceptibility.[23] The "residual level of saturation" [1] in tailings, even in "free draining" dams, can still lead to liquefaction if triggered. The Fast-Track Panel needs robust assurance that Waihi's drainage systems are not only designed for PMP but are demonstrably *effective* in actively maintaining pore pressures below critical levels under extreme rainfall conditions projected to become even more extreme under the most recent climate change projections, particularly given the specific characteristics of the Waihi tailings. This requires detailed and dynamic modeling of drainage efficiency and its impact on stability [29], moving beyond static design considerations to a continuous, performance-based assessment.

5.8 Enhancing Long-Term Stability and Oversight

5.8.1 Oceana Gold reports a "comprehensive monitoring and surveillance program" for its existing Storage 1A and 2, which is detailed in an Operations, Maintenance and Surveillance Manual.[42] This manual is regularly updated to comply with New Zealand Dam Safety Guidelines (NZDSG), with further updates scheduled for 2024.[42] Monitoring activities include visual inspections, measurements of supernatant decant pond water volumes and levels, freeboard measurements, and oversight of materials and construction standards.[42] The data collected from this program is provided annually to the Waikato Regional Council and Hauraki District Council and undergoes independent peer review by a Peer Review Panel (PRP) engaged by Oceana Gold.[42]

5.8.2 Oceana Gold is also actively piloting a "digital twin" technology for proactive monitoring of slope stability at Waihi. This advanced system integrates vast amounts of siloed data, including sensor readings and real-time Internet of Things (IoT) data, to provide critical insights into core pressure and groundwater levels. This allows for dynamic risk management and proactive action following events such as significant rainfall.[43] The digital twin system also facilitates easy access to historical models and audit trails, enhancing transparency and accountability.[43]

5.8.3 Globally, the mining industry, through organizations like the International Council on Mining and Metals (ICMM), has developed updated guidance (published in 2025) on tailings management and closure. This guidance emphasizes early planning, strong governance, and progressive closure activities to ensure long-term stability. ICMM members are committed to implementing the Global Industry Standard on Tailings Management (GISTM) -- but has Oceana Gold confirmed membership of ICMM and adherence to the guidelines? .[44]

5.8.4 Despite these advancements global statistics consistently show that tailings dam failures continue to occur at a relatively constant rate. These failures are often linked to "apparent deficiencies in design, operation and management which are repeated".[1] Human error is also acknowledged as a contributing factor in these incidents.[6] A key point of contention locally regarding the Waihi operations is the independence of the peer review process. While Waikato Regional Council staff express confidence in the current annual peer review, critics advocate for a truly independent review, arguing that it should not be appointed by the company itself.

5.8.5 The broader literature consistently highlights that even with "improved technology for design, construction and operation," tailings dam failures still occur due to "apparent deficiencies in design, operation and management which are repeated".[1] This suggests a critical gap between documented procedures and actual, demonstrable resilience, potentially stemming from human error, the protracted nature of TSF construction over multiple staff/ownership changes, or a focus on compliance rather than genuine, proactive risk mitigation. The call for *independent* peer review directly addresses this potential for unconscious bias or conflict of interest in assessments.

5.9 Table 2: Key Risk Factors and Mitigation Strategies: Golden Cross Lessons Applied to Waihi TSF

Risk Factor (from Golden Cross)	Lesson Learned (from Golden Cross)	Application/Mitigation Strategy for Waihi TSF
Construction on Ancient Landslide / Precarious Slope [15]	Thorough, regional geotechnical investigation is essential to identify and characterise all deep-seated geological vulnerabilities.	Mandate comprehensive, independent deep-seated geological/geotechnical surveys for all TSF footprints, extending beyond immediate dam area.
High Rainfall / Water Pressure Buildup [13]	Robust, active water management is critical to control pore pressure and prevent instability, especially in high rainfall environments.	Require integrated hydrogeological modeling for extreme rainfall events (including most recent climate change projections) and robust, redundant drainage systems to maintain critical pore pressure levels.

Liquefaction Susceptibility [2]	Tailings liquefaction potential must be rigorously assessed for all seismic events, regardless of magnitude.	Demand updated liquefaction analyses for all TSFs, considering the full spectrum of seismic events from very small to large, and their specific impacts on saturated tailings.
Small-Magnitude Earthquake Trigger (Brazil case, relevant for Waihi)	Very small, proximal earthquakes can be catastrophic triggers for liquefaction flow slides in susceptible dams.	Explicitly model and mitigate risks from low-magnitude, high-frequency, proximal seismic triggers in design and operational protocols.
Inadequate Long-Term Financial/Legal Provisions	Perpetual financial and legal provisions are non-negotiable for TSFs, covering indefinite environmental and social liabilities.	Require robust, periodically reviewed financial bonds and legal frameworks that genuinely cover the perpetual environmental and social liabilities of the TSF, preventing taxpayer burden.

5.10 Recommendations for the Fast-Track Panel's Decision-Making

Based on the critical lessons derived from the Waitekauri (Golden Cross) landslide and the broader understanding of tailings dam safety, the following recommendations are put forth for the Fast-Track Panel's consideration regarding the Oceana Gold Waihi application:

5.10.1 Recommendation 1: Mandate a Comprehensive, Independent Seismic Re-assessment

The Panel must require an immediate, comprehensive, and *independent* seismic hazard assessment for *all* Waihi TSFs (existing Storage 1A, 2, and proposed Storage 3). This assessment must fully integrate the latest peer reviewed studies on the Kerepehi / Te Puninga fault (see Sections A and B). It must also account for the potential for large "megathrust" earthquakes (M>7-8) from the Hikurangi Subduction Zone, identified as New Zealand's largest source of earthquake and tsunami hazard. (see Section B) [34] Crucially, the re-assessment must explicitly model and address liquefaction potential under these revised seismic parameters, including the impact of *small-magnitude, proximal earthquakes* (Mw 2.0-2.6) as demonstrated by the 2015 Brazil dam collapse. The review must be conducted by experts *not* appointed by Oceana Gold to ensure complete impartiality and avoid any perceived conflict of interest. This recommendation directly addresses the core contradiction identified: the existing Waihi TSF design relies on outdated seismic data, while new scientific understanding significantly increases the perceived hazard for the region. This is not a static risk; it dynamically evolves with new scientific insights. The emphasis on *independence* for the re-assessment is crucial to overcome potential biases inherent in company-appointed reviews. Regulatory bodies must establish robust mechanisms for continuous, mandatory re-evaluation of seismic hazards for critical infrastructure, ensuring that designs are updated to reflect the latest scientific understanding. This includes considering the full spectrum of potential seismic events, from frequent small tremors to less frequent large quakes, and their combined effects.

5.10.2 Recommendation 2: Require Robust Hydrogeological and Geotechnical Due Diligence

The Panel should insist on an independent, in-depth review of the Waihi TSF's foundation stability, internal drainage systems, and pore pressure management strategies. This review must specifically assess the dam's performance under *combined extreme rainfall and seismic scenarios*, explicitly modeling the "perfect storm" potential where saturated tailings are subjected to earthquake shaking. It should verify the effectiveness of the drainage systems in actively maintaining pore pressures below critical levels, particularly given the specific geotechnical properties of Waihi tailings (e.g., silty clay, low plasticity) [21] and the likelihood of a "residual level of saturation".[1] The Golden Cross landslide was fundamentally a hydrogeological failure exacerbated by pre-existing instability.[15] The global trend of increased rainfall-induced failures [29] reinforces the escalating nature of this risk. Therefore, assessing hydrological and seismic hazards in isolation is insufficient. The synergistic interaction between water saturation (from extreme rainfall) and seismic shaking (triggering liquefaction) represents a critical and potentially catastrophic failure pathway that must be explicitly modeled and mitigated. Integrated hazard modeling, which considers the compounding and cascading effects of multiple natural phenomena, should become a mandatory standard requirement for TSF design and risk assessment. This moves beyond siloed analyses to a holistic understanding of system vulnerability.

5.10.3 Recommendation 3: Strengthen Independent Oversight and Regulatory Frameworks

To ensure the highest level of safety and public confidence, all TSF design, construction, operation, and monitoring data, including the output from Oceana Gold's digital twin system, must be subject to continuous, *truly independent* peer review. This means that the Peer Review Panel (PRP) should be engaged and directly accountable to the regulatory authority (e.g., Waikato Regional Council, Hauraki District Council), rather than being appointed by Oceana Gold. Clear, legally binding mechanisms for regulatory intervention, based on identified risks from these independent reviews, must be established, enforced, and publicly transparent. While Oceana Gold's internal monitoring and adoption of advanced technologies like digital twins [43] are positive, the ultimate responsibility for public and environmental safety rests with the regulators. A peer review panel engaged directly by the company, no matter how competent, can be perceived as lacking full independence, potentially leading to less conservative assessments or slower adoption of new scientific findings. True independence fosters public trust and ensures a more critical, unbiased assessment of risk. Regulatory frameworks for high-hazard facilities must mandate independent oversight at all stages, from initial design through to post-closure. This independence should extend to the appointment and reporting lines of review panels, ensuring that their primary accountability is to the public interest and safety, rather than the project proponent's commercial objectives.

5.10.4 Recommendation 4: Secure Perpetual Financial and Legal Provisions

The Panel must require robust financial bonds and legal frameworks that explicitly cover the *perpetual* environmental and social liabilities of the Waihi TSF, extending indefinitely beyond mine closure. This provision must realistically account for the long-term nature of tailings consolidation (tens of years) and the potential for Acid Mine Drainage (AMD) generation (hundreds of years).[41] The bond amount must be periodically reviewed and adjusted to reflect the true, evolving costs of potential long-term failures, ensuring that the taxpayer is not burdened with the financial consequences of a future incident. The concept of "perpetuity" for TSFs [1] combined with the multi-century duration of some environmental impacts like AMD [41] and the slow consolidation of tailings (tens of years) [41] reveals a profound intergenerational liability. The financial bond for Golden Cross ($12M) was clearly insufficient for the actual stabilization costs ($30M) [9], demonstrating a systemic underestimation of long-term liabilities. The absence of clear legal responsibility for post-closure maintenance in New Zealand [41] means that society, rather than the mining company, bears the ultimate, potentially perpetual, cost and risk. This implies that current financial and legal frameworks are grossly inadequate for the scale and duration of the environmental threat.

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6 Section D

Environmental and Socio-Economic Impacts Downstream of Paeroa of a Tailings Dam Breach

6.1 Executive Summary

6.1.1 Oceana Gold's dam breach assessment for the proposed Storage 3 Tailings Storage Facility (TSF) at Waihi identifies "catastrophic" impacts on major infrastructure and the natural environment up to the town of Paeroa, leading to a "High Potential Impact Classification". However, the study's critical limitation lies in its termination of flood routing and impact assessment immediately downstream of the Ohinemuri River's confluence with the Waihou River. This omission leaves unaddressed the potential for widespread, long-term ecological and socio-economic devastation to the Waihou River, the already degraded Firth of Thames, and the ecologically sensitive Hauraki Gulf. Drawing parallels with the catastrophic 2015 Fundão tailings dam breach in Brazil, which saw toxic tailings travel hundreds of kilometers to the Atlantic Ocean, causing profound river and marine ecosystem collapse and severe socio-economic disruption, it is evident that a comprehensive "source-to-sea" assessment is imperative for a project of this scale. The current assessment, by failing to model and evaluate these downstream and marine impacts, does not meet contemporary best practice for robust environmental risk assessment for large-scale tailings facilities.

6.2 Introduction

6.2.1 The responsible management of mining tailings, particularly in seismically active and high-rainfall regions, demands an exhaustive understanding of potential failure consequences. This critique focuses on the environmental, social, and economic impact assessment presented by Oceana Gold for a hypothetical breach of its Storage 3 TSF. This review specifically evaluates the robustness of the study's conclusions, considering its geographical scope and drawing upon critical lessons from international tailings dam failures, such as the Fundão disaster in Brazil. The objective is to ascertain whether the presented assessment adequately captures the full spectrum of risks to the Ohinemuri River, its tributaries, the Waihou River, the Firth of Thames, and the wider Hauraki Gulf marine environment.

6.3 Review of Oceana Gold's Dam Breach Assessment: Scope and Findings

6.3.1 Oceana Gold's assessment correctly identifies the Ohinemuri River and its tributaries, including the Ruahorehore Stream, as the primary receiving watercourses for a potential tailings dam breach. The report models both "Sunny Day" (normal conditions) and "Rainy Day" (extreme rainfall, 1-in-1000 year flood) breach scenarios, concluding that the "Rainy Day" scenario presents the maximum incremental consequences. Under this scenario, the assessment projects "catastrophic" impacts on major infrastructure and the natural environment, and "major" impacts on residential dwellings and community recovery time, which is assessed in "years". Specifically, it anticipates:

- **Inundation:** Overtopping of stopbanks in Paeroa, leading to shallow flooding, and incremental flooding along the Ruahorehore Stream, Ohinemuri River flood channel, southern Waihi township, Karangahake Gorge, and adjacent farmland.
- **Infrastructure Damage:** Significant damage to Storage 3 itself (over a year for repair), potential destruction of Baxter Road Bridge, Waikino Railway Bridge, and Waitawheta Road Bridge, and significant damage to sections of State Highway 2 (SH2). Localised overtopping and erosion of Ohinemuri River stopbanks near Paeroa are also anticipated.
- **Natural Environment:** "Major" and "catastrophic" incremental impact on the natural environment, requiring costly and time-consuming restoration of the Ohinemuri River, adjacent farmland, and Ruahorehore Stream. The impacted area is noted to be significantly wider than a "Sunny Day" breach, including Gilmour Reserve and 20 hectares in Paeroa township.
- **Social, Cultural, and Economic Impacts:** Damage to the Karangahake Gorge Historical Walkway (tourism impacts), significant cultural impact for Māori due to water contamination (water as a taonga), and major economic impacts for OGNZL, employees, and the Waihi community due to potential cessation or reduction in mining. Farms using Ohinemuri River water for irrigation would also face economic effects.

6.3.2 While these findings are stark and deemed “catastrophic”, the fundamental flaw in the assessment's robustness lies in its geographical boundary. The report explicitly states that its flood routing model is "terminated immediately upstream of the confluence of the Ohinemuri River and Waihou River". This means that the potential impacts on the Waihou River, the Firth of Thames, and the wider Hauraki Gulf marine environment are not quantitatively assessed or even qualitatively discussed in detail.

6.4 The Critical Omission: Downstream Ecological and Socio-Economic Impacts Beyond Paeroa

6.4.1 The Ohinemuri River flows directly into the Waihou River, which then discharges into the Firth of Thames. The Firth of Thames is already recognized by the Waikato Regional Council as a "degraded water body." This critical hydrological connection means that any tailings breach, even if its immediate catastrophic physical impacts are contained to Paeroa, would inevitably transport a massve volume of sediment and toxic contaminants further downstream into these sensitive river, estuarine and marine environments.

The absence of detailed assessment for these downstream areas represents a profound gap in the study's robustness:

6.4.2 **Ecological Impacts on Waihou River and Firth of Thames:** The Waihou River, as a major conduit, would experience severe sedimentation, altering its morphology, smothering benthic habitats, and impacting fish and invertebrate populations. Upon reaching the Firth of Thames, the fine-grained tailings, potentially containing acid-forming materials and mobilized heavy metals (as the ore is noted to contain PAF material), would introduce chronic pollution. This could lead to:

- **Smothering:** Direct physical smothering of seagrass beds, shellfish beds, and other critical intertidal and subtidal habitats.
- **Turbidity:** Prolonged high turbidity, reducing light penetration and impacting photosynthetic organisms at the base of the food web.
- **Contamination:** Bioaccumulation and biomagnification of heavy metals (e.g., arsenic, lead, mercury, chromium, nickel, manganese, as seen in other tailings disasters) within the food chain, threatening fish, shellfish, and marine mammals.
- **Ecosystem Collapse:** Disruption of delicate estuarine and marine food webs, potentially leading to localized or widespread ecosystem collapse, especially given the existing degraded status of the Firth.

6.4.3 **Impacts on Hauraki Gulf Marine Environment:** The Hauraki Gulf, a significant marine protected area and a vital ecological and economic asset, is the ultimate recipient of waters from the Firth of Thames. The long-distance transport of fine tailings particles and dissolved contaminants could extend impacts far into the Gulf, affecting:

- **Biodiversity Hotspots:** The RAMSAR reserve of international significance in the southern Firth of Thames, sensitive habitats like sea grass, sponge gardens, and fish spawning grounds.
- **Endangered Species:** Threatening endangered marine species through habitat degradation and bioaccumulation.

6.4.4 **Socio-Economic Impacts:** The unassessed downstream impacts would have severe socio-economic consequences:

- **Fisheries:** Collapse of commercial and recreational fisheries in the Waihou River, Firth of Thames, and potentially parts of the Hauraki Gulf due to habitat destruction, fish die-offs, and contamination, leading to significant livelihood losses.
- **Aquaculture:** Impacts on aquaculture operations (e.g., mussel farms and fish farming) within the Firth of Thames and Hauraki Gulf.
- **Tourism and Recreation:** Damage to coastal tourism and recreational activities (boating, swimming, birdwatching) due to pollution and aesthetic degradation.
- **Cultural Values:** Further profound impacts on Māori cultural values, as the marine environment is deeply intertwined with their identity, traditional practices, and spiritual well-being.

6.4.5 Oceana Gold's assessment of a 1-in-1,000 year dam breach at Waihi forecasts "catastrophic" impacts on infrastructure and environment, with "major" residential damage and multi-year recovery, including 200 people at risk and two potential fatalities.[1] Crucially, this analysis largely omits downstream impacts on the Waihou River, Firth of Thames, and Hauraki Gulf. The 2015 Fundão disaster in Brazil, where toxic tailings traveled hundreds of kilometers, devastated marine ecosystems and affected 1.6 million people, leading to a $32 billion settlement.

6.4.6 A Waihi breach reaching the Hauraki Gulf could trigger comparable, unquantified costs. This would likely exceed New Zealand's costliest natural disasters, such as the combined Cyclone Gabrielle and Auckland Anniversary floods ($9-14.5 billion), representing an unprecedented environmental and socio-economic catastrophe for the nation with costs and recovery timelines likely eclipsing previous national disasters.

6.5 Lessons from the Fundão Tailings Dam Breach, Brazil

6.5.1 The 2015 Fundão tailings dam breach in Mariana, Brazil, serves as a stark, real-world illustration of the devastating, far-reaching consequences of a tailings dam failure that extends into marine environments. This disaster provides critical insights into the potential scale of unassessed impacts for the Waihi operation:

- **Massive Release and Riparian Devastation:** The Fundão dam released an estimated 43.7 to 62 million m^3 of toxic tailings. This torrential flood engulfed villages, destroyed hundreds of buildings, and obliterated 1,469 hectares of forest along 77 km of waterways.
- **Widespread Contamination:** The toxic sediment carried heavy metals, including arsenic, lead, mercury, chromium, nickel, and manganese. Concentrations in water, sediments, fish, and shrimp exceeded safety limits by dozens or even hundreds of times.
- **Riverine and Marine Ecological Catastrophe:** The plume traveled over 650 to 700 km downstream, reaching the Atlantic coast. It caused massive fish die-offs (14 tons in freshwater, nearly 29,000 carcasses near the ocean) and polluted estuaries, reefs, and marine protected areas, including the highly biodiverse Abrolhos National Marine Park. Marine impacts included the smothering of coral reefs, seagrass beds, and benthic organisms by iron-rich sediment, increased turbidity, and bioaccumulation threatening higher trophic levels and endangered species. Scientists warned that recovery could take decades.
- **Profound Socio-Economic Disruption:** The disaster triggered a water crisis for over 250,000 residents, led to the collapse of fishing communities' livelihoods, and affected more than 1.6 million people socially and economically. The owners faced a $US 32 billion settlement for environmental restoration and social compensation.
- **Protracted Recovery:** Environmental recovery has been slow, hindered by persistent heavy metals and altered river morphology, with full restoration potentially taking generations.

6.5.2 While the volume of tailings at Waihi (e.g., 1.976 Mm^3 for a Rainy Day breach) is smaller than Fundão, the *nature* of the potential contaminants (PAF material) and the *pathway* to a sensitive marine environment (Firth of Thames, Hauraki Gulf) are strikingly similar. The Fundão disaster unequivocally demonstrates that the impacts of a tailings breach are not confined to the immediate downstream river sections but can extend hundreds of kilometers, causing profound and long-lasting damage to marine ecosystems and the communities reliant upon them.

