In reply please quote: FTA211
File No: 60 59 02Q

25th August 2025

Waikato REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

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Alex Mickleson
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Substantive@fasttrack.govt.nz

Kia ora Alex,

FTAA - OceanaGold – Fast-track Approvals Act 2024 – Waihi North Project Application [FTAA-2504-1046]

Please find attached a memorandum in response to MINUTE 1 of the EXPERT PANEL: Decision under section 53 of the Fast Track Approvals Act 2024 requesting comments on the substantive application for Waihi North [FTAA-2504-1046].

Should you require any further information with regard to the above, please contact Sheryl Roa – Principal Consents Advisor via email at sheryl.roa@waikatoregion.govt.nz or via phone on 021356854.

Kind regards

A M d'Aubert

AnaMaria d'Aubert
Manager – Regional Consents
Resource Use

Resource Use Directorate
Waikato Regional Council
Memorandum

File No.:	60 50 02Q
Date:	25th August 2025
To:	Sheryl Roa
From:	AnaMaria d'Aubert
Subject:	Memorandum in response to Minute 1 of the Expert Panel on the substantive application Waihi North [FTAA-2504-1046]

INTRODUCTION

The Waikato Regional Council (WRC) has been assessing the Waihi North Project since it was first lodged as a resource consent application under the Resource Management Act 1991, back in June 2022.

The following experts have been involved in the assessment of effects associated with the Waihi North Project (both the resource consent and Fast Track applications) and providing advice to the Waikato Regional Council:

- Dr Jonathan Caldwell – An Environmental Chemist who holds the role of Senior Scientist within the Science, Policy and Information Directorate at the Waikato Regional Council;
- David Bouma – A Senior Civil and Environmental Engineer who holds the role of Project Director, Technical Director Dams and Rivers at Tonkin and Taylor. Mr Bouma was assisted in the assessment by Tim Coote who is a Senior Geologist with Tonkin and Taylor with a background in monitoring at the Golden Cross closed mine site;
- Dr Paul Weber – An Environmental Geochemist who holds the role of Director, Principal Environmental Geochemist at Mine Waste Management Ltd;
- Alan Pattle – An Environmental Engineer who holds the role of Director at Pattle Delamore Partners (PDP);
- Dr Ngaire Philips – An Aquatic Ecologist and Ecotoxicology Specialist who holds the role of Director at Streamlined Environmental;
- Karen Denyer – A Wetland Ecologist who holds the role of Director at Papawera Geological Ltd;
- Sheryl Roa – A Freshwater Ecologist who holds the role of Principal Advisor – Consents, within the Resource Use Directorate at the Waikato Regional Council

Additionally, Dr Jenny Webster-Brown a Water Quality Scientist provided initial comment on the original application made to the Waikato Regional Council.

I have not repeated every aspect of the application documentation within this memoranda rather the focus has been on identifying all the potential effects from the proposal and whether the Company's proposed consent conditions are sufficient or require further clarification.

I have not provided the further information request, associated responses and technical assessments undertaken as part of the resource consent application process referred to within some of the Appendices. These documents are however, available on request.

This memoranda consists of the following:

1. A short background to the original Waihi North Project application and the work undertaken by WRC's experts prior to lodgement of this Fast Track process;
2. Clarification of the differences between the Fast Track application and the application WRC assessed;
3. For each effect identified, then a summary of each of WRC's experts overall opinion – a full copy of all technical comments are provided in the Appendices;
4. WRC's conclusion including a table of WRC's overall comments and details of where some outstanding issues remain.

1.- BACKGROUND

The Waihi North Project was lodged with WRC on 23rd June 2022. As part of the initial assessment, a request for further information was undertaken by WRC. The Company provided a number of responses with the supply of the final aspects of the request provided just prior to the Fast Track application being lodged. The Company withdrew the application before WRC upon acceptance of its Fast Track application.

Over the last 2-3 years a number of meetings with the Company and WRC staff have occurred with the various experts and in particular, discussions have focused on the hydrological and freshwater aspects of the proposal.

2. FAST TRACK APPLICATION VERSUS APPLICATION LODGED WITH WRC

The differences between the Waihi North Project lodged with WRC and the application associated with the Fast Track process are small. An area identified within the project as the Services Trench Area has been removed from the application. The consents for this area were processed by WRC on a non-notified basis and are due to commence shortly.

Additionally, the Company has included some new borrow pits within near proposed TSF3.

Other than these two matters the Waihi North Project Fast Track proposal remains largely as lodged with the WRC back in June 2022.

3. EFFECTS MATTERS

3.1 Air Discharge Effects

Dr Caldwell's assessment of the proposal can be found in Appendix A. Dr Caldwell states:

"In my own opinion, the assessments and conclusions provided by Beca are consistent with what I have previously reviewed in August 2022. In summary:

- *Beca has identified all potential sources of contaminants to air from this proposal and associated potential effects on the Waihi airshed and surrounding area outside the airshed.*
- *There are sufficient methods and measures being proposed to reduce the risk for these potential effects.*
- *My previous s92 request for comment and discussion on the reasons for not considering mercury emission control for the carbon regeneration stack was addressed previously by Tonkin and Taylor in their s92 Response January 2023 which I was satisfied with at the time. This was also discussed in T&T's Technical review in B.23 identified above and I remain satisfied that it is not necessary to require mercury emission control for the carbon regeneration stack (however, additional emission control will be provided by installation of the retort oven as proposed by the applicant).*
- *The proposed monitoring is sufficient for providing early identification of any potential effects.*

Tonkin and Taylor's Technical Review provides me with confidence that Beca's assessment of environmental effects is comprehensive and the proposed management and mitigation measures are sufficient for ensuring a low level of effects on the environment and people."

