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.