6.5.3 Oceana Gold's assessment of a 1-in-1,000 year dam breach at Waihi forecasts "catastrophic" impacts on infrastructure and environment, with "major" residential damage and multi-year recovery, including 200 people at risk and two potential fatalities.[1]. The 2015 Fundão disaster in Brazil, where toxic tailings traveled hundreds of kilometers, devastated marine ecosystems and affected 1.6 million people, leading to a $US 32 billion settlement. A Waihi breach reaching the Hauraki Gulf could trigger comparable, unquantified costs. This would likely exceed New Zealand's costliest natural disasters, such as the combined Cyclone Gabrielle and Auckland Anniversary floods ($9-14.5 billion), representing an unprecedented environmental and socio-economic catastrophe for the nation with costs and recovery timelines likely eclipsing previous national disasters.

6.6 Robustness of the Study and Best Practice

6.6.1 Given the lessons from Fundão and the direct hydrological connection to the Waihou River, Firth of Thames, and Hauraki Gulf, Oceana Gold's current dam breach assessment is not robust. Best practice for assessing the environmental and socio-economic risks of critical infrastructure like tailings dams demands a comprehensive "source-to-sea" or "source-to-receptor" analysis. This includes:

- **Full Hydrological Modeling:** The modeling should extend to the ultimate receiving waters, accurately simulating the transport and dispersion of tailings and associated contaminants throughout the entire river and marine system.
- **Detailed Ecological Risk Assessment:** This must go beyond general statements of "significant but recoverable" damage to include specific assessments of impacts on marine flora and fauna, benthic communities, and sensitive habitats within the Firth of Thames and Hauraki Gulf. This requires baseline ecological data for these areas.
- **Contaminant Transport and Fate:** A thorough analysis of the potential for heavy metal mobilisation from the tailings (noted to be PAF) and their transport, deposition, and bioaccumulation in the marine environment is essential.
- **Long-Term Recovery Projections:** Realistic projections for environmental recovery, acknowledging that full restoration of complex marine ecosystems can take decades or even generations, as demonstrated by Fundão.
- **Comprehensive Socio-Economic Impact Assessment:** A detailed evaluation of the impacts on all affected stakeholders, including commercial and recreational fisheries, tourism, and Māori cultural values, extending to the marine environment.

6.6.2 The current assessment, by terminating its modeling at Paeroa, implicitly dismisses the potential for significant impacts on these critical downstream environments. This approach is inconsistent with the scale of potential consequences and falls short of the rigorous standards required for a project with a "High Potential Impact Classification."

6.7 Conclusions and Recommendations

6.7.1 The assessment of a tailings dam breach is fundamentally incomplete and therefore not robust. The failure to model and assess the consequences beyond Paeroa, particularly for the Waihou River, the Firth of Thames, and the Hauraki Gulf, represents a critical oversight. The catastrophic and far-reaching impacts of the Fundão disaster serve as a stark reminder of the potential for widespread ecological and socio-economic devastation when such comprehensive assessments are lacking.

6.7.2 Recommendations:

1. **Extended Dam Breach Modeling:** Mandate a comprehensive dam breach modeling exercise that extends the flood routing and contaminant transport simulations through the entire Waihou River system, into the Firth of Thames, and across the Hauraki Gulf. This modeling must account for the physical dispersion of tailings and the transport of dissolved contaminants.
2. **Detailed Marine Ecological Impact Assessment:** Require a dedicated, in-depth ecological impact assessment for the Firth of Thames and the Hauraki Gulf. This assessment should include:
    - Baseline studies of key marine habitats (e.g., seagrass beds, shellfish beds, intertidal zones) and wading birds and other threatened or endangered species. (RAMSAR)
    - Specific modeling of sediment deposition patterns and their physical impacts.
    - Analysis of heavy metal mobilisation from tailings and their potential for human and non-human bioaccumulation and biomagnification within marine food webs.
    - Assessment of impacts on marine biodiversity, including endangered species.
    - Realistic long-term recovery projections, acknowledging the potential for multi-decade or generational timescales.
3. **Comprehensive Socio-Economic Impact Assessment for Coastal Communities:** Conduct a detailed socio-economic impact assessment that

specifically addresses the potential consequences for fishing communities, aquaculture operations, fish farming, tourism, and recreational users within the Firth of Thames and Hauraki Gulf. This must also include a thorough evaluation of impacts on Māori cultural values associated with these marine environments.

4. **Development of Marine-Specific Mitigation and Remediation Plans:** Based on the extended impact assessments, develop detailed, actionable mitigation and remediation plans specifically tailored for marine environments, drawing upon lessons learned from international tailings dam failures.
5. **Re-evaluation of Potential Impact Classification:** Re-evaluate the "Potential Impact Classification" for the Storage 3 TSF based on the full, comprehensive assessment of environmental, social, and economic consequences extending to the marine environment.

Only through such a comprehensive and transparent assessment can the true risks of a tailings dam breach be understood and adequately managed, ensuring the long-term protection of New Zealand's precious natural heritage and the well-being of its communities.

6.8 References

- Engineering Geology Ltd. (2025). *Oceana Gold (New Zealand) Limited - Waihi Operation, New Zealand Storage 3 Tailings Storage Facility RL155 - Dam Breach and Potential Impact Classification Assessment*. OGNZL Reference No.: WAI-983-080-REP-GT-0013 Rev1.
- Engineering Geology Ltd. (2025). *OceanaGold (New Zealand) Limited Waihi Operation Waihi North Project Volume 1 Natural Hazards and Options Assessment Technical Report*. OGNZL Document Reference: WAI-985-000-REP-LC-0002 Revision: 2.
- *Fundão tailings dam failures: the environment tragedy of the largest technological disaster of Brazilian mining in global context* DOI: 10.1016/j.pecon.2017.06.002
- *Human-made disasters and economic impact for a developing economy: evidence from Brazil* Natural Hazards (2021) 109:2313–2341 https://doi.org/10.1007/s11069-021-04921-4
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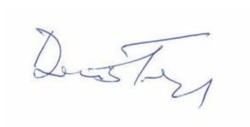
Dated: 23 August 2025

Denis Tegg



BEFORE THE FAST-TRACK APPROVALS PANEL

In the matter of the Fast-Track Approvals Act 2024

And

In the Matter of applications by Oceana Gold (New Zealand) Limited for various resource consents and other authorities relating to the Waihi North Project (including the Wharekirauponga Underground Mine)

And

In the matter of the submission on the above applications by Coromandel Watchdog of Hauraki Inc

Brief of evidence of Nic Conland

Dated: 24 August 2025

Qualifications and Experience

1. My full name is Nicholas (Nic) Ashley Conland. I am the director of environmental consultancy, Taiao - Natural Resource Management Limited. I was a Senior Environmental Consultant at Jacobs New Zealand Limited in Wellington and have at least 25 years' experience involved in natural resource planning and regulation, including policy development and evaluation through assessment of environmental effects and catchment modelling.

2. I am a director for The Stream Limited, a specialist science communication and dashboard development company. As part of my role in The Stream projects I have designed tools and dashboards for communicating environmental outcomes and monitoring indices for a broad range of data across marine, terrestrial, aquatic and air domains.

3. I have a Bachelor of Science (Chemistry, Information Systems), Waikato University, Hamilton; a Diploma of Design (3D), Waikato Polytechnic, Hamilton; and a Post Grad Certificate of Proficiency (Environmental Planning and law), Victoria University, Wellington.

4. I have prepared expert evidence for plan change hearings in Otago, Canterbury, Wellington, Hawkes bay, Gisborne, Waikato, Auckland, Bay of Plenty, and Northland for second generation regional plans and attended numerous Environment Court mediation sessions as an expert witness. I have prepared evidence for Boards of Inquiry and prepared and presented expert evidence for the Environment and District Courts.

5. I am informed by my experience at Greater Wellington Regional Council as a compliance programme manager and a water quality specialist responsible for reviewing applications for natural resource use, preparing meaningful and workable consent conditions and setting requirements for mitigation, control and monitoring with contractors in the Wellington region with the Resource Management Act 1991 (RMA) for freshwater effects as a result of land use.

6. Since 2010, I have led science teams and provided strategic direction for numerous public and private organisations, I have presented papers on best practice for Freshwater Accounting Frameworks under the NPS FM 2014, adaptive management and relationship management between local authorities and rural communities.

7. Of particular relevance are catchment projects to determine the effectiveness of planning proposals. Including:

    a. I managed the design, development and preparation of the Selwyn Waihora SOURCE Model, for the Canterbury Land Water Resource Plan (CLWRP) Variation 1 and Central Plains Community Water Scheme.

b. I led the development of the Tukituki SOURCE Model, for the Tukituki Plan Change 6; including the scenario development to test the policy and rule framework for the freshwater limits and catchment landuse capability (**LUC**) load allocations.

c. I prepared the design and scope for the Ruamahanga SOURCE model, the design, development and preparation of the Ruahuwai SOURCE Model (Upper Waikato) used to evaluate the Waikato Regional Plan Change 1 rule and policy framework.

d. I prepared the design and undertook practice reviews for the Waipaoa River SOURCE model and developed the scenarios for the model to test the responsiveness of the natural systems to changes in the catchment landuse and the rule framework in the Tairawhiti Resource Management Plan.

e. I provided guidance, technical advice and review for the design, development and application of the Kaituna-Pongakawa-Waitahanui and Rangitikei catchment models for the National Policy Statement Freshwater Management 2017 requirements for the Bay of Plenty Regional Council.

f. I provided a peer review report (co-authored with Dr Hamilton and Dr Rutherford) for the Auckland Council freshwater management tool (FWMT).

g. In 2019 I was engaged as a peer reviewer for Tauranga City Council freshwater management tool development.

8. Nationally, I have assessed risk and cost components for four different environmental bonds. The bonds for the MV RENA, NZ Steel Landfill, Kate Valley Landfill and Hampton Downs were different in the range of risk elements and cost components, they considered the likely risks from credible events and the present value costs for mitigations, compliance and rehabilitation.

9. The bonds for NZ Steel (Auckland), Hampton Downs (Waikato) and Kate Valley (Christchurch) were all contested through the Environment Court and resolved as an agreed figure for financial assurance relative to the agreed risks from the activity being consented.

10. In 2017 I presented expert evidence on the environmental bond for the MV RENA on behalf of Bay of Plenty Regional Council. My bond evaluation was adopted by the parties to provide a guaranteed environmental bond to respond to a range of environmental risks with a costed range of mitigation responses.

11. I have recently been engaged by Auckland Council on behalf of the Kaipara Moana Remediation fund to project manage the development of operational tools to support the restoration of the Kaipara Moana, assessing landscape risks and the available toolbox of mitigation options.

12. Recently, I have prepared whenua environment plans for ahu whenua to provide a risk assessment framework to achieve trustee goals within an adaptive management or Titiro Whakatika framework.

13. I have undertaken this work with reports and data supplied by other parties and rely on the accuracy of this information to make my assessments and conclusions.

14. As a result of my qualifications and experience, I have considerable factual knowledge and expertise in the areas of water quality impacts and catchment management, science communication and the effectiveness for adaptive management principles.

Code of Conduct

15. I have complied with the code of conduct when preparing this statement of evidence and will do so if required to give oral evidence before the Expert Panel considering the application by Oceana Gold (New Zealand) Limited (**Applicant**) under the Fast-track Approvals Act 2024 (**Act**) to expand its existing gold and silver mining operations at sites in the Waihi North area of the Coromandel Peninsula, being Fast-track Application No. FTAA-2504-1046 (the **Waihi North Project Application**).

16. My qualifications as an expert are set out above.

17. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Summary

18. This document is compiled for Coromandel Watchdog of Hauraki and outlines critical risks and inconsistencies in the applicant's expert evidence and mitigation recommendations for the proposed Waihi North Project (WKP) in the Wharekirauponga catchment of the Coromandel Forest Park.
19. Drawing on the technical reports lodged by the applicant—for ecology and biodiversity assessments, groundwater and hydrology modelling, and management plans—it is evident that:

- Residual effects remain uncertain and potentially irreversible.
- Mitigation relies heavily on adaptive management, which is reactive, not preventive.
- Offsets and compensation are proposed before avoidance is demonstrated, breaching best-practice environmental hierarchy.
- Conditions are vague, broad, and not enforceable, contrary to the requirements of the Fast-track Approvals Act 2024.

20. For these reasons, the Panel can—and should—exercise its powers to decline the proposal.

Fasttrack Approvals Act 2024

21. Fast-track Act enforceability requirement: Conditions must be specific, measurable, and enforceable. The applicant's conditions are framed in broad, aspirational terms ("plans will be prepared," "offsets will be delivered"), without binding performance standards. This falls short of the Act's legal threshold.
22. Expert Code of Conduct: Ecological evidence acknowledges uncertainty (frog responses to vibration, pest-control lag times), but management plans downplay these uncertainties. This mismatch undermines the reliability of expert evidence before the Panel.
23. **Why it matters**: Where conditions are not precise and uncertainties are downplayed, the Panel cannot discharge its duty to ensure adverse effects are adequately avoided, remedied, or mitigated.

Observations on Ecological and Biodiversity risks

Threatened species at risk

24. Confirmed presence of Hochstetter's frog and suitable habitat for Archey's frog within the project footprint.
25. Residual uncertainty acknowledged by ecology experts, requiring large-scale pest control and compensation.
26. **Why it matters**: Frogs are highly threatened species with limited offsetting potential; even "low but uncertain" risks exceed acceptable thresholds in DOC estate.

Offsetting before avoidance

27. Pest-control and habitat compensation are proposed upfront, while avoidance/minimisation alternatives (e.g., portal placement, vent location) are not fully demonstrated.

28. Why it matters: The mitigation hierarchy is clear: avoid, then minimise, then rehabilitate, and only then offset. Skipping to offsets undermines ecological integrity.

29. Contradictions in risk assessments:

- Air discharges (Beca): vent emissions risk to frogs is "very low."
- Ecology (Boffa Miskell): vent emissions carry "low but uncertain residual risk," requiring compensation.

30. **Why it matters**: Internal contradictions erode confidence in conclusions of "less than minor."

Net gain claims vs. time lag

31. Ecology reports promise "Net Gain" and "Nature Positive" outcomes.
32. Pest-control benefits for frogs may take 5–10 years to materialise.
33. **Why it matters**: Ecological harm is immediate, while claimed benefits are delayed. This undermines the credibility of a "net gain" position.

Hydrological and Groundwater Grounds

Predicted flow reductions within error margins

34. 7-day MALF reductions 2–13%, wetted-width reductions 0–5%.
35. Modelling admits 10–20% uncertainty at low flows, with weakest calibration in headwater streams.
36. **Why it matters**: In pristine Natural State streams, even small reductions are ecologically significant. If predicted effects are within model error, effects are effectively unquantifiable.

'Warm Spring' and spring systems

37. Applicant predicts Warm Spring (~3.5 L/s) will cease and later recover, with elevated sulphate.
38. Conceptual model concedes Warm Spring effects "cannot be accurately predicted at this time."
39. **Why it matters**: Springs are highly visible ecological features. Drying, recovery uncertainty, and post-closure water-quality risks pose unacceptable ecological impacts.

Identified risk zone vs. "minor" conclusions

40. Reports identify a 1.2 km reach of potential effect where connectivity risk is higher.
41. Yet overall conclusions still say effects are "less than minor."
42. **Why it matters**: A defined risk zone contradicts a blanket "minor" conclusion; this is grounds for precautionary decline.

Adaptive management reliance

43. Water Management Plan relies on alert/respond triggers and reactive measures.
44. **Why it matters**: For Natural State waterways, "monitor and fix later" is inadequate. The legal and policy expectation is to avoid impacts upfront.

Incomplete post-closure geochemistry

45. Assessments of post-closure water chemistry are ongoing; sulphate risks acknowledged but not quantified.

46. **Why it matters**: Long-term water quality cannot be left unresolved in a decision to permit mining in DOC land.

Cumulative and Integrated Risks

47. Stacked stressors (vibration + vent discharges + dust + water loss) are assessed separately, not cumulatively.

48. Residual risks to threatened frogs, headwater streams, and springs overlap spatially, compounding effects.

49. Adaptive management assumes risks will be detectable and reversible—but effects on frogs and headwaters may be subtle, delayed, or irreversible.

50. **Why it matters**: The true ecological footprint is likely greater than the sum of isolated assessments. Lack of cumulative analysis leaves a critical knowledge gap.

Conclusion of summary

51. The applicant's own evidence reveals material uncertainties about effects on threatened species, Natural State waterways, and spring systems. Mitigation relies on reactive adaptive management and offsetting before avoidance, while post-closure risks remain unresolved.

52. For highly protected ecosystems in the Coromandel Forest Park, this does not meet the legal, ecological, or policy thresholds of the Fast-track Approvals Act 2024.

53. The Panel therefore has a robust evidential and legal basis to decline the Waihi North Project's application for mining in the Wharekirauponga catchment.

Observations on the Waihi North Proposal – ecological management context

Fasttrack Approvals Act 2024

54. Inconsistent with Fast-track Act tests:
    a. The Act requires that conditions be specific, measurable, enforceable.
    b. The A.10 report frames mitigation in broad, aspirational terms ("EMP will be prepared," "offsets will be delivered") without 'SMART' metrics.
    c. Residual effects are pushed into offset/compensation schemes without first demonstrating avoidance/minimisation hierarchy. This runs contrary to national biodiversity offsetting guidance.
55. Expert conflicts from the ecology experts acknowledge data gaps and uncertainty (frog vibration responses, long lag times for pest-control benefits), but management reports downplay them. This undermines the reliability of evidence presented to the Panel.

Ecological and Biodiversity Grounds

56. Threatened species at direct risk:
    a. Confirmed presence of Hochstetter's frog and suitable habitat for Archey's frog within the mine footprint.
    b. The B.36 report (Bioresearches) states effects are uncertain but potentially significant; A.10 reframes these as "manageable."
57. Uncertainty exceeds mitigation certainty:
    a. Pest control may take 5–10 years to show frog population benefits. Project effects (vent discharges, blasting vibration, noise/light) are immediate and potentially irreversible.
    b. This time lag undermines claims of net gain or "nature positive."
58. Offsets before avoidance:
    a. Pest-control and habitat compensation are proposed upfront, yet alternatives analysis for vent locations, tunnel portals, or tailings site placement is thin. This suggests offsets are substituting for avoidance, contrary to best-practice hierarchy.

Physical and Operational Risk Grounds

59. Vibration thresholds inconsistent:
    a. Vibration assessment (B.53 Heilig) proposes a 15 mm/s surface limit but admits data on frog sensitivity is inadequate. Ecology (B.37 Boffa Miskell) relies on a precautionary >2 mm/s impact footprint.
    b. Conflicting thresholds mean residual risk cannot be reliably quantified, and adaptive management lacks enforceable "stop" points.
60. Air discharge contradictions:

a. B.22 (Beca) air assessment calls frog risk from vent emissions "very low," while B.37 (ecology) insists residual risk justifies large-scale compensation.
b. Such contradictions create reasonable doubt that mitigation can ensure "less than minor" ecological effects.

61. Dust and noise risk near Willows farm:
    a. B.22 (Air discharges) report identifies moderate–high nuisance risk at 111 Willows Rd, requiring strict stop-work triggers.
    b. Yet B.37 (ecology) characterises effects at Willows as "Low–Very Low."
    c. This inconsistency undermines the credibility of the "residual effects are minor" conclusion.

Cumulative Effects Grounds

62. Stacking of multiple stressors ignored:
    a. Reports assess dust, vibration, noise, lighting, hydrology largely in isolation.
    b. No integrated cumulative-effects assessment for frogs, lizards, bats, or hydrological systems.
    c. The absence of this integration leaves significant uncertainty around the true ecological footprint.

Precedent and Policy Grounds

63. Outstanding Natural Area (ONA) & public conservation land:
    a. The mine sits within the Coromandel Forest Park, a high-value conservation landscape.
    b. Even if effects were "low" or "uncertain," the public interest test in the Fast-track Act allows the Panel to weigh irreversible biodiversity and cultural heritage risks over uncertain economic gains.
64. Limits to offsetting threatened species:
    a. NZ offsetting guidance recognises "limits to what can be offset" for species with high vulnerability or low replacement potential (e.g., Archey's frog).
    b. Because the project admits residual frog risk, and frogs cannot be feasibly offset, the project crosses those ecological "red lines."