Within his memoranda Dr Cauldwell has provided some suggested changes to the consent conditions associated with the air discharges. The Company has been provided with a copy of these suggested changes.

3.2 Gladstone Pit, Tailings Storage Facility 3, Northern Rock Stack. Willows Road Rock Stacks

Mr Bouma and Mr Coote's assessment can be found in Appendix B. Overall they state:

"In general terms, we consider that the documentation reviewed (B01 to B06, B09 & B12) is generally appropriate and consistent with expectations for a Substantive Fast Track Application resource consent application. We note that the draft resource consent conditions have generally captured recommendations for the ensuing project detailed design and construction phases, including appropriate peer review work."

The key aspect with all of these structures will be the design and review process. Generally, the consent conditions adequately provide for these aspects well.

- **Gladstone Pit**

The review identifies that as the pit does not meet the definition of a dam, a building consent is not required therefore, the consent conditions need to lock in the design criteria to ensure the Gladstone Pit is built and maintained in accordance with the design assumptions.

There are some comments provided by the reviewer that require clarification from the Company. However, I note that these matters are relevant to the final design of the Gladstone Pit which is provided for via the various certification processes and management plans associated with the Gladstone Pit.

- **Tailings Storage Facility 3**

Key aspects of this part of the review is that where issues remain outstanding, then the reviewer advises these can be addressed as part of the detailed design phase. The Company proposes that the detailed design is peer reviewed and it is proposed that this process be a consent condition. There are no aspects of this part of the proposal that require any further comment.

- **Northern Rock Stack (NRS)**

A building consent is not likely required for the NRS therefore the resource consent conditions need to ensure that the measures proposed by the Company are in place to ensure that the NRS is built and maintained in accordance with the design assumptions.

Again, the issues raised by the reviewer can be addressed as part of the detailed design phase.

Overall, the reviewer states: *"We agree with the EGL recommendation that "Detailed design is required for the NRS as drains and stability considerations require assessment, and drawings and specifications are required for construction. So, while building consent is not required under the Building Act, a peer review of the detailed design is recommended, to be provided by an appropriately qualified independent party.."*

- **Willows Road Rock Stacks (WRS)**

The proposed WRS is an operational NAF and PAF stockpile at the Willows Road site. The stockpile is proposed to store up to 1,100,000 m^3 of rockfill from the Wharekirauponga Underground Mine and tunnel development. The stockpile will store both NAF and PAF material.

"In general terms, we consider that the document is generally appropriate and consistent with expectations for a Substantive Fast Track Application resource consent application. It incorporates a similar design approach and reporting structure to the EGL Northern Rock Stack report (B05, Revision 2 dated 15 February 2025."

A matter raised by the reviewer is the requirement for a peer review of the piezometer network proposed around the Gladstone Pit. The reviewer comments (Pages 9-10 – Point 35) that the application documentation provides for a piezometer network system around the Gladstone Pit. Specifically, the Company's PSM 2025b report states at section 12.3.5:

"The stability analyses show that the risk of rock mass failure with current standing water tables and 50% depressurisation is low. However, the 50 % depressurisation needs to be confirmed, and this will be accomplished by implementing the following:

a. *A comprehensive piezometer network around the pit to be established before mining commences, which needs to be defined as part of the Ground Control Management Plan and installed before mining commences.*
b. *Planning for a comprehensive horizontal drain program in the pit.*
c. *Horizontal grading of the berms (that is inclined berms) in the upper flatter sections of slope to direct rainfall runoff and any shallow seepage away from lower slopes.*
d. *A staged early pit development to allow the rock mass conditions, geological structure and geology to be confirmed before commitment to final pit crest and overall design slopes. "*

WRC Comment

At this stage, WRC could not find where in the proposed conditions this programme of works is proposed. I have assumed it would be provided within the Groundwater Management Plan but can not see where it is specifically provided for within the consent conditions. Clarification on where this matter is specifically provided is requested.

Other than the matter referred to above all other matters associated with the design and construction are considered to be adequately addressed via the proposed consent conditions.

3.3 Geochemistry

Dr Paul Weber of Mine Waste Management Ltd has undertaken an assessment of the geochemistry related matters for this application. He has reviewed the Fast Track proposal and provided a number of suggested changes to the proposed conditions along with some additional conditions to provide clarity. His assessment can be found in Appendix C.

Dr Weber has reviewed the proposal comprehensively and has provided four responses to the information previously provided as part of the request for further information associated with the resource consent application. Overall, Dr Weber has advised that the majority of matters have been resolved by the application either via the response to the requests for further information or via the proposed consent conditions. His remaining issues in general are:

AMD Classification

- Clarification is required throughout the Conditions that 'acid rock drainage' (ARD) is not restricted to rocks that generate acidity (e.g. potentially acid forming (PAF)) but can also include rocks that generate neutral metalliferous drainage (NMD) including rocks that are classified as PTEL (potential for trace element leaching – high mercury).
- ARD should be added to the definitions of the Conditions and further clarification should be provided on what ARD means. For instance: ARD includes acidic drainage from PAF materials and potentially circum-neutral drainage from materials such as those classified as PTEL. Otherwise, AMD should be used and a definition provided that includes the risks associated with ARD and NMD.

- The document discusses management processes for PAF materials (e.g., capping of PAF material), however PTEL materials should also be managed in a similar manner. Further clarification is required.
- Further work is required to validate the classification criteria for PAF and non-acid forming (NAF) materials. Column leach testing should be undertaken to validate the classification threshold that uses a neutralisation potential ratio (NPR) of 1 (i.e. confirm NAF materials will not generate acidity in the long term). The work program should be certified by the WRC and it should be used to validate/refine the Waste (rock) Classification Protocol.
- Draft Conditions (i.e., SC2.K.5 uses the incorrect NAF classification criteria). It would be more appropriate to state that the NAF materials are classified in accordance with the Waste (rock) Classification Protocol.
- The sampling requirements provided in the draft Waste Classification Protocol are high-level and further explanation is required. The updated sampling criteria can then be certified by the WRC as being appropriate.
- It is recommended that the following documents, not identified in the draft Conditions, should be certified by the WRC:

    i) Waste (rock) Classification Protocol.
    ii) Detailed Design Reports (to ensure, where required, that AMD management processes are addressed).

WRC Comment
The Company is requested to address the above matters.

- Monitoring is required to confirm that oxygen is excluded from waste rock stacks. This should be a condition, unless it will be contained within the management plans. Elevated oxygen concentrations should be a trigger for a risk-based review of material management processes.

WRC Comment
The Company is requested to confirm how this matter is covered off i.e. is there a proposed specific condition or whether it is part of a management plan – if so which one?

- The management of nitrogenous compounds, derived from the use of nitrogen-based explosives requires further consideration. There should be a consent condition that addresses the storage and use of nitrogen-based explosives.

WRC Comment
Consent conditions have been suggested to the Company to address this matter – this email is appended to Dr Weber's review.

- Low permeability layers used to cap PAF materials requires further consideration. It is recommended the design criteria are included in the various management plans.

WRC Comment
I consider that the design criteria as part of the proposal will address this matter.

- Proposed Consent Condition SC5.O.4 and SC6.J.4 state: "*Placement of selected, coarse waste rock as the initial layer on the low-permeability layer of the stockpile footprint to act as a leachate drainage layer*". This will enable oxygen ingress into the facility. This should be avoided to minimise AMD risks.

WRC Comment

The Company is requested to clarify this wording so that the intent can be better defined.

- A study should be undertaken to assess AMD sludge management options after closure of the TSF and any potential risks to the receiving environment. This study should be completed before closure.

WRC Comment
This matter is to be addressed as part of the Rehabilitation and Closure concept for the site. At this stage I do not consider that a specific condition is required to address this matter.

Note as per Dr Weber's review, WRC has already provided other recommended changes to the Company that are of low importance e.g. providing reference to degrees Celsius in tables where temperature is required to be reported. WRC has assumed that these matters will be addressed by the Company and have only referenced those matters that are of higher importance within this response to the Hearing Panel.

3.4 Groundwater Effects

Alan Pattle of PDP Ltd has undertaken an assessment of the groundwater component of the proposal. He has reviewed the Fast Track proposal and the set of consent conditions dated 5th August 2025. His assessment along with the conditions dated 5th August 2025 can be found in Appendix D. These conditions came about following a number of meetings between WRC representatives and the Company on the groundwater effects.

Mr Pattle's overall assessment is as follows:

"Characterisation of the deep groundwater system in terms of throughflow quantities and discharge zones is a limitation to locking down a complete conceptual model. Without these fundamental aspects understood the ensuing analysis of effects of the proposed mining activity is limited.

There is also uncertainty about the potential for induced leakage from the streams into the mine once dewatering begins. However, the field detection of currently existing strong vertical groundwater gradients and/or an unsaturated zone above the deep system at heads 20m to 40m below stream level suggests that potential for leakage may be limited. This observation is positive for avoiding reductions in natural stream flow within the WKP catchment.

In relation to effects on other water users in the catchment the reports state that the nearest users is 5km downstream from the WUG mine and that effects on this and other users will be less than minor. This review agrees with that conclusion.

FloSolutions state the groundwater modelling to be at Class 2 level which according to Barnet et al[2] is defined as applicable for:

- *Providing estimates of dewatering requirements for mines and excavations and the associated impacts.*
- *Evaluation and management of medium risk impacts.*

The reference states that Class 1 level modelling is required to evaluate high risk impacts.

Interra prefer to use a more recent reference[3] to assess the model reliability but nevertheless this reviewer considers the degree of reliability of the assessment is appropriately described by the Class 2 definition.