Recommendation

65. The Panel can decline consent on these grounds:
    a. Legal insufficiency: Conditions are not specific or enforceable, contrary to the Fast-track Act.
    b. Residual uncertainty: Expert evidence acknowledges material unknowns; mitigation does not remove them.
    c. Hierarchy breach: Compensation and offsets are proposed before avoidance/minimisation are proven feasible.
    d. Contradictory evidence: Technical reports disagree (air vs. ecology; vibration vs. ecology). This undermines reliability.

e. Biodiversity limits breached: Residual risks to Archey's and Hochstetter's frogs cannot be offset.
f. Cumulative effects untested: Stacked risks across noise, vibration, air, and habitat fragmentation remain unassessed.

66. The Panel can reasonably conclude that the project creates unacceptable residual risks to threatened species and fails to demonstrate avoidance/minimisation before relying on offsets. Under the Fast-track Act, with enforceability and precautionary principles in mind, the Wharekirauponga underground mine should be declined.

Inconsistencies in the Ecology reports

Vent-raise emissions and effects on frogs — “very low risk” vs “low but uncertain risk requiring compensation”

67. Air discharges (Beca): concludes “the risks of discharges to native flora or fauna, particularly the Archey’s frog, near to the proposed tunnel raises is considered to be very low.”

68. Terrestrial ecology (Boffa Miskell): repeatedly says there remains a low but uncertain residual risk to Archey’s & Hochstetter’s frogs from vent-raise air/water vapour and surface expression of blast vibration, and therefore proposes large-scale pest control (633 ha) plus research funding as compensation.

69. **Why it matters**: If ecological experts say residual effects are uncertain enough to require compensation, an air report saying “very low” could look dismissive. You’ll want an integrated position (e.g., adopt ecology’s conservative framing and tie air-quality monitoring/trigger actions to it).

Which vibration limits actually apply where (and why)? — clarity vs mixed messages

70. Heilig (vibration): proposes no amenity-based criteria for the Dual Access Tunnels because they’re remote, and describes any tunnel-development vibration under frog habitat as “low amplitude and transient”; monitoring not proposed for the dual tunnels.

71. Project-wide conditions (A.09): still frames frog management around a mapped 315 ha area >2 mm/s at surface and locks in a 15 mm/s 95-percentile surface limit for WUG production blasting (any time).

72. **Why it matters**: Not contradictory, but easy to confuse. For evidence, spell out the three regimes plainly: (i) GOP/borrow pits 5/1 mm/s at residences; (ii) Willows/Plant access tunnels 5/1 mm/s at residences; (iii) WUG production 15 mm/s at ground above mine with an ecology-driven >2 mm/s footprint used for pest-control targeting.

How “immediately reversible” are noise/light effects?

73. Terrestrial ecology: describes several stressors (lighting; drilling/heli noise; continuous vent-raise noise) as “localised, temporary and immediately reversible upon completion of works.”

74. **Why it matters**: “Immediately reversible” sits awkwardly with continuous emissions planned for years; effects may end when works cease, but their duration is long. An

expert could press for clearer duration descriptors and for outcome-based performance standards (e.g., species behaviour metrics near vents).

Air-quality dust risk near Willows vs ecology's "Very Low–Low"

75. The B.22 Air discharges report: flags moderate–high short-term risk of nuisance dust to 111 Willows Rd (and moderate at 122), recommends a new met/TSP station and enforceable wind-trigger responses (5 m/s alert; 7.5 m/s alarm, stop dusty works within 200 m).

76. Terrestrial ecology (Willows farm): overall terrestrial effects at Willows are rated Low–Very Low after standard site controls and minor riparian planting.

77. **Why it matters**: Not strictly inconsistent (different receptors), but the air report implies stricter operational controls may be needed than the ecology summary conveys.

"Net gain / nature-positive" claims vs residual-effects admissions

78. B.37 Terrestrial ecology report aims for a "Net Gain" and "Nature Positive," integrating landscape and ecological responses.

79. However the same report simultaneously acknowledges residual uncertainty for frogs, requiring compensation (not only offsetting).

80. **Why it matters**: To defend "net gain," ensure the accounting excludes purely visual landscaping and transparently shows that frog-focused compensation (pest control + research) is additional and commensurate with the scale of uncertain effects (The ecology report does say only initiatives addressing ecological effects are counted).

Use of Golden Cross as the key analogue for frog vibration sensitivity

81. The A.09 report (assessment of effects) vibration section: leans on Golden Cross experience (<5 mm/s typically; up to ~10 mm/s) and reports frogs remained "abundant," to justify low likelihood of harm.

82. B.53 Heilig + B.37 ecology reports, despite the Golden Cross comparator, still impose 15 mm/s cap and a wide pest-control buffer due to data gaps on leiopelmatid vibration perception.

83. **Why it matters**: Golden Cross isn't directly comparable (geology, blast geometry, habitat). Precautionary approach required for remote setting; frog-specific cap (trigger) and monitoring; adaptive management triggers that reduce impacts not off-set them.

Residual uncertainty about frogs vs. confidence in monitoring/management

84. Bioresearches: Hochstetter's frog surveys were conducted, but detection relied on specific microhabitats (shaded, stony streams). Habitat exists within the project footprint, and frogs were confirmed in surveyed streams.
85. A.10 (management/monitoring): frames residual effects as manageable through standard monitoring, without fully stressing detection limitations or false negatives in frog surveys.
86. **Why it matters**: If monitoring plans assume detection = absence of effect, they may understate residual risk. Stronger adaptive triggers may be needed (e.g., assume presence until robust evidence of absence).

Offset/compensation before full avoidance/minimisation demonstration

87. Bioresearches: acknowledges At-Risk/Threatened fauna (frogs, lizards, bats, birds) but argues no "significant" invertebrates are expected; impact is treated as localised.
88. A.10: moves quickly to outline offset/compensation programmes (pest control, planting, monitoring) rather than documenting in detail what avoidance alternatives were considered for each site.
89. **Why it matters**: This risks looking like compensation is a substitute for avoidance, not a last-resort step in the hierarchy.

Different emphasis on threatened species sensitivity

90. Bioresearches: carefully notes survey effort for frogs, lizards, bats, and explicitly ties methods to DoC datasets and threat classifications.
91. A.10: describes management frameworks generically (Ecological Management Plans, Biodiversity Offset Plans) without reiterating the high conservation status of the same species.
92. **Why it matters**: Downplaying threat status in monitoring/management summaries weakens the case for precautionary conditions.

Confidence in "net gain" vs. disclosure of monitoring timeframes

93. Bioresearches: acknowledges frog population responses to pest control can take 5–10 years to show measurable change.
94. A.10: emphasises "nature positive" outcomes without caveats about these lag times.
95. **Why it matters**: Claims of "net gain" may appear premature without explicit recognition of long ecological response horizons.

Condition enforceability

96. A.10: mitigation/management measures are described in broad terms (plans, monitoring programmes, adaptive management).
97. Fast-track Act (Schedule 5 & 7): requires that conditions be specific, measurable, and enforceable.

98. **Why it matters**: If conditions are vague (“pest control will be implemented”), they risk being unenforceable; Bioresearches provides enough detail (target species, methods, site mapping) to anchor enforceable conditions.

Observations on the Hydrology reports

Predicted flow effects

99. The hydrology modelling in B.32 (GHD) expects the 7-day (mean annual low flow) MALF at monitored sites to reduce ~2–13%, with wetted-width reductions 0–5%; effects are “most noticeable” in small headwaters like Edmonds and Thompsons.
100. The B.32 Wharekirauponga model notes limited calibration data in these headwaters and an overall 10–20% uncertainty at low flows.
101. **Why it matters**: Reductions of 2–13% in low flows may sound small on paper, but in fragile headwaters like Edmonds and Thompsons Streams, even slight decreases can mean shallow riffles dry out, fish lose habitat, and aquatic insects decline.
102. These streams (headwater sites) already run close to ecological limits in summer, the model’s 10–20% uncertainty leaves a real risk that impacts could be significantly worse than predicted.

Cause of flow loss

103. The groundwater modelling in B.26 (GHD) drives the hydrological settings in the streamflow reductions (constant, peak baseflow-loss assumption across the mining period) — i.e., the water balance is conservative on paper.

104. **Why it matters**: The Warm Spring and EG-vein spring are projected to dry up or reduce to a trickle during mining. Springs are not just a source of water—they are cultural features, refuges for native fish, and indicators of aquifer health.

105. The B.33 report states in section 7.4.2 that dewatering effects cannot be accurately predicted at the time of the application.

106. Even if they return after closure, The A.09 (Assessment of effects) predicted sulphate contamination could permanently alter water quality, undermining their ecological and cultural value.

Springs

107. In B.33 (Flo-Solutions) the Warm Spring (~3.5 L/s) and a downstream EG-vein spring (~5 L/s) are expected to cease/reduce during mining, then return post-closure (with elevated sulphate predicted at Warm Spring after recovery).
108. **Why it matters**: The Warm Spring and EG-vein spring are projected to dry up or reduce to a trickle during mining. Springs are not just a source of water—they are cultural features, refuges for native fish, and indicators of aquifer health. Even if they return after closure, AECOM (2024) predicts sulphate contamination could permanently alter water quality, undermining their ecological and cultural value.

Surface–deep connectivity

109. B.27 groundwater reports mostly frame the shallow system as weakly connected to the deep EG-vein system, but identify a 1.2 km "area of potential effect" where rhyolite is at surface and connectivity risk is higher.
110. **Why it matters**: Reports claim the shallow and deep systems are mostly separate, but acknowledges a 1.2 km zone where connectivity could be strong. If fractures in this rhyolite zone provide pathways, mine pumping could draw down shallow streams much more severely than anticipated, threatening surface flows and biodiversity well outside the mapped area.
111. B.33 (Hydrogeology) report also states that Drawdown effects propagate preferentially within and along the vein systems due to their higher permeability relative to the low permeability andesite host rocks.
112. Overall conclusion in the B.27 Groundwater report that effects on surface water are "less than minor," catchment-scale take 2,200–3,300 m^3/d, with recovery of groundwater post-closure (~30 years).
113. **Why it matters**: The project's 2,200–3,300 m^3/day groundwater take may look modest at a catchment scale, but its localised effects could devastate sensitive habitats. The idea that the system will "recover" in ~30 years overlooks the fact that species lost or habitats degraded may never return. For ecological communities, a 30-year hole in the hydrological system is effectively permanent.

Tunnels

114. Methodology relies on pre-grouting; tunnel effects are said to be unmeasurable at surface, though local short-term losses under fracture zones are acknowledged elsewhere.
115. **Why it matters**: While the company says tunnel drainage will be "immeasurable", experience elsewhere shows short-term localised losses through fractured rock can be severe.
116. Even small unanticipated leaks could drain wetlands or headwaters, with changes appearing suddenly and irreversibly.
117. The reliance on pre-grouting assumes engineering will perfectly seal fractures—something history suggests is rarely guaranteed.

Management approach

118. A Water Management Plan (WMP) uses "alert/respond" triggers, adaptive measures (grouting, supplementary water, re-injection), and quarterly reporting; it seeks to protect Natural State streams.
119. **Why it matters**: The proposed Water Management Plan relies on "alert and respond" triggers, meaning damage may occur before interventions kick in. Quarterly reporting is far too infrequent to detect rapid stream declines.

120. While measures like re-injection or supplementary water sound reassuring, they often create artificial flow regimes that do not replace natural groundwater-fed systems, leaving ecosystems altered and vulnerable.

Conclusions on Internal inconsistencies

121. Certainty about Warm Spring vs. admitted uncertainty
   a. Effects narrative: spring will cease then return; water quality "similar," but sulphate higher.
   b. Conceptual model caveat: "cannot be accurately predicted at this time"; more structural/hydrochem (incl. isotopes) work is needed. That undercuts the confident impact/mitigation story.

122. "Less than minor" at surface vs. explicit identification of at-risk reach
   a. A global "less-than-minor" conclusion sits beside a mapped 1.2 km area where the protective andesite cover is absent and vein–stream connectivity could occur—prompting "more intensive monitoring."
   b. That is a residual risk zone, not de minimis.

123. Modelled flow effects are small—but within model uncertainty
   a. Low-flow reductions up to ~12–13% are comparable to the hydrology model's 10–20% uncertainty band at low flows and are largest exactly where calibration is weakest (Edmonds/Thompsons).
   b. That weakens reliability for headwater Natural State streams.

124. Adaptive management reliance vs. Natural State policy intent
   a. The WMP is explicitly adaptive ("anticipate and react," with triggers based on anomalies and a flowchart for "materially greater" inflows persisting >1 week).
   b. That may be standard practice, but it doesn't front-load avoidance of effects; it waits for triggers to act—hard to reconcile with a high bar for Natural State protection.
   c. Proposed consent conditions themselves envisage adaptive measures when "Respond" triggers are reached, again signalling effects-then-mitigate.

125. Post-closure geochemistry still not understood
   a. The groundwater/surface-water geochemical mixing for post-closure is ongoing; preliminary results not yet available. Yet the narrative asserts only local sulphate elevation at Warm Spring on recovery.
   b. That's a gap on long-term water-quality risk.

126. Under the Fast-track Approvals Act (and general Part 2/RMA effects principles carried across), the Panel can decline where effects are uncertain, potentially significant, and not credibly avoided—especially for Natural State waters in a DOC estate.

127. The proponent's own conceptual model says Warm Spring effects "cannot be accurately predicted" now, while effects reports assume predictable cessation/recovery

(and even "improved" quality during mining). That is a credibility gap on a key pathway.

128. In headwaters where ecology is most sensitive, predicted low-flow reductions are on the same order as model uncertainty and lack robust calibration. That fails a precautionary evidential standard for Natural State streams.

129. The H.06 WMP and proposed conditions predominantly react to observed changes (trigger/Respond logic; quarterly TARPs), rather than demonstrate up-front avoidance. For protected Natural State waterways, a "monitor + fix" posture is a policy mis-match and a legitimate basis to decline.

130. Post-closure geochemical assessments that would underpin "no long-term effect" claims are unfinished. Approving now would bank on later studies to prove safety—again failing the precautionary bar.

Questions the Panel can put to experts

1. **Warm Spring mechanism & fate:** What level of confidence (quantified) supports predictions of cessation and recovery timing/chemistry, given FloSolutions' statement that effects cannot be accurately predicted at this time? What additional structural/isotope work is scheduled, and when?
2. **Headwater calibration**: Provide a sensitivity analysis showing how 7-day MALF reductions change under the 10–20% low-flow uncertainty and under alternative calibrations for Edmonds/Thompsons; demonstrate that predicted effects remain below ecological significance thresholds.
3. **Area of potential effect**: For the mapped 1.2 km reach of high connectivity, what pre-emptive (not reactive) design controls are proposed to avoid connectivity and stream-loss—beyond monitoring?
4. **Triggers**: Where (numerically) are Alert/Respond thresholds set for flows, heads, and inflow rates, and how do they tie to ecological limits rather than model expectations? Are supplementary water/re-injection feasible in remote Natural State streams?
5. **Closure**: Until the post-closure geochemistry and mixing models are complete, what enforceable performance standards (receiving-environment) can guarantee no adverse long-term changes (e.g., sulphate increases) at the Warm Spring and downstream?

Conclusion

Given the acknowledged unpredictability at Warm Spring, the uncertainty/calibration limits where effects are largest, the identified at-risk reach, the heavy reliance on adaptive management, and unfinished post-closure water-quality work, the Panel has a robust evidential basis to find that the adverse effects on Natural State waterways are not adequately avoided nor sufficiently certain to be “minor.”

That meets a rational threshold to decline the application for the WKP catchment elements at this time.

IN THE MATTER of the Fast-Track Approvals Act 2024

AND

IN THE MATTER of an application for consents for Mining activities in the Waihi and Wharekirauponga areas by OceanaGold Ltd

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STATEMENT OF EVIDENCE OF HAMISH DAVID KENDAL

ON BEHALF OF COROMANDEL WATCHDOG OF HAURAKI

ECOLOGY

19 August 2025

Introduction

1) My name is Hamish Kendal; I am a consultant ecologist of 24 years with Natural Solutions (www.ecologist.nz). I have a Postgraduate Diploma (with Distinction) in Parks, Recreation and Tourism, majoring in Ecology (1997).
2) I am a member of the NZ Ecological Society, National Wetland Trust, Waikato Botanical Society, and NZ Biosecurity Institute.
3) I am based on the Coromandel Peninsula and am very familiar with the ecology of the area. I have experience in threatened species monitoring and management, animal and plant pest management, and ecological planning and design of development initiatives.

Code of Conduct

4) I confirm that I have read the Environment Court Practice Note 2023 - Code of Conduct for Expert Witnesses (Code), and have complied with it in the preparation of this memorandum. I also agree to follow the Code when participating in any subsequent processes, such as expert conferencing, directed by the Panel. I confirm that the opinions I have expressed are within my area of expertise and are my own, except where I have stated that I am relying on the work or evidence of others, which I have specified.

Scope of Statement

5) These comments on this application are supplied to help inform the Coromandel Watchdog of Hauraki submission to the Fast-track Panel. Due to time constraints, I have read only the documents relating to my area of expertise and have skimmed others. These comments are my expert opinion as an ecologist.
6) Some of the concerns I have about the potential adverse effects rely on the expertise of others to confirm the scale and severity from the activities (e.g. geo-hydrologist for dewatering, vibration expert for blasting effects).
7) Expert reports are referred to by their code number.
8) I have focused on the Wharekirauponga area above the underground mineshaft (Environmental Monitoring and Enhancement Area, C01 Fig 1), the 632ha proposed areas of pest control WAPMA (as mitigation), and the 18,870ha voluntary Biodiversity Project Area (C09 Fig 1).
9) I have read the Conditions of consent as proposed by the governing agencies (section D), and the Updated proposed conditions.

Vibrations from underground blasting

10) OceanaGold acknowledges that vibrations from blasting are likely to adversely affect Archey's frog – hence their research to understand the percentage of area of the frog population that will be affected (in B41).
11) The severity and scale of this effect is unknown, but an area of 3.15km^2 has been supplied as the area of potential effect from vibration that will last 11 years. The area of effect is defined by vibrations of >2mm/s, but if frogs are affected by vibrations less than this then the actual area of adverse effect could be much greater. If the evidence for this becomes clear, then the potential effects on frogs will need to be reassessed.
12) The B41 report supplies evidence that the potential effect on the Archey's frog population will be limited to 1% or less of the area that the frogs are found on the Coromandel peninsula. Nonetheless, the adverse effect on this threatened species is acknowledged as unavoidable and 'compensation' is proposed (in B37) in the form of pest control in the area exposed to vibration (314ha) and immediately adjacent (318ha).
13) However, the estimate of the Archey's frog population from the OceanaGold expert has been questioned by independent experts as being grossly over-inflated.[1]
By overestimating the population, the potential effect of the mining activity on the local population has been minimized. This is a dangerous presumption to make when managing a threatened species with a sensitivity to vibrations from mining, and especially combined with the likely and more permanent loss of frog habitat from dewatering (see later).
14) The B41 report shows that Archey's frog densities in the area of >2mm/s vibrations are very high compared with other areas of good frog habitat. This is likely to reflect that this is an area where they can survive well, and therefore the mining activity will be negatively affecting a stronghold area of the species resulting in a potentially disproportionately large effect on the population.
15) The B38 report acknowledges the adverse effects from the vibrations in the mining footprint. The report suggests from modelling that pest control in both the mining footprint and surrounding offset area (632ha total) will enable a net gain of the frog population.
16) What is not acknowledged in the B38 report is that regardless of the number of frogs that are in the area of mining footprint, if they are affected by the vibrations to their detriment (i.e. not able to communicate or breed), then it will affect all of the frogs in that area regardless how many there are. This will be particularly devastating with the

[1] Dr Jo Monks, PhD, Ecology Lecturer Otago University Department of Zoology (*pers. comm.*)

cumulative and permanent potential effect of dewatering of the groundwater affecting the forest, wetlands and streams. Undertaking pest control to help frogs assumes that the effect of pests is the only negative effect on the population, which in this case it is patently not. Therefore, the population will not necessarily increase with pest control when it is limited by the effects of vibrations and dewatering. Models are only as good as the information fed into them; so there needs to be evidence that this proposal will maintain or enhance the frog population if it is to have any credibility at all.

17) The B47 report in the final paragraph (p37) suggests there will be a net gain in ecological value. However, any gain in the populations of common species in the pest control areas has very little weight against the decrease of threatened species populations. Also, If the frog populations inside the affected areas crash due to vibrations or dewatering then this is a significant weighting of negative value in that area, which pest control will not reverse because there may be no frogs to protect from predation. Also, the pest control program will be flawed if its design doesn't actually help increase the frog population (see later).