Potential effects on wetland and riparian vegetation are still not well understood but that should develop through baseline monitoring."

Based on Mr Pattle's assessment WRC has no issues with the proposed consent conditions provided by the Company dated 5th August 2025.

3.5 Freshwater Effects

Dr Ngaire Philips of Freshwater Solutions Ltd has undertaken an assessment of the effects on the waterways from this proposal and her assessment can be found in Appendix E. She has reviewed the Fast Track proposal and provided a number of suggested changes to the proposed conditions. Her overall conclusion is:

"I consider that there remain some uncertainties regarding the potential magnitude and extent of effects on surface flows arising from the uncertainties in the models on which the effects assessment has been based. However, I consider any unexpected effects are likely to be appropriately addressed through the proposed baseline and ongoing monitoring, and the proposed adaptive management approach."

The issues raised in Dr Philips review are as follows:

- The potential length of time (at least 80 working days) to get augmentation to the potentially affected waterways.
- Recommends an analysis of the full suite of parameters undertaken for the existing monitoring currently underway at WKP along with an analysis of the intended receiving environment.
- Requests clarification of where the proposed Instream Work Aquatic Ecology Management Plan is within the ELMP-WA is included within the consent conditions.
- The BML (2024) states *"there is merit in specific review of the monitoring data for Thompson Stream to confirm the underlying low permeability layer and the effect that has on predicted stream flows and ecological values.*

  This review is not currently included as a condition of consent or as an action within the proposed Ecological and Landscape Management Plan. I propose that such a condition be added to the condition suite.

WRC Comment
I note that this could be accommodated via consent conditions or inclusion in the Ecological and Landscape Management Plan. If the Company could please advise on how this matter is to be accommodated.

- Comments on the discharge limit for Mercury in the annual monitoring data and suggests a review of this limit in the discharge to the Ohinemuri River.

WRC Comment
Dr Philips undertakes the annual review of the monitoring data associated with this site for WRC. This specifically involves assessing the Company's analysis of data and information on discharge characteristics and in-river water quality, as well as the results of surveys of macroinvertebrates, periphyton, sediment and water quality undertaken in spring and autumn each year to assess compliance with the company's resource consents.

Given the data within the annual report identifies the limit is not near the limit specified within the current and proposed consent conditions, Dr Philips suggests considering a lower limit than is currently authorised by its existing consents i.e. the existing data shows that the historic maxima for some parameters is much lower that the consent limits.

I note that this review of parameter limits could take place after the Fast Track process and is not necessarily a matter for consideration by the panel. That is, the Company could undertake a change to consent process to accommodate this request. Alternatively, WRC could consider a s128 review of the consent conditions if the mater warrants such action.

Dr Phillips provides other comments on the proposed consent conditions that would benefit further discussion from the Company on whether they are simple errors e.g. Is the Waihi Area Water Quality

Management Plan a new plan or should the reference more correctly have been to the Water Management Plan, or whether further clarification of the intent of the conditions are required.

Further discussion to clarify these simple matters from the Company is requested.

3.6 Wetlands

Karen Denyer of Papawera Geological Ltd has undertaken an assessment of the wetland component of the proposal. She has reviewed the Fast Track proposal and provided a number of suggested changes to the proposed conditions along with some additional conditions to provide clarity. Her assessment can be found in Appendix F.

The only issue that is in contention with respect to the wetlands is Ms Denyer assessment of TB1. Ms Denyer provides a rationale for TB1 to be considered a restored natural inland wetland and to compensate for this loss should be off-set via like for like re-instatement elsewhere within the project site. Ms Denyer provides suggested conditions that provide for the like for like re-instatement.

There are other matters raised by Ms Denyer within her assessment with respect to suggested changes to the consent conditions and proposed new conditions are for clarity purposes.

3.7 Planning Matters

I have reviewed the Fast Track application documents and I also originally reviewed the Waihi North application made to the WRC back in June 2022. I have reviewed the conditions dated 28 July 2025 and the conditions related to the underground activities within Areas 1,2 3 and 5 dated 5th August 2025. I am the consenting and monitoring officer for the site and have been for 15+ years.

The Company has generally provided a comprehensive assessment of the relevant planning documents and proposed consent conditions. Unless stated otherwise I agree with the assessment undertaken by the Company. However, there are a few matters that I consider need addressing:

a) The National Environmental Standards for Sources of Human Drinking Water (NES) is relevant here due to the location of the Waihi drinking water supply within the Ohinemuri River. This water supply source is a supplementary source for the town of Waihi and is downstream of any potential discharges from the Willows Rock stack and the sediment control measures proposed at Willow Road. There is currently no condition proposed by the Company to address this NES. A condition to address this matter is required.

b) The Company proposes to take surface water from streams and wetlands for monitoring purposes within Area 1. This activity and its associated conditions potentially provide for an impact on natural state waterways. Providing for the overarching taking of water with few restrictions means that there may be an unintended consequence and a potential impact on these waterways. It would be more desirable that this activity is restricted to the purpose for which it will be used for. It is my understanding that this consent will be associated with the supplementation of the stream flows if required. The lack of detail with respect to the monitoring aspect of the proposed water takes means that there is no ability to assess whether the allocable flows within the Waikato Regional Plan will be met or whether it is proposed to provide restrictions around the taking of water e.g. when low flows occur any water take must cease. Further clarification from the application is required to provide meaningful consent conditions that are required under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 and/or the Waikato Regional Plan.