Groundwater dewatering

18) OceanaGold acknowledges that there will be an effect of creating the mine shaft on dewatering the groundwater in the Wharekirauponga catchment (see report B32 Hydrology Modelling, p47):
"The results indicate the 7-day MALF could be reduced at current monitoring locations within the catchment between 2 to 13% because of base flow reduction as a result of mining. All other flow metrics calculated also indicate a reduction between the pre-mining and mining scenarios."

19) The scale of the dewatering, and the effect of this on the ecology and native species is likely to be significantly under-estimated for the following reasons:
   a. The estimated range of 2-13% reduction is based on a model that has a series of assumptions that with any small change could multiply the negative effect of dewatering.
   b. The effect of dewatering is only related to stream flow, but the negative effects of dewatering surface or shallow groundwater on forest ecosystems will be potentially felt across the whole area, and this has enormous negative ramifications for the moist habitat requirements of frogs. It is of course a negative effect on the forest itself and other native species inhabiting it.
   c. The B46 report on wetlands (p12) suggests that:

“Wetlands fed by surface water or shallow groundwater are highly unlikely to be impacted by the dewatering; only wetlands fed by deeper groundwater are.”
There is no evidence provided as to why this is ‘highly unlikely’, therefore as a precautionary measure it would be expected to consider that surface and shallow ground water will be affected by the dewatering from the mining activity. The table from p16 shows that the wetlands classed as ‘surface water’ cover a significant total area. Also, the B32 hydrology report does not make this conclusion, so there is no evidence provided that the surface or shallow groundwater systems will not be affected.

d. The B46 report (p20) lists weeds present already in the area. Disturbance resulting in drying and dieback of forest, and subsequently less canopy shade, will provide an advantage to weeds. This could result in weeds dominating larger areas. Also, new weed species could take hold where the seed may already be present but the moisture and shade from canopy cover prevents them from establishing. The chance of weeds being inadvertently introduced also increases.

20) The potential adverse effects of dewatering on native frogs are grossly underestimated. This is a significant potential effect that has been given little weight in the assessments. There has been no attempt to avoid this effect, and the methods to mitigate the effects (after they have been detected) are inadequate (grouting, supplementary water, reinjection) and have no evidence to support that they will work. The mitigation or offsetting is not focused on the whole area of forest where frogs require moist microhabitats to be maintained for their population to remain stable or increase.

<u>Wetlands</u>

21) The first point to recognise is made in report B46 (table 2 p23):
“2.8% of the original wetland extent remains within the Coromandel area…
and wetlands vegetated with mature forest are also far rarer than they would historically have been.”
Therefore, with much less than the national average remaining wetlands (around 10%), every small, forested wetland is even more significant in this area.

22) Report B46 (p7) introduces the Area of Investigation, which in a footnote explains:
“For the purposes of this report, the ‘Area of Investigation’ is the modelled area within which it was determined that risks to wetlands were greatest.”
Several points about this:

a. The purpose of the B46 report (p6) is to provide *“an assessment of the potential ecological impacts of the proposed WUG mine upon wetlands present within the Area of Investigation”.* However, it does not explain why the assessment is limited to this area only, therefore the purpose of the report has been limited to this area when the effects of the activity will certainly be wider than this.

b. The report limiting its assessment to where the effects on wetlands are the 'greatest'. What does this mean? The potential effects on other wetlands will still potentially be significant and adverse, so they need to be included. This indicates the evidence is woefully lacking in its coverage, missing a large area where significant damage is likely to wetlands (considered of Very High value) from mining activity.

c. Modelling often lacks real data and relies on underlying assumptions that can skew judgment. Therefore, the Area of Investigation line needs to be used as a guide and as a precaution the consideration of potential adverse effects on wetlands needs to be much wider.

23) The B46 report (p22) identifies 8 wetlands with 'higher susceptibility' to being affected by dewatering. Two points:

a. On p23 of the B46 report it clearly states:
"The wetlands within the site are considered to have 'very high' ecological value."
This is ALL the wetlands, so it would be prudent for an assessment to include those with 'medium' and 'low' susceptibility because of the potential significant adverse effect should errors be found in modelling assumptions.

b. There is a suggestion that a linkage between groundwater and surface water could be found, which implies that any drainage of groundwater could affect surface water levels. This is acknowledging that the 'highly unlikely' dewatering of wetlands fed by surface water directly (made on p12) could actually be dewatered indirectly via a link with groundwater. There is not enough evidence here to satisfy concerns that the negative effects on surface water-fed wetlands could not occur.

<u>Streams</u>

24) The B47 report (p22, para 3) acknowledges that the Wharekirauponga stream and tributaries have 'Very High' freshwater values, including threatened fish species'. The assessment of streams is lacking in evidence to support the proposal to offset/compensate when little weight has been given to the methods of avoiding the adverse effects as a priority.

25) The B48 report by NIWA is reliant on hydrology data in terms of the scale of dewatering effects on instream habitat (from Executive Summary):
"The results focused on the effect of reductions to the 7-day Mean Annual Low Flow (7-day MALF) and changes to median flow according to detailed groundwater (FloSolutions 2023a, b) and surface water modelling (GHD 2024)."

So, if there is any question about that modelling evidence then the NIWA assessment of effects on streams will need to be done again.

Frogs

26) Archey's frog are listed by the IUCN as Critically Endangered, which is the category just below Extinct in the Wild[2], and have an At Risk – Declining conservation status in New Zealand[3].
27) Hochstetter's frog in the southern Coromandel are an At Risk - Declining threatened species[4].
28) Archey's and Hochstetter's frogs' habitats are slightly different but overlap. They both utilise stream/wetland margins and cool, moist, shady areas of the forest. Archey's rely more on leaf litter as a refuge and are associated in higher population densities with more mature forests that have dense understory vegetation. Hochstetter's frogs prefer damp environments under stones and woody debris. Both species rely on moist, stable microhabitats which makes them vulnerable to changes in forest structure and hydrology.
29) Archey's frog populations suffered heavily from chytrid fungus that decimated the population down to levels they are today. This was a catastrophic event from which the populations haven't recovered and is another reason that they have a highly threatened species status. The cumulative effect of disease on top of predation and habitat loss is the reason that many threatened species' are in trouble, and why they usually can't withstand any further pressures.
30) Archey's and Hochstetter's frogs have a variety of threats recognized by the Department of Conservation[5] including:
    a. Rats
    b. Mice
    c. Drying of the forest understory habitat from climate change
    d. Drying of streams from lower water flows
    e. Increase of the severity of storms contributing to floods and slips that destroy stream habitat

    These last 3 threats can also be caused by the dewatering effects of mining that dry the forest interior and reduce leaf litter; and destabilise the catchment increasing the potential for slips in storms that degrade frog habitat.

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[2] https://www.iucnredlist.org/species/11450/66654575
[3] https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs44entire.pdf
[4] https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs44entire.pdf
[5] https://www.doc.govt.nz/news/media-releases/2025-media-releases/frogs-impacted-by-predators-climate-change/

31) The B47 report (table on p29) suggests a net gain in frog populations from modelling. The modelling however excludes the potentially most significant effect to frog populations from the assessment, which is the dewatering of groundwater effects on the habitat of Archey's and Hochstetler's frogs throughout the forest areas. This is aside from also being detrimental to their habitat in the streams and wetlands and their margins. This potential and likely effect needs to be included in the assessment of the risk to frogs of the mining activities.

Other species

32) If potential adverse effects on native species' are identified that are likely and unavoidable, and they are more than minor, then the Precautionary Principle needs to be applied to avoid the effects as a priority. This particularly pertains to any threatened species or ecosystem, and especially on land designated for conservation purposes.
33) Swamp maire (*Syzgium maire*) is a tree of wetlands that is Nationally Vulnerable, and ramarama (*Lophomyrtus bullata*) is Nationally Endangered (c)[6]. Both have suffered serious decline from the effects of Myrtle rust, and have the added pressure of climate change which will also negatively affect them. Any change in their habitat towards a dryer environment will exacerbate the negative effects on the survival of the trees that remain. Therefore, the significant potential effects of dewatering on wetland and forest drying are a substantial 'nail in the coffin' for these species in this area. This is acknowledged in report B46 (p27).
34) When the forest is in drought conditions, from a very dry summer; increasing effects of climate change; or from dewatering of groundwater, the forest vegetation is under more stress and cannot provide the seasonal food resources to the native fauna that are dependent on it. This is acknowledged in report B46 (p27).

Avoiding adverse effects

35) The 'residual adverse effects' referred to in the B47 report (p26) in RMA terminology are the 'unavoidable adverse effects' of the activities. The potential for this to occur is dependent on the likelihood of dewatering of the wetlands and streams and the relative humidity of their margins from the lowering of groundwater. But more significantly the effect of dewatering on lowering the moisture in the forest, which provides the largest area of suitable habitat for both Archey's and Hochstetter's frogs.
36) In report B46 section 5.4 (p28) the project is considered to have a Low magnitude of effect on wetlands based on the evidence provided by OceanaGold's hydrology experts

[6] https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs43entire.pdf

under the Ecological Impact Assessment guidelines. In Table 6 of Appendix A this equates to a Moderate Magnitude of Effect (MoE). Several points about this:

a. The Moderate MoE is only for 8 wetlands, but the assessment should be much wider encompassing all the wetlands (as explained above).
b. This table is also relevant for threatened plant species of wetlands including swamp maire which are rated Very High value for Rarity (p23).
c. The report B43 (Pii) states that *"The freshwater habitats surveyed within the Wharekirauponga Stream and its tributaries are of Very High ecological value. All habitats are classified as significant, providing habitat and migratory pathways to a number of Threatened and At-Risk native fish species."*
d. Any of the above could easily tip into the Very High level of effect with a High MoE that this report has not anticipated.
e. Similarly, the adverse effects on Archey's and Hochstetter's frogs could easily tip into the High MoE causing this to be a Very High effect.
f. The footnote of p28 states that it is accepted by ecologists that a significant ecological effect is triggered by a Moderate, High or Very High level of effect (i.e more than minor). All the above effects are at least Moderate and would easily become Very High when the potential effects of the mining activity become reality.
g. The footnote of p28 also states that "It is usual for a 'Very High' level of effect to trigger re-design or avoidance." This is considered a prudent decision to be made before any adverse effect can occur.

So, without any confidence in the evidence supplied, any one of the adverse effects will trigger re-design or avoidance, which is accepted as a precautionary pathway by experts using this effects system.

37) In the table on p29 of the B46 report, under Temporal Scale and Duration and reversibility, the mine is proposed to operate for 14 years. Then, it is suggested that any effects on the groundwater from the mining activity will return to 'normal' within 'about 10 years'. This times nicely with the definition for a 'permanent effect' which is over 25 years. However, there is no evidence to support this suggestion, and there is an acknowledgement in the table that there will be permanent adverse effects on vegetation if the dewatering is significant enough. This also confirms that these experts are not confident that the dewatering will not have this effect.
38) Also, in the table under Risk and Uncertainty, is the statement *"it is impossible to predict with certainty how the wetlands may be affected."* This throws uncertainty over the entire assessment that other wetlands would not be significantly and adversely affected by the dewatering.

39) At the bottom of the table the overall Magnitude of Effect is assigned as ‘Low’, despite the significance of the effects outlined. This is the result of a subjective interpretation of a string of weak evidence, which has been highlighted here.

40) On p30 of the B46 report the effects management hierarchy is tabled, but there is no clarification that the hierarchy prioritises avoidance over minimisation which is a priority over offsetting. In the referred ‘Guidance on Good Practice Biodiversity Offsetting in New Zealand’ (New Zealand Government, 2014)’[7], under 2.1:
“…what differentiates biodiversity offsetting from other forms of impact management is that it requires: A mitigation hierarchy to be followed, i.e. offsetting significant residual effects after appropriate avoidance, minimisation and on-site rehabilitation activities have taken place…”

41) On p30 of the B46 report there is a statement that adverse effects on wetlands cannot be avoided nor minimised. This is a fait accompli, because there is no evidence that another method or site has been considered that would avoid adverse effects, or at least have more/less adverse effects than the method/site proposed. Also, given that the adverse effects are expected before the project begins, the clear alternative is not to undertake the mining activities at this high value site. The applicant is acknowledging but not avoiding the significant adverse effects but has not demonstrated a clear need for the activity other than private economic gain.

Proposed mitigation for effects of dewatering

42) It is important to plan to monitor the wetlands as per s5.3 of the B46 report (p27). However, the evidence that the proposed mitigation methods for reversing the adverse effects of dewatering is very weak and it is questionable whether the mitigation has a high likelihood of being successful. There must be emphasis to provide evidence of a method that is proven to avoid a negative effect before dewatering occurs. This is necessary because wetlands and streams of Very High value are at stake, as well as other very significant adverse effects on the forest and its associated terrestrial and instream fauna including the threatened species of frogs, fish and plants.

43) P31 of the B46 report suggests Grouting as a Remedial Action should dewatering into the mine shaft occur, which claims to maintain shallow groundwater under the site. There are many issues with this proposal that render it ineffective:
    a. Grouting cracks will only is going to shift the water to emerge somewhere else, it won’t necessarily maintain the groundwater above;
    b. The mineshaft is to be back-filled, so there won’t be access to maintain grouting;

[7] https://www.doc.govt.nz/about-us/our-policies-and-plans/guidance-on-biodiversity-offsetting/

c. Vibrations from further drilling, or earthquakes will open gaps in the grouting and create further gaps;
d. The grouting is a temporary solution that will eventually allow water through, so the negative effect of dewatering groundwater will occur even if it is somewhat delayed by grouting.
e. Who will be responsible for ensuring the protection of surface and groundwater once the mining consent expires?

44) P31 of the B46 report suggests Supplementary Water and Reinjection methods as a Remedial Action should dewatering into the mine shaft occur, which claims to return water to maintain shallow groundwater under the site. There are many issues with this proposal that render it ineffective:
a. This is a temporary fix at best, requiring manual pumping of and management of water, which will have gaps in its delivery that will have dewatering effects, and only after the monitoring has noticed this already occurring;
b. The method will only operate during the mining phase, and not after it has closed, effectively delaying the adverse effects of dewatering until the mining has finished;
c. The backfilling of the mine shaft will not give access to the water for it to be pumped out;
d. The water in the pumping process will be warmed, creating a warming affect in the groundwater with its associated adverse effects;
e. There will potentially be contaminants in the managed water that could adversely affect highly sensitive frogs where it is pumped back into the system;

45) S6.2 of the B46 report outlines Offsetting or Compensation measures should the Remedial methods not function as needed, or the sites are too remote. This will be the default for all the wetlands because of the reasons outlined, and all the sites are remote. Again, it is a fait accompli that this proposal has defaulted to compensation without adequate consideration of Avoidance as a priority for wetlands that are of Very High value.

46) P32 of the B46 report concludes that with remedial and compensation actions the ecological effects of dewatering are Negligible and the level of effect is Low. This is, again, a highly subjective interpretation of a string of weak evidence. At the very least it is clear that following the end of mining activity the ongoing adverse effects are going to be Very High, and this is unacceptable to have temporary compensation for permanent adverse effects.

47) The B47 report (p35) states that their ecological enhancements *"…will achieve clear net-benefits that substantially exceed the value and extent of areas modified or removed."* However, 'substantially' is a grossly subjective interpretation of the balance that is hoped for, when the true potential is that threatened frog and tree species,

amongst other species, will become locally extinct after their habitat is permanently degraded from dewatering.

Pest control

48) In B40 it is stated that *"The primary compensation measure to address these potential residual effects is wide scale intensive pest control over an area of 633 ha."*

49) In B35 (P3) OceanaGold propose an 18,870ha Biodiversity Project of 'predator' control surrounding the Waihi North Project, for which OceanaGold states: *"Importantly, the Project is not mitigation or compensation for an adverse effect of the WNP."* The Biodiversity Project is offered *"to offset potential impacts to native frogs from the effects of vibration."*

50) Firstly, in the Effects Management Hierarchy, Avoidance or Mitigation of adverse effects in the Waihi North Project Area is not proposed. The priority of Avoiding adverse effects has not been investigated, and the last resort of Compensation has been chosen preferentially. This neglects the applicant's responsibilities to rule out the possibilities of methods to avoid the adverse effects.

51) In the B47 report (p35, second para) – regardless of whether additional compensation 'usually forms' part of the ecological package (no evidence is provided for this), the applicant has already declared that the Biodiversity Project is not part of the mitigation for adverse effects, therefore it is not available for considering weighting of values in this consent application.

52) The B47 report (p27 bullet), by proposing this research, acknowledges that they don't know if pest control as currently proposed would help frogs. Indeed, it is assumed that predation of frogs is a significant issue, but it requires research at this site to prove that it is, and if the proposed pest control will help. Therefore, where is the evidence that it can confidently be offered as compensation for adversely affecting the frog population?

53) In B47 (p35) under Additionality, it is stated that: *"All of the component parts of the effects management package involve activities or actions that would not have been otherwise undertaken by OGNZL or other agencies…".* Since the B47 report (Feb 2025) there has been aerial 1080 pest control work undertaken by the Department of Conservation in the same area in 2025.[8] Therefore the proposed Biodiversity Project is additional to this pest control already being undertaken. Further, of course, nobody else is offering to provide all these unavoidable adverse effects!

[8] https://maps.doc.govt.nz/externalmaps/index.html?viewer=pesticidesummary

54) The pest control proposed is only for the life of the mining project. After that point in time everything reverts to the current status quo and nothing will have been achieved, and the negative effects from the mining activities will remain.

<u>Pigs</u>

55) Pigs are known to predate Archey's and Hochstetter's frogs [9][10]. In this study 44-66% of pigs had visible evidence of frogs in their guts. One pig had 56 individual frogs. DNA analyses revealed a higher number of pigs had consumed frogs, but they did not have visible remains. It is unknown how much time it takes for pigs to digest frogs to when they are unrecognizable, and therefore how many days of feeding that these numbers represent. Regardless, this number of frogs predated, multiplied by the number of pigs feeding on them, multiplied by the number of days this occurs per year is a significant potential effect relative to the estimated population size of frogs.

56) It is questionable how pig control can be effective over a large area such as the areas proposed, for the following reasons:

   a. Even professional hunters with trained dogs find it difficult to kill many pigs in a pack;
   b. Pigs cover large distances so can turn up in the project area from elsewhere in a short time;
   c. Pigs that are hunted may move to another area where they are just as likely to be feeding on native frogs;
   d. 1080 operations will not kill all of the pigs in that area;
   e. Following 1080 operations there can be a ban on dogs in the area or reluctance to use them for a long time, which removes the hunting pressure on pigs so they can return;
   f. Any residual or transitory pig population may still have a significantly large adverse effect on the local frog population.

   Therefore, it is not conclusive whether pig control could be offered as compensation for adverse effects of mining activities on frogs.

57) There needs to be a comprehensive monitoring programme inside and outside the pest control project area that begins before pest control starts, then carries on after pest control. This will provide monitoring information on pig and frog populations in both areas. There are significant questions about unintended consequences:

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[9] https://newzealandecology.org/nzje/3583 Hotham E,R et al, *New Zealand Journal of Ecology* (2025) *49(1): 3583: Frog-predator interactions in Aotearoa New Zealand: observations and two case studies using molecular and visual gut-content analyses*

[10] https://www.nzgeo.com/stories/one-pig-one-night-fifty-six-frogs/

a. what will happen if the pig control doesn't work to help increase the frog population inside the pest control area?
b. What will happen if the frog population outside of the pest control area falls in relationship to increasing pig numbers?

This 'management reaction to monitoring' has been set up for other aspects of the mining proposal (e.g. management of dewatering if monitoring of wetlands show they are negatively affected).

58) The monitoring programme needs to be extensive to cover the pest control area and an equivalent adjacent area with frogs but no pest control. There needs to be a budget set for the monitoring programme.
59) The management that is proposed to alleviate any unintended consequences of the pest control programme must be approved by DOC (as being proven by evidence).
60) There must be a budget set for this pig management, and a bond held by a third party to 150% the value of the budget to ensure that it is undertaken if the OGNZL walks away. The pig control must have targets approved by DOC that are to be reached before any bond money is released.

Mice

61) The B47 report (p27) suggests that pest control may not include mice. This is not acceptable because, following rat control, the mice population has been shown to increase and negatively affect frog populations. This unintended consequence was documented in the Whareorino forest[11] where there was reduced recruitment of young frogs due to increased predation by mice that were able to access micro-refuges of the younger frogs. Even with an increase in survival of adults, the long-term prospects for the population with reduced recruitment are not promising. The authors of the Whareorino study suggest that rat control alone may not be sufficient to recover depleted frog populations and recommend further research to understand the effects of mice.
62) There needs to be a budget set to control mice over the whole Biodiversity Project pest control area, and a research project funded to further understand the effects of mice on frogs inside and outside the project area. A bond must be held by a third party to 150% the value of the budget to ensure that the control and research is undertaken. The mice

[11] Germano, Jennifer M., et al. "Age Dependant Effects of Rat Control on Archey's Frog (*Leiopelma Archeyi*) at Whareorino, New Zealand." *New Zealand Journal of Ecology*, vol. 47, no. 2, 2023, pp. 1–12. *JSTOR*, https://www.jstor.org/stable/48807004. Accessed 14 Aug. 2025.

control must have targets approved by DOC that are to be reached before any bond money is released.

Budget

63) The B40 pest control plan is a high-level framework of ideas. It does not consider the practical effects of the proposed pest control on the actual biodiversity objectives and then target the management decisions and methods towards this. There is a raft of practicalities that are not in the plan which are required to resource a large pest control operation like this.

64) The budget provided to comprehensively undertake pest control over the Biodiversity Project area is significantly underfunded. For example, there is no consideration for huts that will be required for pest control operators. A single hut itself will cost more than $500,000 to consent and put in place. Several of these may be required. A large outlay of resources and time will be required for the initial layout of trap and bait lines and then continued maintenance. Where is the budget for this infrastructure and other essentials such as an office base, staff and vehicles, and poison sheds, tools, … etc? All of this must be in place before any pests are killed.

65) A project of this scale must be bonded to ensure that OceanaGold does not walk away from it. The bond will need to be 150% the value of all the setup costs, ongoing management and monitoring of the project area and beyond. The project must have targets approved by DOC that are to be reached before any bond money is released.

Freshwater Ecology Issues

Waihi North Project

Dr Mike Joy

The Morgan Foundation Senior Research Fellow in Freshwater Ecology and Environmental Science

School of Geography, Environment and Earth Sciences

Te Herenga Waka—Victoria University of Wellington

Wellington, 6012

Introduction

My full name is Michael Kevin Joy, but I am known as Mike Joy. I live in Wellington.

I am a Senior Research Fellow at the School of Geography, Environment and Earth Sciences at Victoria University of Wellington. My field of research is in freshwater ecology.

Part (A): Qualifications and experience

I have a Bachelor of Science in Ecology (1997) and Master of Science with Honours in Ecology from Massey University (1999). In 2003 I obtained my PhD in Ecology from Massey University. Both my Masters and PhD research focussed on freshwater issues in New Zealand: My Master thesis was called "Freshwater fish community structure in Taranaki: dams, diadromy or habitat quality?".

My PhD thesis was called "The development of predictive models to enhance biological assessment of riverine systems in New Zealand".

Between 2003 and 2018, I was a Lecturer, then Senior Lecturer, at Massey University in ecology and environmental science. I have been a faculty member of Victoria University of Wellington since 2018.

I have published numerous journal articles[1] on topics relating to freshwater ecology, including:

[1] A full list of my publications can be found at <orcid.org/0000-0001-9457-5013>.

MK Joy and others "The grey water footprint of milk due to nitrate leaching from dairy farms in Canterbury, New Zealand" (2022) 29(2) Australasian Journal of Environmental Management 177.

AD Canning, MK Joy, and RG Death "Nutrient criteria to achieve New Zealand's riverine macroinvertebrate targets" (2021) 9 Peer J 1.

MK Joy and AD Canning "Shifting baselines and political expediency in New Zealand" (2020) Marine and Freshwater Research.

M Joy, KJ Foote, P McNie, and M Piria "Decline in New Zealand's freshwater fish fauna: Effect of land use" (2019) 70(1) Marine and Freshwater Research 114.

MK Joy "Our deadly nitrogen addiction" in C Massey (ed) *The New Zealand Land & Food Annual Volume 2* (Massey University Press, Palmerston North, 2017) 119.

MK Joy "Freshwaters in New Zealand" in A Stow, N Maclean, and G. Holwell (eds) *Austral Ark: The State of Wildlife in Australia and New Zealand* (Cambridge University Press, Singapore, 2014) 227.

MK Joy, and RG Death "Freshwater Biodiversity" in JR Dymond (ed) *Ecosystem Services in New Zealand* (Manaaki Whenua Press, Lincoln New Zealand 2013) 448.

I have also published the following books on freshwater ecology:

Mike Joy (ed) *Mountains to Sea Solving New Zealand's Freshwater Crisis* (Bridget Williams Books, Wellington 2018).

Mike Joy *Polluted Inheritance New Zealand's Freshwater Crisis* (Bridget Williams Books, Wellington 2015).

I have been an Associate Editor of Marine and Freshwater Research Journal (CSIRO, Australia) since 2015; an associate editor for the Springer Journal — Biodiversity and Conservation since 2019; and an Editorial Panel Member for Transylvanian Review of Systematical and Ecological Research since 2010.

I have served on various technical advisory groups for government agencies. I was on the Landcorp Environmental Reference Group for four years, from 2015 to 2019. I was also on the Ministry for the Environment Science and Technical Advisory Group, or **STAG**, from 2018 to 2020.

I have developed bio-assessment tools that are used by many regional councils and consultants. I also developed the Fish Index of Biotic Integrity, which is now included in the National Policy Statement for Freshwater Management, or **NPS-FM**. I have published scientific papers in many fields from artificial intelligence and data mining to the freshwater ecology of sub-Antarctic islands.

I have received several awards for my work, including:

- an Ecology in Action award from the New Zealand Ecological Society (2009);
- an Old Blue from Forest and Bird (2011);
- a Tertiary Education Union Award of Excellence for Academic Freedom and Contribution to Public Education (2013);
- the Royal Society of New Zealand Charles Fleming Award for protection of the New Zealand environment (2013);
- the Morgan Foundation inaugural River Voice Award (2015);
- the inaugural New Zealand Universities Critic and Conscience Award (2016); and
- a semi-finalist for the 2018 and 2022 Kiwibank New Zealander of the year; and
- the Callaghan Medal, awarded annually by the Royal Society of New Zealand, in 2023 for communication efforts focussed on the decline of freshwater ecosystems and drinking water, and sustainability challenges in current food systems.

For the last two decades, I have been working at the interface of science and policy in New Zealand with a goal of strengthening connections between science, policy and real outcomes to address the multiple environmental issues facing New Zealand.

Part (B): Code of Conduct

1. I confirm I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2023.

2. I have complied with the code of conduct when preparing this statement of evidence and will do so if required to give oral evidence before the Expert Panel considering the application by Oceana Gold (New Zealand) Limited (**Applicant**) under the Fast-track Approvals Act 2024 (**Act**) to expand its existing gold and silver mining operations at sites in the Waihi North area of the Coromandel Peninsula, being Fast-track Application No. FTAA-2504-1046 (the **Waihi North Project Application**).

3. I have read D.4 WRC Conditions.

4. The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for my opinions expressed are also set out in this evidence.

5. Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

6. My qualifications, relevant experience and basis for my expertise are as set out above.

Part (C): Comments on Boffa Miskell report for Oceana Gold

I have the following comments on the Boffa Miskell report for Oceana Gold.

My focus is to highlight my genuine concerns about the significant adverse impacts arising from the Applicant's outlined approach to stream relocation, warm spring destruction and selenium in the Ohinemuri River.

1. In the opening pages of the Boffa Miskell Report (**report**) (pages 3-6) there are statements summarising key freshwater issues. These include the intention to destroy the only warm spring in the Wharekirauponga area and sections of several waterways in the Waihi town vicinity. Justifying the “total loss” of the warm spring by offsetting with “protecting and enhancing” elsewhere, and characterising the relocation of a 1.4kn of a stream as “low Impact” and diversion of another stream as a “ low to high” impact, is unscientific. The impacts of destroying and relocating waterways are not “low to high”, they are severe for those waterways and their flora and fauna. “Offsetting” does nothing to justify this damage. In the case of the warm spring, total loss means total loss.
2. The impacts on the Warm Spring, the Mataura Stream, the Ruahorehore Stream, the Headwaters Gully stream, the TBI (tributary ?) at Northern Rock Stack are all matters of concern. The ability to restore these waterways to their optimum is nil.
3. Page 7 relates to reconsenting mine wastewater discharges into the Ohinemuri river. There is no specific information on the age of the consents being applied for “re consenting”, the breaches of those consents, or the methodology of collecting specific data for pollutants such as selenium. How many fish surveys have been carried out? What MCI data was collected related to mine pollutants.
4. Water treatment – there is no information as to how mine wastewater will be treated to remove the range of pollutants such as selenium.
5. Selenium Impacts - A Case in Point One of the many environmental impacts of hard rock gold mining is Selenium, the source of selenium is the ore (it is one of many trace elements within the ore itself). New Zealand has generally low levels of Selenium, but it is found in the same places as gold. The hard rock is crushed to the consistency of talcum powder to get the gold out and as part of the process in Waihi the wastewater from the mining area is processed and discharged to the Ohinemuri River. Selenium is a mineral which can be toxic to fish at higher levels and bioaccumulation of selenium through the food chain risks fish species and their eggs.

6. Boffa Miskell Page 116 highlights a concerning approach to selenium levels. The author of this report has actively sought to clarify why Oceana Gold, and the Waikato Regional Council are using far less robust toxicity levels for selenium in freshwater than the USEPA level is under debate by USA scientists for being too lax.
7. In the USA the union of concerned scientists https://www.ucs.org/resources/attacks-on-science/selenium-standards-misinterpret-key-research have been lobbying for a long time to change it because the author of the paper that the EPA used to come up with the limit disagrees with their conclusions and says it is too lax.
8. The effect of selenium on fish eggs, also known as the "invisible impact of selenium" *"The potential for selenium to rapidly and severely affect fish populations has been recognized for over 2 decades (e.g., Cumbie and Van Horn, 1978). However, selenium poisoning can be "invisible" because the primary point of impact is the egg, which receives selenium from the female's diet and stores it until hatching, whereupon teratogenic deformity and death may occur. Adult fish can survive and appear healthy despite the fact that massive reproductive failure is occurring (Lemly, 1985a; Coyle et al., 1993). Consequently, fish populations can decline or even disappear over the course of a few years for no apparent reason —unless one is cognizant of the subtle way in which selenium operates."* Reference: https://files.nc.gov/ncdeq/Public%20Records%202/DWR%20Records/Selenium%20on%20Fish%20Time%20Bomb%20Dennis%20Lemly%201999.pdf
9. Figure 1 below from the paper: Lemly, A. D. (1999). Selenium Impacts on Fish: An Insidious Time Bomb. Human and Ecological Risk Assessment: An International Journal, 5(6), 1139–1151. https://doi.org/10.1080/10807039.1999.10518883 shows that impacts on reproductive failure begin at 2 parts per billion and are 100% lethal to egg formation at 10 part per billion.

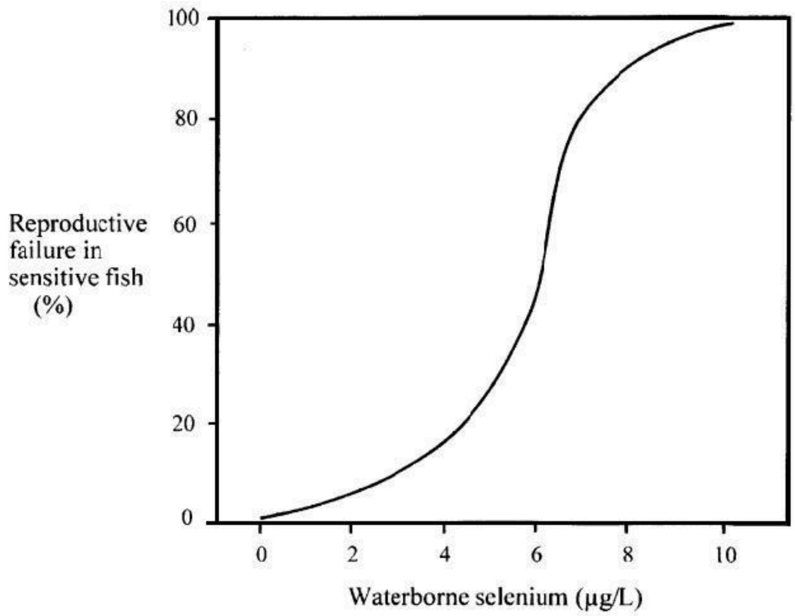

Figure 1. Relationship between the concentration of selenium in habitats favorable for bioaccumulation (*e.g.*, lakes, wetlands) and the degree of reproductive failure in sensitive fish species (*e.g.*, bluegill, *Lepomis macrochirus*). A small increase in waterborne selenium can result in catastrophic impacts on reproductive success. Recent escalation in human activities that promote the mobilization of selenium into aquatic ecosystems threatens to activate this time bomb on a widespread scale in the United States and elsewhere.

10. The current monitoring regime involves a suite of parameters being tested over a range of levels e.g. sediment, water quality, periphyton, macroinvertebrates, macrophytes and fish at a number of sites – generally six but not all of those listed are sampled at each site. For example, the annual sampling of fish is undertaken at an upstream (control) site and a downstream site within the Ohinemuri River but not at the four sites in between. Since monitoring began the data indicates that the range of selenium found in bullies is 1.8-3.5mg/kg at the control site and 4.0-8.5mg/kg at the downstream site and in eels is 2.0-3.5mg/kg at the control site and 4.8-7.7mg/kg at the downstream site.
11. Note the fish sampling consent condition is flawed: The limit suggested by Lemly is 5.85 ppm which is mg/kg so many of the fish are in the samples are around the lethal limit, therefore if the lethal limit applies to New Zealand fish and the sampling involves live fish then any fish killed by excess Selenium will not be captured (as they are dead).
12. There has been an erroneous assumption made that because selenium is found in fish at the upstream “control site” the source of the Selenium is not the mine discharge. The simple explanation is that almost all our native fish migrate upstream throughout their lives and thus they will accumulate

selenium from the discharge during their upstream migration from the sea all the way up the Ohinemuri and If they haven't received a lethal dose will eventually be found above the discharge.

13. Thus, the consent conditions are fundamentally flawed in relation to Seleium in three ways; 1. the selenium level limits are flawed because they don't include reproductive impacts, 2. the use of a 'control site' that isn't, in fact it is another impact site and 3. Because the fish sampling shows fish are already close to the lethal level of selenium it will miss fish killed by excess selenium.
14. The only real control site would be to use fish from a river on the other side of the Coromandel Peninsula as any fish migrating up from the Firth of Thames would have some Ohinemuri selenium influence. The flawed Selenium Levels used, and the lack of a true control site means that claims of 'no impact' in the past because consent conditions are met (and that claim is debatable) is in error, in fact there is ample evidence the processing plant is having significant impacts on aquatic life.
15. The company's view is that the EPA "limits" are overly conservative, has no scientific basis. Thus, claiming 'no impact' is far from proven and the next phase must be to answer that answer that question before the discharge can be assessed.

Matters to consider:

a. Is it ok to use USEPA levels? (The safe levels for NZ native fish have never been tested)

b. Why no investigation into reproductive failures, the effect of selenium of fish eggs has not been considered when levels are an order of magnitude lower than EPA limits?

c. Why do WRC take mining companies word for it whether a level is safe or not?

d. why did the reports done by Golders not look at other fish species and test safe levels in NZ fish?

e. Live fish sampling means that fish suffering sub-lethal or lethal effects of Selenium will be missed

16. I have also generally reviewed the first iteration of consent conditions. I have not reviewed, but seek an opportunity to review, the latest iteration of consent conditions, and related documents. Unfortunately these arrived too late in preparation of my evidence.

Coromandel Consultant Limited

11 August 2025 CCS Ref:1108

1. My name is Katherine Selby-Smith
2. I am an Environmental Engineer.

Code of Conduct

3. I confirm I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2023.
4. I have complied with the code of conduct when preparing this statement of evidence and will do so if required to give oral evidence before the Expert Panel considering the application by Oceana Gold (New Zealand) Limited (**Applicant**) under the Fast-track Approvals Act 2024 (**Act**) to expand its existing gold and silver mining operations at sites in the Waihi North area of the Coromandel Peninsula, being Fast-track Application No. FTAA-2504-1046 (the **Waihi North Project Application**).
5. The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for my opinions expressed are also set out in this evidence.
6. Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
7. My qualifications, relevant experience and basis for my expertise are as set out above.

Documents Reviewed

8. In preparing this evidence, I have focused my review on my counterpart expert. I have therefore reviewed the following:

B.07 Beca 'Willows Farm Stormwater Management Report ' dated 24 February 2025

B.25 GHD 'Waihi North Project Water Management Studies (WAI-985-000-REP-LC-0011_Rev3)' dated 17 February 2025

9. I have also generally reviewed the first iteration of consent conditions. I have not reviewed, but seek an opportunity to review, the latest iteration of consent conditions, and related documents. Unfortunately these arrived too late in preparation of my evidence.
10. I also note that I have not yet had the opportunity to undertake a site visit.
11. I have reviewed the following documents which forms part substantive application documents for the Waihi North project under the Fast Track Legislation.
12. I reviewed two documents and have provided commentary below each.

B.07 Beca 'Willows Farm Stormwater Management Report ' dated 24 February 2025

13. The stormwater philosophy uses the following industry standards;

- Waikato stormwater runoff modelling guideline (TR2020/06), Waikato Regional Council.
- Waikato stormwater management guideline (TR2020/07, updated May 2020), Waikato Regional Council.
- Regional Infrastructure Technical Specifications (RITS), Waikato local Authority Shared Services.

14. Essential to any stormwater design is choosing the appropriate rainfall data. The Beca design uses '*The rainfall data was obtained from HIRDS (June 2021) and uses the RCP 8.5 data for climate change to 2050. Climate change to 2050 has been selected as this is a temporary site and is not expected to in operation for more than 30-years. design follows the WRC guidelines and is follows standard industry practise in the design'*.

15. They are using the highest RCP scenario and correct timeframe (if the project has a 30-year design life). However, they indicate they are using rainfall data obtained from HIRDS in June 2021. I checked the latest version of HIRDs rainfall data and there has been an increase of 24-hour rainfall depth. In the report they use 152mmm, 238mm, 369mm for the 24-hour rainfall depth for the 50% AEP, 10% AEP and 1% AEP events respectively. These figures in HIRDS are now 161mm, 252mm and 394mm.
16. As this is the preliminary design, I would assume they would obtain the latest HIRDS figures available for the design. This would result in increased runoff volumes but I would also assume that this can be factored into the final stormwater design (e.g. longer swales or larger detention pond).

B.25 GHD 'Waihi North Project Water Management Studies (WAI-985-000-REP-LC-0011_Rev3)' dated 17 February 2025

- Section 2.3.2 Regime Compliance (pg 17)

17. The tables and commentary uses data from the existing wastewater treatment plant from January 2019 to December 2020, which the report states "*WTP is currently operating within the compliance criteria as outlined in RC 971318*".
18. This data is 5 years old, and does not confirm the WTP is 'currently' operating within the compliance criteria.

- Section 2.3.3 In-stream compliance (pg 19)

19. The tables and commentary uses data from the in-stream water quality from January 2019 – March 2021, which the report states "*Ohinemuri River water quality is currently within the compliance criteria for all relevant parameters*".
20. This data is 4 years old, which does not confirm the in-stream water quality is within the compliance criteria.

- Reference document 2025b or EGL 2025b?

21. This document is referenced as GHD (2025b) on page 26, page 28, page 29 (referring to rainfall record and stream data)

22. This document is referenced as EGL (2025b) in Figure 22 page 45 (Proposed TSF3 Collection Pond)
23. In the references, there is no GHD report from 2025 only *'EGL, 2025b. Oceana Gold (New Zealand) Limited. Tailings Storage Facility. Storage 3 RL155.Technical Report.'*
24. Therefore I reviewed the EGL report;

- There is no reference to rainfall data collected in the Wharekirauponga catchment, therefore statements in Section 3.1.1 (page 26) are incorrect.
- In Section 3.2.1 (pg 28) references baseline flow data for the Mataura Stream. There is no reference in the EGL document.
- Section 3.2.2 (pg 29) references baseline flow data of the Wharekirauponga. There is no reference in the EGL document.
- Figure 22 in the report is from the EGL report (Appendix a)

25. Further investigation indicates this is probably a typo and is meant to refer to WWLA, 2024a. Q2 June 2024 – Hydrological Monitoring Summary. Wharekirauponga Stream Catchment and Mataura Stream Catchment Quarterly Flow Gauging. Rev1.

Report prepared by;

Kate Selby Smith
Environmental Engineer (BE Env.)
M. 022 0438 206

LIMITATIONS

- Coromandel Consultant Limited (CCL) has prepared this report for the exclusive use by Coromandel Watchdog of Hauraki for the WUP proposed underground mine.