c) I note that Condition C70 specifies that Industrial and Special Risk Insurance in the sum of $17 million (2025 dollars) and public liability insurance to the sum of $7 million (2025 dollars) is to be supplied prior to the exercise of the consents. WRC is supportive of this however, it is my understanding that Industrial and Special Risk Insurance is not available as a stand alone insurance or if available is covered under another type of insurance. So reference to this specific

insurance may need to be flexible. Further, it is entirely feasible that the insurance landscape will change over time, so as such I request that reference to this insurance provide the words "*or some other commensurate and suitable insur*ance". It is also entirely feasible that the amount of this insurance will increase over the duration of the consents (35 years), and as such the wording "*at least*" should be included to ensure that the insurances can be increased should the activities at the site and any potential CPI increase warrant such an increase.

d) I note that the Martha Trust Deed does not provide for taking over the NRS, GOP, new TSF3 as proposed by the Company. A change to the Trust Deed is required before this can occur.

I understand that all of the other matters relating to the consent conditions I have previously raised with the Company have been (or are in the process of being) addressed.

4.0 CONCLUSION

The Company has generally provided a comprehensive set of consent conditions commensurate with the activities and potential effects associated with the proposal. The exception to this, is the request to take water from streams and wetlands for monitoring purposes within Area 1. This aspect of the proposal is not well documented with respect to when it is proposed to take water, how much, rate of take and other matters where the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 may apply. There are no specific conditions proposed around these important aspects and I am unable to advise on specific conditions to address this matter. But I consider that appropriate conditions could be applied once clarity around when this consent will be utilised is determined.

Despite the issues raised above I consider that there are no outstanding issues between the Company and WRC and its experts that are not in the process of being addressed. It may be that some further explanation from the Company is warranted in some instances to clarify how some effects are better managed or addressed but overall WRC does not consider that there are any effects nor policy impediments to this Fast Track process.

A table of the key issues that require addressing is below:

Effect	Comment	WRC Outstanding Issues
Potential air discharge effects from the site	WRC consider that the Company's proposed management and mitigation measures associated with the discharge to air activities are sufficient to ensure low level effects on the environment and people over the course of the activities.	Comment is requested from the Company on whether the suggested changes to the consent conditions are acceptable or whether further clarity is required.
TSF3, Gladstone Pit, Northern Rock Stack. Willows Road Rock Stacks	The key issues for these aspects of the proposal are the design criteria.	Comment is requested on where the piezometer network system around the Gladstone Pit is provided for within the consent conditions.
Potential geochemistry effects from the activities	WRC has focused on the geochemistry effects from the project being the potential pathways during the on-site activities (e.g. rock movement and storage) and the associated risk to the environment. For this reason the focus has been on understanding where within the	Comment is requested from the Company on whether the suggested changes from Dr Weber are acceptable or whether further clarity is required.

	system there may be pathways and how to avoid any risk of downstream effects from the activities.	
Potential freshwater effects	If an effect on the surface waterways is detected then the length of time the supplementary water can be implemented is a concern identified. This needs more clarification and certainty to ensure that the supplementary water can be initiated once an issue is detected (most likely if the volume of groundwater increases during underground operations)	More detail is requested on how the Company will ensure that the supplementary water will be implemented within a timely manner if required. Some matters relating to clarity of specific consent conditions is required.
Potential groundwater effects	WRC consider that the Company's proposed consent conditions, provided they are complied with, will provide sufficient information to develop baseline monitoring such that the effects on the surface waterways and wetlands can be better understood over time.	There are no outstanding matters with respect to the effects on the groundwater.
Potential effects on wetlands within all areas	TB1 has been assessed as a wetland and it is suggested that like for like replacement is required by WRC's technical advisor. Suggested changes to some conditions and new conditions have been suggested to achieve more certainty.	Comment is requested from the Company on whether there is scope for the suggested like for like replacement for the wetland aspect of TB1 within the overall site. Comment is requested from the Company on whether the suggested changes to the consent conditions and the new conditions are acceptable or whether further clarity is required.
Planning Matters	There remain a couple of planning issues that need to be addressed relating to the taking of monitoring water from waterways and wetlands within Area 1 and providing for the NES for sources of drinking water.	Comment is requested from the Company on the proposed water take within Area 1 for monitoring purposes. A condition addressing the NES - for sources of drinking water is requested. Minor changes to the stated insurances and values are suggested.

Memo

File No:	47 01 00
Date:	7/08/2025
To:	Sheryl Roa – Principal Consents Advisor, RUD
From:	Jonathan Caldwell – Senior Scientist (Environmental Chemist), SPI
Subject:	**Technical Assessment – Waihi North Project, Fast Track**

Purpose

This report provides my updated assessment of potential effects on the environment from discharges to air associated with Oceana Gold (NZ) Ltd's Waihi North Project for which a substantive Fast Track application has been lodged with the Environmental Protection Authority.