BEFORE THE FAST-TRACK APPROVALS PANEL

In the matter of the Fast-Track Approvals Act 2024

And

In the Matter of applications by Oceana Gold (New Zealand) Limited for various resource consents and other authorities relating to the Waihi North Project (including the Wharekirauponga Underground Mine)

*Informing comment from Coromandel Watchdog of Haurak***i**

Brief of evidence of Luke Easton

Dated: 18 August 2025

- My name is Luke Easton.
- I hold an MSc, PGDip, and PhD in Zoology
- I am a specialist in native frogs, having studied them for over a decade.

- I confirm I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2023.
- I have complied with the code of conduct when preparing this statement of evidence and will do so if required to give oral evidence before the Expert Panel considering the application by Oceana Gold (New Zealand) Limited (**Applicant**) under the Fast-track Approvals Act 2024 (**Act**) for gold and silver mining activities at sites in the Waihi and Wharekirauponga area, being Fast-track Application No. FTAA-2504-1046 (the **Waihi North Project Application**).
- The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for my opinions expressed are also set out in this evidence.
- Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
- My qualifications, relevant experience and basis for my expertise are as set out above.

In preparing this evidence, I have focused my review on my counterpart expert. I have specifically reviewed the following:

B41 and 42, and B 58.

I have also generally reviewed the first iteration of consent conditions. I have not reviewed, but seek an opportunity to review, the latest iteration of consent conditions, and related documents. Unfortunately these arrived too late in preparation of my evidence.

Below are my comments for Coromandel Watchdog of Hauraki on frog impacts as in the Oceana Gold Waihi North Fast-track Approvals Application documents.

1. Dylan van Winkel's assessment report highlighted the scarcity of literature investigating vibration impacts on amphibians, and specifically the lack of relevance of such studies to leiopelmatid frogs, which lack middle ear structures such as tympanic membranes.
2. Nonetheless, these studies (examples of abstracts below) demonstrate that vibrations do have an impact on a repertoire of amphibian responses, from behavioural through to physiological. Therefore, to suggest that there would be no impact on leiopelmatid frogs is nonsensical.
3. Absence of evidence is not evidence of absence.
4. Caorsi, V., Guerra, V., Furtado, R. *et al.* Anthropogenic substrate-borne vibrations impact anuran calling. *Sci Rep* **9**, 19456 (2019). https://doi.org/10.1038/s41598-019-55639-0 : Anthropogenic disturbance is a major cause of the biodiversity crisis. Nevertheless, the role of anthropogenic substrate vibrations in disrupting animal behavior is poorly understood. Amphibians comprise the terrestrial vertebrates most sensitive to vibrations, and since communication is crucial to their survival and reproduction, they are a suitable model for investigating this timely subject. Playback tests were used to assess the effects of substrate

vibrations produced by two sources of anthropogenic activity– road traffic and wind turbines– on the calling activity of a naïve population of terrestrial toads. In their natural habitat, a buried tactile sound transducer was used to emit simulated traffic and wind turbine vibrations, and changes in the toads' acoustic responses were analyzed by measuring parameters important for reproductive success: call rate, call duration and dominant frequency. Our results showed a significant call rate reduction by males of *Alytes obstetricans* in response to both seismic sources, whereas other parameters remained stable. Since females of several species prefer males with higher call rates, our results suggest that anthropogenically derived substrate-borne vibrations could reduce individual reproductive success. Our study demonstrates a clear negative effect of anthropogenic vibrations on anuran communication, and the urgent need for further investigation in this area.

5. Zaffaroni-Caorsi, V., Both, C., Márquez, R., Llusia, D., Narins, P., Debon, M., & Borges-Martins, M. (2022). Effects of anthropogenic noise on anuran amphibians. *Bioacoustics*, *32*(1), 90–120. https://doi.org/10.1080/09524622.2022.2070543 : Anthropogenic noise is widespread in nature and has been shown to produce a plethora of impacts on wildlife. Sounds play a fundamental role in the lives of amphibians, with species relying on acoustic communication for social and reproductive behaviour, and thus noise can potentially interfere with these activities. Here, we provide a literature review on the effects of anthropogenic noise on anuran amphibians, based on 32 studies (63 species from 14 families) that document noise-driven changes in species behaviour, physiology and ecology caused by urbanisation, transportation and energy production. Experimental and observational studies found evidence that both airborne and seismic anthropogenic noise influence

anuran calling activity, with consequences in mate selection, and induce physiological changes including increased stress, suppressed immune function and colouration changes. Negative noise effects in species abundance and attendance over the reproductive season were reported. Even though adaptations and behavioural adjustments enable species to respond to these noises, it is yet to be understood whether these changes alleviate the negative impacts. Furthermore, collaborative efforts between scientists, stakeholders and private/public institutions are imperative to create conservation guidelines and legal instruments to be implemented during urban expansion projects and mitigate the effects of noise pollution on amphibian anurans.

The Golden Cross vibration modelling suggests that leiopelmatids can tolerate between 2–10 mm/s given that they have persisted around the gold mine since operations began (also mentioned in the Waihi North Project Blasting and Vibration [WNPBV] assessment, Pp. 39). Previous monitoring of Hochstetter's frogs reported by Whitaker & Alspach (1999) attest to no evidence of the mine having a discernible impact on the frog population and that the population structure appeared healthy. However, sampling bias – particularly with rainfall – influenced frog numbers they recorded. Hochstetter's frogs move away from streams during heavy rainfall to avoid being washed downstream due to potential floods.

6. Whitaker, A.H.; Alspach, P.A. 1999. Monitoring of Hochstetter's frog (Leiopelma hochstetteri) populations near Golden Cross Mine, Waitekauri Valley, Coromandel. Science for conservation 130. Further, as Dylan van Winkel pointed out, the vibration modelling does not provide evidence of a vibration threshold (in this case their proposed condition of up to 15 mm/s – Pp. 31 of the WNPBV assessment) that, if exceeded, would initiate a response in the frog population that is deemed ecologically meaningful.

In other words, this perceived 'tolerance range' of 2 -10 mm/s may already be causing a negative response – we just currently don't have the means to detect it.

7. Statements in the WNPBV assessment report, such as: *"Based however on the observed habitat of the frog that shows the area covered with leaf matter and other organic material that would attenuate very heavily the level of vibration that would be experienced for frogs living in the area, the level of vibration that would be experienced by any frogs would be significantly less than the modelled values.* [Section 6.3, Pp. 21]*"* have no integrity as these have not specifically been measured, and again, to what degree of vibrations are required to elicit responses in frogs, whether it be behavioural, physiological or how they communicate, remains unclear.
8. Which leads me to Brian Lloyd's frog population assessment reports. He clearly identifies the flaws in the study design and analyses, which is great to have transparency. Brian is an incredible statistician, but as he so clearly highlights, monitoring frogs (especially Hochstetter's frogs) is difficult and therefore gaining robust data is difficult to achieve for these purposes. However, I strongly oppose his suggested monitoring method of replicating surveys of streams at least 6 times, 1 day apart, as this will be destructive to sensitive frog habitat. Having people regularly walk through and search refuges disturbs the area, even when you are trying your best not to. I do wonder whether transmitting some frogs and mapping their movements, as well as taking urine samples for stress hormone analysis would be useful, but these are just ideas. These techniques have been successfully used on leiopelmatid frogs in the past.
9. Overall, and in short, we have no knowledge of what impacts vibrations have on leiopelmatid frogs. Yes, they are still present, but as long-lived species (18 years for Hochstetter's frog & 39 years for Archey's frog), they

may survive in an environment that is sub-optimal for decades but are still negatively impacted in some way. What we do know is that the destruction of habitat will directly kill frogs that are not physically transferred elsewhere. Furthermore, population estimates from Brian's reports are erroneous to say the least (see his summaries where he highlights the limitations of the study designs).

10. Avoiding further destruction of conservation areas, regardless of what rare species inhabit them, is what we should be aiming for. Those conservation areas were established for the protection of natural and cultural values.

IN THE MATTER of the Fast Track Approvals Act 2024 (FTA2024)

and

IN THE MATTER of the FTAA Application by Oceana Gold New Zealand Limited to extract minerals in the Waihī and Wharekirauponga area

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EVIDENCE OF Prof. Bruce Waldman

SUBJECT Health effects of drilling operations on Leiopelma frogs

DATE 22/08/2025

Evidence of: Prof. Bruce Waldman

Introduction

1. My name is Bruce Waldman. I am an ecologist with 45 years of experience in academia and conservation biology, 16 years (1992–2006) of which I worked on all three species of New Zealand's native *Leiopelma* frogs. At the University of Canterbury, I established the first successful captive-breeding program for Archey's frog. I was also the first person to discover chytrid fungus (*Batrachochytrium dendrobatidis*) in New Zealand and led response plans for this incursion. I recruited to New Zealand the late Dr Phil Bishop, and acted as his supervisor at the University of Canterbury. I also have collaborated with other leading *Leiopelma* researchers, including Dr Ben Bell and his students.
2. I currently am Professor in the Department of Biology at Oklahoma State University in the USA.
3. I hold the qualifications of B.Sc. (Biology Honours), University of Illinois at Urbana-Champaign and Ph.D. (Neurobiology and Behavior), Cornell University
4. While working in New Zealand, I held academic appointments at the University of Canterbury and Lincoln University. Before working in New Zealand, I was a NATO Post-doctoral Scholar in Zoology at the University of Cambridge in the United Kingdom, and Professor in Organismic and Evolutionary Biology at Harvard University in the United States. After leaving New Zealand, I was Professor in Biological Sciences at Seoul National University in South Korea. On retirement there, I accepted the position of Head of Department in Integrative Biology at Oklahoma State University.
5. Since 2015, I have been a National Geographic Society Explorer. A brief description of my research accomplishments is reflected in the profile they provide: Bruce Waldman is an ecologist and conservation biologist. In 1999, Waldman discovered bell frogs dying of amphibian chytridiomycosis in Canterbury, New Zealand. He found that although some individuals were susceptible to the disease, others were resistant and recovered after showing only transient effects. Concerned that the disease might spread to New Zealand's native "living fossil" Archey's frogs, Waldman launched an international campaign to protect the frogs. He subsequently found many Archey's frogs dying in the field. He established assurance colonies at the University of Canterbury and successfully bred the frogs in captivity. Waldman's research group at Seoul National University isolated Asian strains of the chytrid pathogen responsible for the worldwide amphibian pandemic. Genomic analyses revealed that the disease originated in Asia, from which it spread around the world. With his students, he

found that Asian amphibians had evolved adaptive immune responses that conferred resistance to the pathogen, but many non-Asian amphibians remained susceptible. Waldman continues to be an active researcher and advocate for threatened and endangered species in New Zealand, Asia and around the world.

Code of Conduct

6. I confirm that I have read the Environment Court Practice Note 2023 - Code of Conduct for Expert Witnesses (Code), and have complied with it in the preparation of this memorandum. I also agree to follow the Code when participating in any subsequent processes, such as expert conferencing, directed by the Panel. I confirm that the opinions I have expressed are within my area of expertise and are my own, except where I have stated that I am relying on the work or evidence of others, which I have specified.
7. In the preparation of evidence, I have reviewed and considered the following documents, including those provided by the Applicant in their Substantive Application:
    a. Significant natural areas of the Waikato region: streams and rivers – Waikato Regional Council TR -2010-19 (TR-2010-19)
    b. Fasttrack Approvals Act 2024
    c. B.23-Tonkin-Taylor-Technical-Review-of-Air-Quality-Assessment
    d. B.22-Beca-WUG-Air-Discharge
    e. B.53-Heilig-Blasting-and-Vibration-Assessment
    f. D.02-Hauraki-District-Council-and-Waikato-Regional-Council-Combined-Proposed-Conditions
    g. D.01-Thames-Coromandel-District-Council-Proposed-Conditions
    h. Part-I-Cover-and-rules-assessment
    i. B.37-Boffa-Miskell-Terrestrial-Ecology-Values-and-Effects-of-the-WUG
    j. B.36-Bioresearches-Terrestrial-Impact-Assessment
    k. B.35-OGNZL-Biodiversity-Project-Overview
    l. B.31-WWLA-Shallow-and-Deep-Groundwater-Movement
    m. B.30-WWLA-Groundwater-Effects-Tunnel-Elements
    n. B.26-GHD-Groundwater-Assessment-Part-1
    o. B.27-WWLA-Wharekirauponga-Groundwater-Assessment
    p. B.25-GHD-Water-Management-Studies
    q. A.12-Substantive-Application-Report-Conclusion
    r. A.11-Substantive-Application-Report-Fast-track-Approvals-Act-2024-Requirements
    s. A.10-Substantive-Application-Report-Management-and-Monitoring-of-Environmental-Effects

t. A.09-Substantive-Application-Report-Assessment-of-Effects
u. A.05-Substantive-Application-Report-Project-Description
v. OGNZL-D.04-WRC-Conditions-Clean-Version-28-July
w. H.06-WUG-Water-Management-Plan
x. D.04-Waikato-Regional-Council-Proposed-Conditions
y. B.33-Flo-Solutions-Hydrogeologic-Site-Model
z. B.32-Wharekirauponga-Hydrology-Modelling

Frog Conservation Issues Not Adequately Addressed

8. **Population Fluctuations and Mysterious Declines**
    a. Despite their longevity, *Leiopelma* frogs undergo extreme population fluctuations.
    b. In the 1990s, most Archey's frogs disappeared from the Tapu–Coroglen ridge. Many were found dying in the field, which I collected under DoC permits for further study.
    c. Mortality causes remain unresolved. While DoC attributed declines to chytrid fungus, our research showed that none of the dying frogs were infected. Instead, they were immunocompromised and succumbed to common microbes.
    d. Evidence suggested environmental stressors—such as pesticides or pollutants—were suppressing immunity. However, this explanation was dismissed in favour of chytrid, even though population collapses occurred before chytrid arrived in New Zealand.
    e. Frogs collected in poor health recovered in sterile captive conditions, further undermining the chytrid hypothesis.
9. **Global and National Significance**
    a. Archey's frog is ranked the world's #1 EDGE (Evolutionarily Distinct & Globally Endangered) amphibian by the Zoological Society of London. Their evolutionary uniqueness makes them globally irreplaceable.
    b. Species with long lifespans and fluctuating populations are especially vulnerable to extinction.
10. **DoC's Inadequate Response**
    a. DoC has neglected monitoring of Archey's frogs in the Coromandel, relying on limited and flawed data.
    b. Oceana Gold's population models are unreliable, as DoC blocked systematic sampling, causing contractors to conduct irregular surveys. Their projection models violate numerous statistical assumptions.
    c. Having conducted long-term transect surveys myself, I have never seen the densities claimed in Oceana Gold's reports.
    d. DoC's failure to advocate for this critically endangered species breaches its obligations to the Crown to safeguard biodiversity.
11. **Impacts of Vibration and Noise**
    a. Amphibians are highly sensitive to low-frequency ground vibrations. Studies show wind turbines disrupt breeding in midwife toads, and

African clawed frogs suffer morbidity and mortality from similar vibrations.

b. Salamanders, which share sensory similarities with *Leiopelma*, detect seismic vibrations via bone conduction. Such exposure elevates stress hormones, suppresses immune function, and increases disease risk.

c. Frogs also use vibrations for communication, predator detection, and navigation. Chronic anthropogenic vibration could mislead orientation, impair homing, and disrupt critical life behaviours.

12. **Challenges of Translocation**
    a. Amphibians generally show strong site fidelity, often attempting to return to their original home ranges.
    b. Translocation success in frogs is poor: while short-term survival may be acceptable, long-term establishment is rarely achieved.
    c. Small founding populations are vulnerable to inbreeding and demographic collapse.
    d. Subtle mismatches in microhabitat (humidity, vegetation, refuges) further undermine survival and reproduction.

Conclusion

13. New Zealand's *Leiopelma* frogs—especially Archey's frog (*Leiopelma archeyi*)—constitute a globally unique and irreplaceable evolutionary lineage. They are listed as "Critically Endangered" by the IUCN Red List and are afforded protection under the Wildlife Act 1953 as absolutely protected species.
14. The ongoing declines in *Leiopelma* populations cannot be attributed to chytrid fungus and are increasingly understood to be exacerbated by human-induced stressors. Doc have not ensured their effective protection, and the proposed mining activities pose a direct and unacceptable risk to the survival of these species.
15. Under the **Resource Management Act 1991 (RMA)**, decision-makers are required to:

a. Recognise and provide for the protection of significant indigenous fauna as a matter of national importance (s.6(c));

b. Safeguard the life-supporting capacity of ecosystems (s.5(2)(b)); and

c. Avoid, remedy, or mitigate adverse effects on the environment (s.5(2)(c)).

16. The destruction or degradation of *Leiopelma* habitat from mining cannot be remedied or mitigated. Predator control or further research do not constitute adequate offsets under the Act, as they do not address the permanent loss of critical habitat or the compounding of threats already placing these frogs on the brink of extinction.
17. Translocation efforts for *Leiopelma* have had only limited success, as documented in DoC's own Recovery Plans (e.g., Bishop et al. 2013). Reliance on

translocation therefore cannot meet the statutory duty to protect these species in situ.

18. Furthermore, New Zealand is bound by international obligations under the **Convention on Biological Diversity (CBD)** and has committed, through the **New Zealand Biodiversity Strategy**, to prevent the extinction of indigenous species and maintain the genetic resources of our unique fauna. Authorising mining that may precipitate the extinction of *Leiopelma* would be contrary to these obligations.
19. In light of these statutory duties and international commitments, the proposed mining activities are incompatible with the survival of New Zealand's endemic frog species. The risk of extinction is not a "minor effect" capable of mitigation but an irreversible and unacceptable outcome.
20. For these reasons, the application must be declined.

BEFORE THE FAST-TRACK APPROVALS PANEL

In the matter of the Fast-Track Approvals Act 2024

And

In the Matter of applications by Oceana Gold (New Zealand) Limited for various resource consents and other authorities relating to the Waihi North Project (including the Wharekirauponga Underground Mine)

Brief of evidence of Sara Smerdon

Dated: 23 August 2025

Memo to Coromandel Watchdog

Wildlife Issues – Waihi North Application

1. My name is Sara Smerdon
2. I am a Field Operations Expert for the Mahakirau Forest Estate Society Inc.

Code of Conduct

3. The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for my opinions expressed are also set out in this evidence.
4. Unless I state otherwise, this evidence is within my sphere of experience and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
5. My relevant experience and basis for my expertise are as set out above.
6. I have not read the conditions.
7. I've reviewed DOC's Wildlife Approval Report and I **support** their analysis. For lizards/frogs, the key gaps are:
8. **Incidental harm:** Too loosely defined. OG should specify **activities, locations, methods, and minimisation** measures **before** any approval.
9. **Frog salvage:** Still high-risk. Require a **complete, peer-reviewed Salvage & Release Plan** up-front (Hochstetter's actions are incomplete).
10. **Northern Striped Gecko (NSG):** Reinstate **clear site-selection/avoidance criteria and exclusion zones**. NSG is the most at-risk herp here - treat as a focus species. Absence of evidence ≠ evidence of absence. FYI at Mahakirau

Sanctuary (MFS) NSG and Archey's frog (AF) share microhabitat, and Wharekirauponga monitoring has recorded **AF encounter rates ~3× MFS**. The fastest way to determine potential presence is with eDNA.

11. **Monitoring & metrics:** Mandate **independent statistical review**, **trigger-based escalation**, and **long-term reporting** i.e., pre-agreed thresholds that automatically trigger stronger protections or pauses (clear decision rules = faster protection, transparency, accountability). Commit to **long-term, in-footprint monitoring of wildlife harm**.
12. **Receiving sites:** Lock in **legal protection in perpetuity, longitudinal monitoring** and intensive **sustained predator control** (including **mice and pigs**), not short-term offsets.
13. Conclusion: DOC has identified clear deficiencies. If OGL is fast-tracked, **robust, enforceable conditions** are essential to avoid unacceptable harm

Sara Smerdon

In the Matter of Waihi North Project

To – The Expert Panel on the Oceana Gold Mining Fasttrack Application

My name is **Catherine Delahunty.**

I am a former Member of Parliament of 9 years (2008 -2017) and and the present Chair of Coromandel Watchdog of Hauraki.

I have experience as a Social Sciences Tutor – Te Tairawhiti Polytechnic/ Bay of Plenty Polytech.

I am a resident of the region and have had 37 years experience working in local communities including Waihi and Whangamata.