I intend that my assessment will assist the Fast Track hearing panel with the consent application hearing decision.

Assessment of discharges to air

In preparing my assessment I have referred to the following application documents and supporting AEEs, as well as consent application documents and s92 responses associated with an application for this activity that was previously lodged with Waikato Regional Council.

1. Substantive-Application-Report-Assessment-of-Effects
2. B.21-Beca-Waihi-Facilities-Air-Discharge
3. B.22-Beca-WUG-Air-Discharge
4. B.23-Tonkin-Taylor-Technical-Review-of-Air-Quality-Assessment

Discharges to air from the Wharekirauponga Underground Mine (WUG) with associated surface infrastructure (Areas 1 & 2) include:

- Topsoil stripping and storage;
- Creation of noise earth bunds and stockpiling;
- Tunnel portals and mine ventilation systems; and
- Site access and haul roads.

Discharges to air from other activities associated with the Waihi North Project (Areas 5-7) include:

- Earthworks associated with creation and operation of the Gladstone Open Pit (GOP);
- A new tailings storage facility to the east of the existing TSF1A, called TSF3;
- A new rock stack called the Northern Rock Stack (NRS); and

- Upgrading of the existing Processing Plant to enable an increase in the ore processing capacity from 1.25 to 2.25 million tonnes per annum.

Contaminants discharged to air from these activities include airborne particulate matter (TSP, PM_{10} & $PM_{2.5}$) respirable crystalline silica, nitrogen oxides (NO_2 and NO), carbon monoxide, mercury and other heavy metals and metalloids. The assessment concludes that these contaminants are expected to remain within the National Environmental Standards for Air Quality, other relevant ambient air quality guideline values and current consent limits beyond the boundary of the project.

Beca's assessment has been based on:

- the long-term ambient air quality monitoring of the existing activities;
- comparison of the proposed activities emissions with the existing emissions;
- potential impacts on air quality based on meteorology; and
- air dispersion modelling of the processing plant emissions as a result of an increased rate of ore processing with and without the installation of a retort oven as an additional form of emission reduction.

A draft air quality management plan has been prepared that identifies dust monitoring and mitigation methods to be used.

Beca concludes that providing OGNZL continues to use the current mitigation methods to minimise discharges to air and adopts the additional mitigation measures recommended the adverse effects of discharges to air from the WNP will be adequately avoided and mitigated. Consequently, the likelihood that these discharges will result in noxious, dangerous, offensive or objectionable effects beyond the site boundary is considered to be low.

Tonkin and Taylor has reviewed Beca's assessment of environmental effects associated with discharges to air and has concluded that Beca's assessment approach, assessment criteria and conclusions are reasonable.

In my own opinion, the assessments and conclusions provided by Beca are consistent with what I have previously reviewed in August 2022. In summary:

- Beca has identified all potential sources of contaminants to air from this proposal and associated potential effects on the Waihi airshed and surrounding area outside the airshed.
- There are sufficient methods and measures being proposed to reduce the risk for these potential effects.
- My previous s92 request for comment and discussion on the reasons for not considering mercury emission control for the carbon regeneration stack was addressed previously by Tonkin and Taylor in their s92 Response January 2023 which I was satisfied with at the time. This was also discussed in T&T's Technical review in B.23 identified above and I remain satisfied that it is not necessary to require mercury emission control for the carbon regeneration stack (however, additional emission control will be provided by installation of the retort oven as proposed by the applicant).
- The proposed monitoring is sufficient for providing early identification of any potential effects.

Tonkin and Taylor's Technical Review provides me with confidence that Beca's assessment of environmental effects is comprehensive and the proposed management and mitigation measures are sufficient for ensuring a low level of effects on the environment and people.

Consent Conditions

I have also reviewed the following documents and have some comments regarding the proposed conditions relating to air discharges:

1. D.02-Hauraki-District-Council-and-Waikato-Regional-Council-Combined-Proposed-Conditions
2. D.04-Waikato-Regional-Council-Proposed-Conditions

ALL A.3

There must be no particulate matter or (including odour) in any discharge to air that gives rise to objectionable adverse effects (as defined in Section 6.4 of the Waikato Regional Plan) at or beyond the boundary of the subject property.

ALL.A.4

Condition ALL.A.3 does not apply to any property or site that is:

a) Owned by the Consent Holder or a related company; or

b) Owned by a third party which is subject to either a registered covenant or a written agreement (a copy of which is provided to the Waikato Regional Council) whereby air quality effects on the property caused by activities authorised under this consent are not to be taken into account for monitoring and compliance purposes.

This condition ALL.A.4 is referring to exclusions to the preceding condition ALL.A.3 which is a standard "no objectionable effects beyond the boundary" condition. This sort of exclusion was debated during Contact Energy's Geofutures consenting a few years ago. After going through a hearing process the final wording was agreed on as following:

Discharges to air that are a result of the exercise of this consent, shall not cause an objectionable or offensive odour beyond the boundary of the Wairākei Power Station Site shown on Plan 2 in Schedule 2 provided that this condition shall not apply to any land:

(a) which is owned and exclusively occupied by the consent holder or leased and exclusively occupied by the consent holder; or

(b) which is the subject of a covenant precluding complaints and/or objections in relation to the consent holder's activities, including discharges to air, on the Wairākei-Tauhara Geothermal System.

I would recommend the following amendments to the wording of these two conditions as follows for the Waihi North Project.

ALL A.3

There must be no particulate matter or (including odour) in any discharge to air that gives rise to objectionable adverse effects (as defined in Section 6.4 of the Waikato Regional Plan) at or beyond the boundary of the subject property shown as Area's 1,2,3,5,6 and 7 of Attachment 1 (Waihi North Project Areas) in Schedule 1.

ALL.A.4

Condition ALL.A.3 does not apply to any property or site that is:

a) *Owned by the Consent Holder or a related company and exclusively occupied by the consent holder or leased and exclusively occupied by the consent holder; or*

b) *Owned by a third party which is subject to either a registered covenant or a written agreement (a copy of which is provided to the Waikato Regional Council) whereby air quality effects on the property caused by activities authorised under this consent are not to be taken into account for monitoring and compliance purposes.*

ALL.A.22

Other than Area 3, for each Area described in Condition C1(b) the Consent Holder must submit an Air Quality Management Plan for certification under Condition C5 no later than 30 working days prior to the commencement of activities in the respective Area.

Reference to Condition C1(b) doesn't seem correct. C1(b) in Schedule 1 refers to the commencement date rather than Areas. Maybe it should be referring to C1(i)?

ALL.A.24

This condition relates to the Air Quality Management Plan requirements.

Tonkin and Taylor's Technical Review makes the following recommendation around the Draft Air Management Plan:

Section 7.3 provides no guidance on the type of monitoring instruments to be used, their installation, calibration and maintenance, which we consider should be addressed in any update to the Dust Management Plan. In this regard, reference could also be provided to the relevant Australia and New Zealand Standards for meteorological monitoring and for nephelometers (i.e., dust monitoring instruments).

With regard to the dust monitoring instrument, we consider that it should be specified that the instrument should be a nephelometer instrument configured to record concentrations in $\mu g/m^3$, and that it should have a heated inlet to minimise the interference from humidity on measured dust concentrations.

I recommend that this should be addressed by the following underlined amendments to condition ALL.A.24:

ALL A24

The Air Quality Management Plan must include, as a minimum:

a. *Details of the site operation and maintenance practices to be implemented to meet the requirements of Condition ALL.A.23 and to ensure that emissions from stockpiles, unsealed roadways, the Processing Plant, rock stacks and tailings storage facilities are minimised to the greatest extent practicable;*

b. *An ambient air monitoring programme for deposited particulate matter (DP), total suspended particulate (TSP), particulate matter smaller than ten microns (PM_{10}) and particle size*

distribution studies (including silica content) including the type of particulate and meteorology monitoring instruments to be used, their installation, calibration and maintenance and reference to the relevant Australia and New Zealand Standards for meteorological and particulate monitoring;

With reference to the TSP and PM_{10} monitoring specified under this condition a nephelometer instrument, or alternative instrument subject to approval by council, shall be used with a heated inlet to minimise the interference from humidity and shall be configured to record concentrations in $\mu g/m^3$.

c. *Monitoring of windspeed, and TSP within 200m of sensitive receptors, and associated use of .... etc.*

REPORT

Tonkin+Taylor

Technical Review, Waihi Goldmine Development Projects Review

Substantive Fast Track Application

Prepared for
Waikato Regional Council
Prepared by
Tonkin & Taylor Ltd
Date
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Job Number
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1 Introduction

1.1 Background

This report presents our technical review of the geotechnical, dam engineering and dam safety aspects of several technical reports prepared to support the *Substantive Fast Track Application* resource consent applications for the Oceana Gold Waihi for the proposed Waihi North Project.

The Waihi North Project adds the Wharekirauponga Underground Mine (WUG) 10km north of Waihi and Gladstone Open Pit (GOP) Mine adjacent to the Process Plant to the existing mining operation at Waihi. This requires new tailings storage to accommodate the increased tailings production. The new tailings storage is to be provided by the proposed new TSF3 and GOP TSFs.

The Hearing Panel have now requested WRC to provide comment on the *Substantive Fast Track Application*. WRC also require technical review of draft consent conditions that are relevant to our area of expertise.

Authority to proceed with this work was provided to Tonkin & Taylor Ltd (T+T) by Waikato Regional Council (WRC) on 27 August 2020 through an Instruction for Service Contract No. 1005082. We have carried out this work under our agreed terms and conditions with the Co-Lab Professional Service Panel Agreement (2 December 2024).