My roles have included working with Waihi constituents on impacts of mining on their homes and mental health over that period.

I am not an expert witness but I have considerable lived experience in contaminated sites through my work with Hon Nick Smith to establish the Contaminated Sites Remediation Fund and in community leadership in the Hauraki.

In preparing these comments I have read the Social Impact Assessment (B.57) prepared by WSP.

I have read the Conditions and Revised Conditions attached to the Application.

1.Gaps in the Social Impact Assessment (SIA)

Since 1988 the community of Waihi have raised issues with the mine owners and operators and with myself in my MP role which are not given any substantive consideration or treatment in the SIA. Expansion of mining in and under the town and the forest will impact on more people in the community

This Social Impact Assessment doesn't acknowledge any present or future social impact on the community at Whangamatā (below the proposed Wharekirauponga Mine in the forest adjacent to that town.)

The Social Impact Assessment makes no mention of numerous social issues associated with this application and provides no independent assessment of the complex social impacts in a mining town where the mining is literally beneath homes.

2. Stress and Forms of Compensation

It's not common to dig an open cast mine pit in the centre of a town especially when it destroys a small maunga . In the first decade of the Martha open pit there was considerable dust and noise affecting streets adjacent to the mine pit. Some people, especially if they had a job at the mine were willing to accept the open cast mine noise and dust. They were relying on the mining company promise that upon closure the mine pit would become a scenic lake. Given the acidic nature of the exposed surfaces of the pit this was never going to be a healthy option and did not eventuate, and the pit north face now is seriously eroded. The proposed Gladstone pit will create another large hole close to this town which will supposedly be filled up with toxic tailings. The impact of the new pit creation and long term future impacts on people living in the vicinity include effects of noise, dust, blasting and vibration, damage to homes and property, mental health issues as a result of blasts etc. Watchdog doesn't have the resources to focus in these but we wish to signal the absence of detail on them could be a concern for the Panel.

The underground mining expansion beneath homes is of greater concerns to some families. Since underground mining started people have complained regularly about the effects of blasting causing vibration under their homes and minor damage to homes and driveways. The burden of proof remains on them to prove a causal link between blasting and damage which is virtually impossible when the company deny this is true and and claim that blasts are within consent conditions. This may be true but doesn't alter the impact on the public with varying sensitivities. The Conditions related top Complaints are concerning as there is no independent agency for residents to complain to and report to Councils on complaints doesn't resolve any of the issues. . People working from home or retired, chronic illness sufferers or on nightshift have expressed the most difficulty with the daily blasts. I am of the view that blasting and vibration conditions should be designed for the most vulnerable not the “average person” .

3. The AEP – Amenity Effects Programme

This programme was created after sustained protest and lobbying by Waihi people. Locals who negotiate this can be offered a “respite” weekend in motels so they can live with the impacts of the conditions under their homes. If the homes are too near the pit or the blasting zones the mining company buys out the people and this owns houses throughout the town. It is not possible to find out how many houses Oceana Gold own in the town at the moment but this enables them to operate in some areas without complaint. A number of people active in the complaints against the mine sold their houses and left town, but needing to sell to the mining company can also silence people who are having issues with mining impacts. This is social impact and if expansion is consented there will be increasing social effects in the town as well as more accommodation needed.

Real estate agents in Waihi have expressed the view that the mining company controls the housing market by default although this view is not universal and would require more research to establish. However, locals residents have complained to me that mining purchases and offering top ups to increase the purchase price distorts the housing market.

It’s important to note the AEP was not created by the mining industry but campaigned for by the community with the help of MP Jeanette Fitzsimons.

There has also been compensation for subsidence risk of $3million to at least 27 households in Waihi.

It’s worth noting that no other towns in Aotearoa have to rely on a company-run compensation scheme to mitigate the social impacts of mining under their homes.

None of this is mentioned in the Waihi North Project application Chapter on Social Impact – as Oceana Gold plans a large expansion in Waihi they should at least explain to the Panel how they expect the AEP to mitigate social impact on the wider numbers of people who will be affected . No “avoid” strategy has been considered.

3. Conditions Related to Waihi Community

There HDC Revised Conditions (C93) require reporting to them on a proposed training scheme for the mining workforce in Waihi. The scheme is the least one would expect for the largest employer in a community and it's surprising that the associated data doesn't exist and such an investment is not already happening.

We would support the HDC Revised Conditions 105-110 which require the company to fund a Social Impact Management Plan including a social impact assessment specialist.

In the Part D Condition 35 we also agree with HDC suggestion that when vibration damage occurs and there is disagreement as to whether mining impact caused that damage a third party must arbitrate. However we would urge the Panel to seek some information about whether this is already a practice, if it works and how many times its has been used to the satisfaction of the homeowners or tenants involved.

4. Wharekirauponga project

The impact on Whangamata people has not been discussed in the Social Impact Assessment Chapter. The uncertainty experienced by the community around their access to their forests, the potential for dewatering and blasting effects on important species in that forest and possible reputational effects on their economy if mining goes ahead, has not been considered.

I attach quotes from some people in Whangamata.

Earthwatch Whangamatā asked Coromandel Watchdog to include this from residents below:

“We are a local group that fights to protect the environment we are intrinsically a part of - our forests, rivers, wildlife and water supply. The location of the proposed Wharekirauponga Gold Mine is particularly significant to Whangamata, being only a short 10kilometers away and the headwaters the southern harbour of Whangamatā - the Otahu Estuary

We work with Coromandel Watchdog and requested that our sample of residents concerns be passed on to the FastTrack Panel.

The Waihi North mining application is impacting on our community now. As a tourist town with a huge influx of both NZ and international visitors, we very much depend on our beautiful surroundings and cannot abide anything that would put that at risk. Not only that, we depend on clear clean water, coming from our nearby valleys, for our water supply. We are concerned at the focus on jobs in this application, to the detriment of the place we live. There are other ways of creating the few jobs that this increasingly automated mining operation can provide.

These comments are not a statistical sample but were volunteered by people who wish the Panel to hear some community perspectives

Kate (Environmental Engineer and Whangamatā Mum)*: I take my daughter for nature experiences into the Parakiwai forest which is our beautiful backyard forest. We always hunt for Archey's Frog and feed the eels. The river has one of the best swimming holes on the Coromandel and we head up every week in summer. The last thing we want is blasting and vibration under that forest or risks to the water table and river flow. Mining is short term gain and will provide nothing for our community and will negatively impact our beautiful backyard forest.*

Luke and Bronwyn (local business owner):

Kia ora,

We are long term residents of Whangamatā, and own a lifestyle block of land we have called home for 20 years. It is 5 minutes drive from the township, bordering forestry areas, and the Waikiki stream. We own a sustainable construction company building homes in Whangamatā since 2006. We are trail runners, bird watchers, and lovers of nature. Our property is a native sanctuary. Every day we run a minimum of 10km in the areas behind where we live. In the weekend, we tramp, or ride bikes, we explore, and we drink from the streams. We have spent many years recreating DOC walking tracks, and smaller tracks made by the generation before us. The latest exploration maps detail the areas we have explored for the last 20 years, as close as 5km from our home - native areas north of September Road and all the way up behind and surrounding Wentworth Valley, as well as across to the Luck at Last track. I am seriously concerned, if mining goes ahead in these areas that many of us grew up exploring and continue to, they will no longer be accessible. We know these areas like the back of our hands. We encounter kereru, ruru, kaka, tui and bellbird regularly. The native trees are some of the most impressive NZ has. We walk through kauri groves, nikau, kahikatea, tōtara and rimu. Unless you frequent these areas, you would not know they are here.

This will impact our family, those who adventure with us, and our tamariki.

Please, we ask that you do not touch the areas behind Whangamatā including the Wentworth Valley. These are magical places, places that are unique to many people. This would negatively impact our mental health and wellbeing in an unfathomable way.

Regards

Luke and Bronwyn.

Sara (local resident and mother): I am a mother of two young children living in the outskirts of Whangamatā. I have resided here for 10 years. Every summer, Parakiwai is a very popular spot for both tourists and locals alike. We frequent the area for bush walks, and swims in the cool deep water holes. Having grown up in the Philippines where environmental degradation caused by mining (poisoned water supply, destruction of native forest flora and fauna, flooding, to name a few) has affected local communities for decades, I am deeply concerned by the proposed mining activities in the area. Mining companies and those invested in mining will always try to make it seem profitable and beneficial to local communities, but history shows benefits from mining are very limited, short-lived, while the damage and environmental degradation are long term and in most cases irreversible. Is that the future we want for local residents, businesses, and visitors?

Let's think long term, let's think about our kids, grandkids, and other future generations.

Andy (Teacher and Farmer; long term resident of Whangamatā): When our family first moved to Whangamatā 32 years ago, we loved the beauty and the opportunity the local river and bush environments gave us to share. Our children played and swam in the clear and clean river water in the DoC estate at Parakiwai and Wentworth valleys. We regularly walk the trails and dip in the pools along the way, enjoying the calm and peaceful tranquillity of the natural settings. As the family has grown and expanded, we still cherish the times we spend at these sites with our children, grandchildren, friends and visitors.

If there was any possible or potential risk to the water quality in either of these catchments, either intentional or accidental, this would severely and negatively impact the environment (including in and around the waters edge) and reduce our enjoyment of the area, with a high probability of posing a prolonged health risk to the natural environment, its inhabitants and visitors alike. Why should we be at risk of having this taken from us for the profits of a few overseas miners?

This area is well documented as a region of high rainfall and regular flooding bears this out. These rain events increase the risk of unforeseen, poorly planned or poorly managed sites related to mining of releasing toxic material into the environment. More and more regions of NZ are feeling the effects of heavier rainfall and atmospheric rivers. I feel for the people of Nelson, Tai Rawhiti and Auckland recently hit by these events, but shudder to think of one hitting this area if there were any mining activity upstream. These rain events are a matter of when not if, and are becoming increasingly difficult to manage any associated risks.

Risks can be short term, as in the life cycle of mining operations, or long term as we saw discharge from long abandoned mine workings pouring into the nearby Karangahape River last year. Incidents such as the recent pollution leak are not covered nor covered by the short-term nature of mining licences, despite the well known very long term toxic legacy. There is no mitigation for these negative externalities as they impact heavily on the natural environment and the loss of enjoyment for the locals and tourists that utilize the area. Mining is a short-term boom and bust industry and the locals are left to live among the mess long after the profits head overseas to the parent mining companies. Why should we locals be subjected to these risks, as those who benefit are few and often from overseas?

These beautiful areas do not deserve the potential disasters that mining can bring. Nearby Tui mine on Mt Te Aroha should be a warning to any governmental authority of the possibilities of long term damage. Our local area does not need the sound of mining operations drowning out the kokako or tui. We prefer our native frogs lining peacefully high on the hills without being shaken by underground mine blasting. Why should our environment and our enjoyment suffer?

We have spent the last 30 years working with the local Rivercare group and Waikato regional Council riparian planting, fencing and maintaining the Wentworth River as it flows through our farm to protect it from unwanted farm runoff and to keep the river water quality as high as possible. Water testing many years ago showed the health of the river increased as it moved through the farmed areas with a drop in E. coli levels. Bird life has flourished and native fish and eels are plentiful. Locals in the Parakiwai Valley have done the same. Stock no longer stand in the river, polluting as they drink. It would be very sad and extremely disappointing if mining activity were to undermine all of this hard work.

Clive (tramper): *I've spent over 30 years up the Parakiwai Valey, tramping and doing*

voluntary track maintenance. Have taken over 30 people to see the valley, including

Japanese tourists. So, it is my favourite place on the whole Coromandel. It’s the only place where I have felt entirely relaxed. In fact, I would like my ashes spread up there when I die. I hate the fact that the mining company don’t consider the impact that tunnelling through all the underground streams and springs may have in the long term, long after they’ve left.

Tomas (local business owner, surfer, mountain biker): Whangamatā is a fantastic place to raise a family and the Parakiwai Valley is the most beautiful walk. Why would we want the noise of helicopters and vibrations from underground mining in a place like this? The Coromandel is a known tourist destination and I am worried for my business if mining becomes a big feature. It makes no sense, why are we letting a big overseas company come in and make a lot of money from us with no benefit to us. In any case, we don’t need their money.

Suzanne (local business owner, tramper): *I am worried that local businesses will ultimately suffer when the Coromandel Peninsula becomes known as the mining capital of New Zealand. Who wants that?!! Right now we are a very well-known tourist destination, known for nature and beauty and tranquillity and recreation and what the politicians don’t seem able to grasp is that the environment IS our economy.*

Kirstan (local resident): Kia Ora. My name is Kristan.

I lived in Whangamatā for 13 years bringing my brood of children up there. One of our special places was Parakiwai where it's untouched beauty of flora and fauna never ceased to amaze us. We would spend the whole day jumping off the cliff and having a picnic. We also like to hike to the waterfall at Wentworth and marvel at the pressure of the underground aquifer pushing up to create this wonderful spectacle.

I now live in Opoutere where the birdlife is incredible.

One of the main water supplies for Whangamatā comes from Rafael's farm which will be compromised if underground drilling is conducted.

It is an unnecessary option for this part of the country which is steeped in beauty and abundance, the main focus should be on maintaining and promoting tourism.

I've never met anyone who works at any mine in my time at Whangamatā nor here in Opoutere.

I am appalled at the government's decision to fast track any type of mining activity and/ or promote it selfishly.

I expect this one term government to continue its destructive course but am also aware that the next government WILL repeal and overturn most of what is happening especially in mining in the Coromandel.

Olivia (counselling student and social worker): *Kia ora, my name's Olivia. My family have been holidaying in Whangamatā for three generations. It is a home for all of us, we have a beach home there and use it amply. I have lived in Whangamatā on and off a couple of times, my last stint being for two years. I've been deeply hurt by the idea that Wharekirauponga could be mined. I have many childhood and adult memories exploring the ngāhere and awa. I love diving into the clean, fresh water and enjoying the peacefulness of the trees and birds. They have been a source of wellbeing for myself in times of hardship and to think about its wellbeing being compromised is heartbreaking. I'm concerned about the future health of the forest and waters. I also surf and dive and am aware that the rivers feed into the ocean, this worries me for the health of the moana. It pains me to think I won't be able to share the joy, rejuvenation and belonging myself, siblings, parents, grandparents and great-grandparents have relished in with my children and grandkids, and generations on. I believe it will change the feel of serenity and purity of Whangamatā that many people enjoy. I say no mining. Ngā mihi.*

Marion (Teacher): I'm an English teacher and love the Coromandel bush and outdoors. I regularly walk to the waterfall in the Wentworth Valley and have been walking the Parakiwai track until it closed. I am devastated that this area will be mined and essentially will be contaminated and forever changed and altered by mining. This area has endangered species including Archie's frog so industrial scale mining will devastate this area. The species will be lost forever. The waterways also risk contamination from the tailing run off. I often swim in the Wentworth Valley River.

The water quality will be degraded forever. I have experienced the arsenic contamination in the creeks and rivers on the south islands west coast.

The devastation cannot be mitigated. This area is a national treasure and affects everyone's well being through the ability to recreate in our beautiful bush.

Trudy (Whangamatā Grandmother): *My concern is for the natural environment. For the unknown damage from the effects of blasting, of vibration, of water pollution on the Parakiwai River and area.*

Parakiwai is a taonga, a pristine environment, one that my family has explored for three generations. 45 years ago we were drawn to the magnificence of the hexagonal columns on the bluff walls at the start of the Parakiwai track, the only gazetted geological region in the Coromandel. We looked for koura, eels, dragon and stone flies in the river and walked to the waterfall and pool where we sometimes found the courage to jump in. We are still picnicking, paddling and swimming in the Parakiwai and still looking for the creatures that show the valley and river is in good health.

There is no way that the destructive effects of mining for gold fit into this. It is so important to ensure that the deep dive into nature that being in the Parakiwai brings is protected for future generations.

Helen (Community Volunteer): I am a community volunteer who has lived in Whangamatā for 31 years. We bought up our sons here and have worked and socialized closely with locals and their families in many ways.

Everyone we know are always attracted to the Coromandel because it's a clean and natural paradise to live in and to visit for holidays and weekend activities.

The outdoors features as the absolutely best reason to be here. We walk and ride and swim and explore and treasure our natural environment so much because it's the soul of our people

The modern day mining proposal for the Whangamatā land is a dark shadow over our community wellbeing and a potential stain on our cherished home.

I am also really worried about a negative effect on our water catchment and the fact that our supply could be severely damaged by the physical and constant draining of our underground aquifer that supports our population.

Being underground in the hills gives me no comfort that we are protected from this invasive and unnecessary assault on our land by indifferent international mining companies.

Please stop before it is too late!

Renée (Primary School Teacher & Scuba Instructor): *I brought my twin girls up in Whangamatā after moving here in 2003. Every summer we take an annual trek up to the big waterfall at Parakiwai at least three times. The numbers of cousins and friends would increase as we talked about it with friends and we all enjoy it so very much. My class and I would visit also and the amount of nature experience and learning the children get is phenomenal, not to mention a love of the outdoors and a passion to protect these spaces right in our backyard. We love the Archey's Frog - the kids are always on the lookout for one and are pumped that a species of frog lives just behind their hometown! The eels are abundant and the bird life is stunning.*

The beauty of the forest and the stillness will be severely hampered by invasive drilling and blasting.

The swimming holes along the river are so awesome, and anything the affects the river and the water table would cause instability. This area is such a treasure. It needs to be loved and protected.

Having moved into instructing Scuba, I see the run offs in the ocean and it concerns me that our beautiful creeks, river, Estuary and ocean will also suffer the effects of any extra water flow. I am against mining - it is for short term gain. It adds nothing to the environment.

Teearn (Events & Sponsorship Manager and Mum): The Parakiwai Valley and swimming hole are a precious tāonga for our whānau and Whangamatā community. As a family we enjoy the beautiful bush, observing native trees and birds, and swimming in the water hole multiple times a week over the warmer months. Having this on our doorstep provides an opportunity to connect with nature and has a positive impact on our health and mental wellbeing. I am concerned that mining in this area and any blasting or vibration will damage the natural environment including water quality, native species, flora and fauna and have a negative impact on this beautiful treasure for our community not only for this generation but for future generations to come. It's also a popular swim hole for visitors to Whangamatā and will have a negative impact on local tourism and perception of the Coromandel.

Graeme (Father, pilot): *I have a long history with the land in the Coromandel, especially Whangamatā. My grandfather returned from WW2 and built what is now my batch on Kiwi Rd in the 1950s. It took him a few years because he had to drive over from Te Awamutu on dirt and gravel roads on his weekends to complete the work.*

I have been going to the batch since I was born. My parents, auntie's, uncle's, cousins and now my kids have all grown up with Whangamatā as a holiday base.

It is part of me. It is part of my family. We all regularly spend time in the bush around Parakiwai and Wentworth Valley. Bush walks, camping and swimming in the rivers and at the smaller beaches near Whangamatā.

The culturally and emotional connection I have with that part of the country is worth more than any dollar value. As I get older it is even more important to me, because it is something that I can pass onto my kids. They can say that their Great Grandparents built this batch, walked this land, swum in these rivers and fished in these seas. No amount of gold can justify the damage that another mine will do to this environment.

The proposed mining will be a short sighted gain that will negatively impact the long term gain of the environmental and tourism based economy.

The rich ecology and environmental value of the region is too great to risk. The risk-v-reward factor just doesn't add up.

I hope the proposed mining does not go ahead.

Debbie (mum - skin therapist): *My family and I have been enjoying Parakiwai and Wentworth for the past 20 years. In particular great hikes and beautiful clear waterholes. Mining here is a risky move that will really harm the beautiful landscape and wildlife in the area. The process can mess with local ecosystems and even lead to polluted water - not great for the community or the marine life. Plus, while some might chase short-term profits, the long-term impacts often create more problems than they solve. It's important to protect these spots, so we can keep enjoying nature and support sustainable tourism that benefits everyone in the long run.*

Sue and Tom (long term Whanga property owners): We have always opposed mining in the Coromandel. In fact I still have the T-shirt from years ago when mining in Waihi was expanded. The Parakiwai Valley is a beautiful spot, beloved by trampers, tourists and locals. When our kids were young it was a favourite afternoon walk of ours and Tom continued to tramp there until very recently. Already we know that access to this beautiful native bush area has been impacted by plans for the mine.

We oppose mining on conservation land in principle because it is crown land and should not be used for a private venture. The profits of the mine mostly go overseas so there is very little economic benefit for the country. On the other hand, mining has very serious effects on the environment such as the endangered Archie's frog. The river water will be polluted and the tailings will be added to the tailings mountain in Waihi.

It is an absolute disgrace that an overseas mining company has been allowed to go ahead with the mine in spite of fierce opposition by the local people.

Renee (Community Worker and Herbalist): *Wharekirauponga is a special place for me, as it is for many who live and visit this part of the Coromandel Coast. I am absolutely devastated that it is facing such a mammoth mining threat! This catchment is a haven of nature for locals, visitors, and for the various creatures that call it home (most notably, the critically endangered Archie's Frog). Degradation of the forest ecosystem through the inevitable pollution (environmental, noise, water), erosion and loss of water, will greatly impact our ability to enjoy the ngahere and swimming hole!*

I am also a local herbalist, and depend on a thriving forest ecosystem to harvest medicinal native plants. The medicinal quality of these plants is defined by the health of the ecosystem, and I have huge concerns over my ability to produce quality herbal medicine for clients if the health of this vital native ecosystem is compromised!

Jan (School Librarian): I chose to live in Whangamatā 50 years ago so my children could grow up learning to appreciate nature, to live in a pristine environment and become part of a community of like minded people.

Their playground extended from the bush to the ocean, the rivers are where they learnt to swim.

They wish to be able to share this beautiful area of Aotearoa with their own children going forward.

The harmful effects of mining will negatively impact on our communities environment, particularly with respect to water quality, that flows from the hills of Wharekirauponga into the Parakiwai river and then into the Otahu estuary out to the Pacific Ocean.

We as a community, through Oceana Gold's exploration process, have already been denied access to the Parakiwai walking track and this would be the case going forward. Will the area be so degraded that it is lost to the people of Aotearoa forever?

Jan (local resident): *Aloha my name is Jan and I have been a local in Whangamatā since the late 1960's. I have four children, eleven grandchildren and one great grandchild. I live in Wentworth Valley.*

I can't believe I am sitting here trying to find words to express how I feel. My feelings are of great concern and very unsettled at the thought of mining underneath where I, my family and neighbours live. It is a privilege to be here as guardians and caretakers of the land.

The Coromandel ranges are sacred. No good will come of mining. It disturbs the mana, the foundations of life that resides upon her soils and resources that flow through the valleys to the waterways, harbours, estuaries, beaches and oceans. It is the place where people, the families, the tourists, the holiday makers come to experience its natural beauty and rivers and more.

Please consider the consequences of mining. Allow the peninsula to be untouched from mining etc and let it be the beautiful pristine place it is known for.

Open up tourism on the peninsula, and encourage the local people to host events into their towns that will nourish the energy of its people and communities instead of sending in the army of machines hidden in the back roads to hide the undermining and threatening the foundations we live on.

Please govern and serve with intelligence to keep these beautiful lands whole and healthy for our generations to come. Please save Aotearoa from being used to fill the pockets of those who don't live here on this land.

I wish for you and others to experience what I have in my neighbourhood.. the mountains, bush, streams and rivers. They are part of the lives of the people of the peninsula and the holiday makers, the tourists.

Set the example for all and protect our lands, nourish our people with hope and encouragement.

The leaders of the world are losing their grace. They are not protecting their lands and the people are losing hope.

Become the guardians and caretakers of the land not the ones who will be known in history who 'sold it out' or worse took what not is there’s to take. There will be consequences.

I wish you all well and pray for God's grace upon you in your service to us your people of Aotearoa and for the souls who are working to save our Coromandel Peninsula from mining.

Mahalo Nui loa.

Mark (retired GP): Kia Ora. My name is Mark; I'm a 75yr old retired GP.

I have used the Parakiwai Valley for recreational purposes for 25 years, and I'm horrified at having it disturbed by mining. I do not believe that tunnelling from Waihi will not disturb the water table, with potentially severe downstream effects. It is even more galling that this ecological vandalism is being undertaken solely for the profit of a transnational corporations. That the local economy will benefit is shown to be a lie by the fact that after decades of gold mining Waihi still occupies the lowest decile in the NZ economic deprivation index - gold mining is good for no one but the company doing it.

Please keep these greedy vandals out of our beautiful Parakiwai.

Jane (local resident): *I am an eighty-seven year old woman. For the last 15 years I have been a permanent resident of Whiritoa Beach. Whiritoa has no reticulated water, residents rely on wells, or tank water. Our well water is very good, however we are the closest community geographically to the proposed mining activity which I understand proposes "extensive dewatering" of the underground. What does this mean for us.*

In addition to my NIMBY concerns, Whiritoa is one of the most beautiful places on the Coromandel if not in the world, many visitors stop to wonder on their way to enjoy the unspoiled forest and mountains beyond. And many retire here.

If the only road in and out becomes hopelessly congested with traffic caused by the " economic benefits " of gold mining, who can blame them for looking elsewhere?

Nicole (local resident): Our area's natural environment, with its spectacular beaches and surrounding native bush is the key reason why so many of us have chosen to relocate to the area and it's what attracts visitors. And without domestic tourism, what will happen to our local economy? There are endless world wide examples of the negative consequences of gold mining and we must take heed of incidents across the ditch - e.g. heavy metals, including arsenic, identified in the drinking water near a major gold mine in New South Wales. These are real-life stories! There's the dust, the contaminated soil and water and there's noise which will particularly affect those closer to the sites, and of course there's the visual impact to our area's natural beauty.

Above all, considering the supposed benefits to the country's economy, there is very few certainty (or transparency?!) about what we will inherit long term, the cost of remediating whatever damage may occur and to what extent that will outweigh the gains, and how long it will take to restore the land.

Ultimately, it will be us and the generations to come that will be living with the negative consequences of gold mining, long after the mining company has made its profits and moved on.

Natalie (Teacher and Mother) As a teacher and mother living in Whangamatā I am deeply concerned the potential impact that mining and prospecting in the Parakiwai and Wharekirauponga areas would have on the education and learning experiences of children and Rangitahi in our community. These natural spaces are not just part of our environment they are essential outdoor classrooms used by outdoor learners of all ages.

From our youngest Tamariki at the local Kindergarten and ECE centre's who regularly visit the Wentworth to learn about eel life cycles in a real life context and participate in predator trapping, to our Ōpoutere School students (years 1-8) who utilise these areas in their Adventure learning curriculum (expeditions, adventure races and paddle boarding up the rivers) these spaces are foundational to their understanding of the natural world and their development as kaitiaki (guardians) of the land.

Students from Whangamatā area school who attend Toku ara (a year 10 outdoors programme) also Students from Whangamatā area school who attend Toku ara (a year 10 outdoors programme) also Rely on these areas for hands on leaning including bush walking, orienteering, mapping and camping. These activities not only build physical skills and resilience but also grounds the Rangitahi and provides an unmatched sense of wellbeing that is essential to their mental health.

Locking our children out of these areas in order to allow an overseas company to take our resources for a measly return is in view unacceptable. Our children deserve to have unobstructed access to these public lands without fear of being harmed or worse fined! It is their democratic right to live and learn in these spaces, after all. What message are we sending them if we the adults let this be taken from them.

Mary, (General Nurse, Midwife, and Community Support Worker, Pensioner and Grandmother of 5 whose future should be spoken for).
I sincerely want my voice to be heard as being violently against the proposed mining of our Conservation Land. But I don't really know what to say or how to pinpoint the words amidst the huge anxiety I am feeling about extracting the Stones and Minerals, the excavating of the ground, and the disruption of the natural flow of waters.
The Mountains, Hills and Valleys that surround the coastal towns of Whangatmata, Whiritoa and Tairua have not just a physical but a deep spiritual draw for those of us who choose to live here and to walk in peace with a land that is pristine, virtually untouched and so unique.
My mind and Body has entered into a sort of helpless paralysis over this — I Scream and Shout silently, my Blood is Boiling, Blood pressure is soaring;

The spirit of the land is saying GO-AWAY, LEAVE ME BE - my soils, rocks, minerals, plants, water and all living species; the sounds of us living in harmony symbiotically. What rights do you have to interfere with the Bones, my life and the Taonga of my existence. Nothing will ever be the same for Ever AND EVER.
When I last walked the Parakiwai Track (about 10 months ago) I got as far as the bridge over the River, near the end , but was caged out of being allowed to go further. The constant sound of helicopters ferrying mining equipment to and fro from this vast caged area was terrifying. There was no native or natural sounds to be heard, the world around us was being pillaged and raped, the spirit was shrouded, dying.
Oceana Gold's proposed invasion into the upper reaches of the Parakiwai areas above Whangamata is being paid for by an outrageously wealthy multinational company that will stop at nothing to achieve its objective. If their operations are not going to disrupt and impede the lives of the peoples living in and around their invasion, then why are they spending so much money upgrading and improving community facilities which our local government can not afford to do. Including paranoid protection from Kauri Die Back which results in closing off even more land for their covert operations. And yes, helping so nicely to contribute to the vermin control.

It's a take over, It conveys Guilt in advance of what they know is going to happen. An Adverse landslide of irreversible change. Its Bribery and Undermining inorder to turn our attention away from what is going to be a rape and pillage of our natural reserve, conservation land and th precious resources it owns.

Waihi North Project

Social Science Impacts

INTRODUCTION

1. My name is Bridgette Masters- Awatere
2. I am a Professor of Kaupapa Māori Psychology and the Associate Dean Māori of the Division of Arts, Law, Psychology and Social Sciences - at the University of Waikato where I have worked for 24 years.
3. I am also a registered Psychologist and Māori health researcher who has undertaken several projects on climate change and Māori health.
4. My qualifications are all from the University of Waikato and include a Bachelor of Social Science (BSocSc) in Māori and Psychology, a Master of Social Science (MSocSc) in Psychology, a Post Graduate Diploma in Community Psychology (PGDipPsych(Comm)) and a Doctor of Philosophy in Psychology.
5. I have read the Environment Court Practice Note 2023 - Code of Conduct for Expert Witnesses (**Code**), and agree to comply with it. My qualifications as an expert are set out above. The matters addressed in my evidence are within my area of expertise. However, where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.
6. I have also generally reviewed the first iteration of consent conditions. I have not reviewed, but seek an opportunity to review, the latest iteration

of consent conditions, and related documents. Unfortunately these arrived too late in preparation of my evidence.

SCOPE OF EVIDENCE

7. My evidence refers to the Waihi North Project Social Impact Assessment and the gaps in that data.
8. My evidence covers the following:
    a. CIAs had not been completed at the time of writing the referenced reports.
    b. The absence of a clear and consistent voice of support for the mining project from iwi, hapū, hāpori groups or others who represent the diverse range of interests and livelihoods of Māori.
    c. Consultation with tangata whenua and others on climate change impacts and its relevance to environment when making their assessment of impacts from the proposed expansion of the Waihi Gold mining project into the Coromandel Forest Park.
    d. The relevance to meet Treaty of Waitangi obligations to Māori
9. In preparing this evidence, I reviewed:
    a. Cultural Impact Assessment Report[1],
    b. Cultural Values Assessment Report[2], and

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[1] **Website sources**

https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.fasttrack.govt.nz/__data/assets/pdf_file/0011/4133/B.49-Clough-Heritage-and-Archaeological-Effects-Part1.pdf

[2] https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.fasttrack.govt.nz/__data/assets/pdf_file/0017/4184/F.01-Waihi-North-Project-Consultation-Summary.pdf

c. Social Impact Assessment Report[3].

PREVIOUS ENVIRONMENTAL DISASTERS

10. We have seen both globally and nationally that when industries are allowed to operate with weak governance and poor accountability, the result is preventable harm and, in many cases, loss of life. Mining is no exception.
11. **In 2015 the BHP Marana Mine tailing dam collapsed killing 19 people, making thousands homeless and destroying rivers and the environment for hundreds of kilometres. This disaster is just one example of the many 21st Century toxic tailings from mining incidents causing social, environmental, cultural and economic damage.**
12. International disasters illustrate the dangers of prioritising short-term economic gain over environmental protection and community wellbeing. For example, the 1984 Bhopal chemical disaster, caused by a poorly regulated pesticide plant, released toxic methyl isocyanate into the surrounding environment, resulting in between 3,000 and 16,000 deaths and over half a million injuries.
13. More recently, the 2014 Flint, Michigan water crisis demonstrated how the removal of democratic safeguards in favour of economic expediency led to widespread contamination, Legionnaires' disease, lead poisoning, and carcinogen exposure that endangered an entire city's population.
14. These cases provide clear warnings for Aotearoa: poorly governed extractive industries, including mining, pose unacceptable risks to public health,

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3 https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.fasttrack.govt.nz/__data/assets/pdf_file/0014/4145/B.57-WSP-Social-Impact-Assessment.pdf

environmental justice, and intergenerational wellbeing. To allow mining expansion under weakened regulatory oversight would repeat these same mistakes, exposing communities and ecosystems to irreversible damage.

15. While Aotearoa has largely been protected from such mass environmental disasters by the RMA, its associated policy frameworks and planning processes, several recent events demonstrate that the resource management architecture needs strengthening from a public health perspective.

MĀORI VOICES IN CLIMATE RESEARCH

16. This submission draws on participant voices documented in the *Haumanu Hauora* report (Masters-Awatere et al, 2022) that I produced as part of the Deep South National Science Challenge Vision Mātauranga Programme.
17. Haumanu Hauora (the research) investigated Māori experiences of climate change and the readiness of health services and their policies to respond to the impacts.
18. The research involved four studies. Three types of participants were included:
    a. Tangata Whenua (focus groups, as well as individual interviews)
    b. Health Service Staff (focus groups, as well as individual interviews)
    c. Rangatahi (individual interviews).
19. Māori participants were from whānau, hapū, and iwi in the Waikato, Lakes and Bay of Plenty regions.
20. Non-Māori participants were employees of a health organisation and resident within the Waikato, Lakes and Bay of Plenty regions.

21. Excerpts of quotes from participants of our studies highlight how climate change is affecting cultural sites, food systems, waterways, health, and intergenerational well-being.
22. Environmental impacts through mining will have overlapping and similar impacts on social and cultural well-being.

MATTERS RAISED IN THE RESEARCH

23. Climate change impacts such as flooding, erosion, and storm surges have caused damage to marae, urupā, housing, and community infrastructure.
24. These impacts strike at the heart of Māori identity, culture, and whakapapa. Comments reflect to protect marae from climate damage.

<u>Damage to Marae and Urupā</u>

- *"…down the road 53 tipuna had to be excavated from our urupā because it's on the bank of the river and the river was eroding to the point where the tipuna were falling into the awa, due in part to erosion…"* (Rangatahi, participant 5)

25. This experience demonstrates that the cultural and spiritual dimensions must be prioritised in adaptation planning.
26. In the Bay of Plenty, where marae, urupā, and coastal landscapes are already under pressure from climate impacts, the additional strain of mining would further compromise Māori health, tino rangatiratanga, and the intergenerational responsibilities guaranteed under Te Tiriti.
27. **Long term effects of mining also have the potential to affect marae and urupā through downstream damage to communities, adding to the pressure already on hapū and iwi in protecting them from climate threats.**

Food Security and Kai Sovereignty

28. Climate impacts are already disrupting Māori traditional and contemporary food systems.
29. Assessments must provide assurance that mining will have no further negative impacts upon these cultural systems.
30. Comments from tangata whenua highlight the need for self-sufficiency and resilience through māra kai and collective land management.

- *"I've been actively working with some of our whānau trying to encourage our whānau to start growing our own kai, but also trying to put pressure on our land trusts who are in control of our collective land resources."* (Tangata Whenua, focus group 2, participant 1)
- *"For me, if you had more people who had their own māra kai and producing their own energy… being able to provide our own food and not have to rely on someone in a different country, importing food to us."* (Rangatahi, participant 1)

31. Food sovereignty is both a practical adaptation strategy and a cultural imperative that strengthens resilience and connection.
32. Any cultural assessment undertaken must include the implications on food security and kai sovereignty as a key cultural consideration for Māori.

Loss of Waterways and Mahinga Kai

33. Whakapapa relationships are not abstract—they are lived and sustained through practices such as food gathering, weaving, building, trading, and hosting, which are all dependent on a healthy environment.

34. Whānau reported significant changes to local waterways, with drying streams, pollution, and the loss of traditional kai sources.

- *"That stream's gone. The water's dried up… the other stream… there's so many houses there now, that it's just got soap suds and stuff in the water."* (Tangata Whenua, focus group 2 participant 2)
- *"Mātauranga Māori will play a big part for our people in the future, because we already had those systems. Well, that's the same out at [BoP rural location]. It always used to be abundant with watercress, but now you'd be lucky if you can get anything"* (Health service staff, participant 2)

35. The degradation of waterways represents a critical loss of mahinga kai, undermining food security, cultural practices, and health.
36. Cultural assessments must mitigate concerns that mining will threaten whakapapa-based connections by degrading land and water systems, polluting ecosystems, and disrupting the foundations of Māori wellbeing.
37. **The recent example associated with mining is the " orange river" incident when in 2024 the Comstock Mine Portal at Karangahake leached a toxic discharge into the Ohinemuri River. That discharge included arsenic which is a risk to water but also can be uptaken by the food chain – see water cress and eels. The impact of this incident has been a major concern to iwi and communities.**

<u>Māori health impacts</u>

38. Climate change is compounding existing inequities in Māori health.
39. Poor housing quality, environmental exposures, and disrupted food and water systems are contributing to worsening outcomes.

40. From a te ao Māori perspective, health is inseparable from the land, waterways, ecosystems, and other species through whakapapa.

41. Tangata whenua are concerned about worsening impacts on health conditions.

- *"…it is getting worse, significantly worse. And the babies are affected and kids are affected, and the adults are affected. And it is worse than it used to be, say about 10 years ago… What I have noticed, and I do think it is getting worse, it's become more prevalent, and that is a result of perhaps the pine, the forestry, and it's the amount of allergic rhinitis and hay fever."* (Tangata Whenua, focus group 2, participant 3)

42. In pursuit of employment Māori whānau are moving to, and working in, conditions that can have negative impacts on their social, cultural and medical well-being (health).

43. Without adequate access to health services and support, persistent health conditions are a concern.

Whakapapa and Intergenerational Responsibility

44. Participants consistently framed **environmental issues** and climate change through whakapapa, emphasising intergenerational responsibilities to tūpuna (those who came before) and mokopuna (those yet to come).

- *"What whakapapa am I leaving him? What whakapapa am I creating? What whakapapa was given to me? How am I improving on what our tīpuna already left for us?"* (Tangata Whenua, participant 7)
- *"…our connection and the links with land is really important for Māori culture"* (Rangatahi, participant 4)
- *"Going back to [papakainga] and seeing what wasn't there that used to be, that really, reconnected with my tipuna... this orchard across the way and it*

was by the awa and people used to go swimming there... they were telling us a story of how you don't go there now... the wairua is off... And it was just, dead trees... It hurt a lot. (Rangatahi, participant 2)

45. This framing underscores that climate and **environmental** responses must move beyond short-term mitigation to uphold intergenerational equity and kaitiakitanga.

CONCLUSION

46. The voices from communities across the Waikato, Lakes and Bay of Plenty regions provide compelling evidence that climate change is already impacting Māori communities across multiple domains—cultural sites, food systems, waterways, housing, and health.

47. These experiences demonstrate the urgent need for **environmental a**nd climate policy and legislation that:

    1. Embeds Māori knowledge and leadership in adaptation and resilience planning.
    2. Protects marae, urupā, and wāhi tapu from further damage.
    3. Supports food sovereignty through māra kai and collective land initiatives.
    4. Prioritises health equity in climate adaptation strategies.
    5. Upholds whakapapa and intergenerational responsibilities as central to decision-making.

48. Previous research with members of the Waikato and nearby regions highlights the importance of integrating health services and support planning into strategies that will ensure protection for vulnerable populations.

49. Strengthening Māori-led climate responses in the Bay of Plenty is essential to ensure cultural survival, community resilience, and the well-being of future generations.

50. The need for cultural and social impact assessments to clearly demonstrate consideration of Māori voices is essential.

51. The Crown and its agencies have obligations under Te Tiriti o Waitangi, including Tiriti rights in environmental and public health governance. While companies and decision-makers may claim to "consult" with iwi and hapū, the processes are often tokenistic, with compressed timeframes that prevent meaningful participation and erode existing governance partnerships already established through negotiated agreements.

Bridgette Masters-Awatere

Reference

Masters-Awatere, B., Young, T., Howard, D., Powell, E., Ranginui Charlton, A., Graham, R., & Dixon, R. (2022). *Haumanu Hauora: Strengthening health institution responsiveness to climate change.* Māori and Psychology Research Unit (MPRU), University of Waikato. Available from https://deepsouthchallenge.co.nz/resource/final-research-report-haumanu-hauora/