1.2 Scope of review

WRC have requested technical review of the following reports identified in the *Substantive Fast Track Application*. Our assessment is limited to geotechnical and dam engineering issues, and dam safety.

i B.01 – Engineering Geology Limited - Tailings Storage and Rock Disposal Volume 1 – Natural Hazards and Options Assessment (EGL 2025a)

ii B.02 – GHD – Gladstone Pit TSF Design Report (GHD 2025a)

iii B.03 – Engineering Geology Limited – Peer Review of Gladstone Pit TSF Design Report (EGL 2025b)

iv B.04 – Engineering Geology Limited - Tailings Storage and Rock Disposal Volume 3 – Proposed Tailings Storage Facility – Storage 3 RL155 (EGL 2025c)

v B.05 – Engineering Geology Limited – Tailings Storage and Rock Disposal Volume 4 – Northern Rock Stack RL173 Proposed Rock Disposal Facility (EGL 2025d)

vi B.06 – Engineering Geology Limited – Storage 3 – Tailings Storage Facility – RL155 Dam Breach and Potential Impact Classification (EGL 2025e)

vii B.09 – Engineering Geology Limited – Willows Rock Stack Technical Report (EGL 2025g)

viii B.12 – PSM – Gladstone Pit Geotechnical Assessment (PSM 2025b)

Our review is limited to review of the supplied documentation for the general design approach and proposed arrangements presented. We have not undertaken independent checks of the presented calculations, models or model results at this stage. We understand that EGL, GHD, and PSM have appropriate internal quality assurance programmes in place that includes checking of calculations, and internal review of report contents.

Our technical review services focus on the geotechnical and dam engineering aspects, and dam safety aspects of the proposed works described in the reports. We understand that the review at this stage is to support resource consent applications under the *Substantive Fast Track Application* programme, and to provide comments that may be relevant to the future detailed design to support the building consent.

We understand that the purpose of our technical review services is, on a level-of-effort basis, is to provide additional assurance regarding the appropriateness of the EGL / GHD designs. Our services do not constitute a means by which principal design responsibility can be passed onto Tonkin & Taylor Ltd (T+T).

1.3 Peer review team

The peer review was undertaken by the following team for this project:

Reviewer	Qualifications, practice area, and job title	Review role
David Bouma	Technical Director, Dams and Rivers BE, ME, CPEng, FEngNZ	Lead reviewer, T+T Project Director
Tim Coote	Senior Principal Engineering Geologist MSc Hons, Engineering Geology, PengGeol	Technical reviewer – Engineering Geology

All reviewers have suitable experience and qualifications in the design and construction of dams relevant to their review roles.

2 Initial technical review, May 2022

T+T reviewed previous versions of six of the eight reports (B1 to B6) included in the current review request by WRC[1] (Attached, Appendix A). That document included general comments within the report and provided some more specific technical comments in an attached comments and responses table.

The attached specific technical comments table related solely to the Engineering Geology Limited document Tailings Storage and Rock Disposal Volume 3 – Proposed Tailings Storage Facility – Storage 3 RL155, dated October 2021 (Current B.04 reference, dated 14 February 2025). We understand that those comments will be addressed at detailed design stage.

In general terms, T+T assessed that the reviewed documentation was appropriate and consistent with expectations for a resource consent application. Based on our review of the revised documents referenced B.01 to B.06, we note that the updated documents mostly contain only minor changes and that our previous general review comments remain valid.

3 Technical review

3.1 General

In general terms, we consider that the documentation reviewed (B01 to B06, B09 & B12) is generally appropriate and consistent with expectations for a *Substantive Fast Track Application* resource consent application. We note that the draft resource consent conditions have generally captured recommendations for the ensuing project detailed design and construction phases, including appropriate peer review work. We have provided general comments in the report sections below and specific technical comments in the attached response table (Appendix B).

[1] Tonkin + Taylor Ltd report. Initial Technical Peer Review – Letter 1 for Waihi Goldmine Developments, Resource Consent Documents. T+T Ref. 27729.0490, dated 16 May 2022

3.2 B.01 Natural Hazards and Options Assessment (EGL 2025a)

This report is Volume 1 of a 4-part series of reports on tailings storage and rock disposal for the Waihi North Project. This report documents a review of natural hazards, and the locations and best available technologies for tailings storage and rock disposal for the Waihi Operation.

We note that the Revision 2 document dated 14 February 2025 is essentially unchanged from Revision C, dated 22 October 2022. Our previous review comments remain valid (Appendix A).

Further review comments:

1 The report notes that: *The National Seismic Hazard Model was updated in 2022. The NSHM (2022) numbers are higher than the 2017 study numbers shown in Figure 9. However, experience at Waihi finds these changes do not make a material difference to the assessed performance of the TSFs. For consistency, the 2017 study has been applied across the Waihi North Project. In detailed design seismic hazard estimates will be updated.*

2 While EGL note that, *from experience at Waihi, the higher numbers from the NSHM (2022) changes do not make a material difference to the assessed performance of the TSFs,* we note that it will be important to ensure that the seismic hazard assessment is updated for detailed design in accordance with the New Zealand Dam Safety Guidelines (NZSOLD 2024).

3 Section 10.3 Assessment of Options (for tailings and waste rock storage) notes that Options 1, 2 and 4 with slurry tailings TSFs score the highest.

3.3 B.02 – Gladstone Pit TSF Design Report (GHD 2025a)

This technical report describes the engineering design of the conversion of the Gladstone Open Pit to a Tailings Storage Facility including a closure plan that rehabilitates the area back to what we assume will be farmland. We assume that some land use constraints may be put on this rehabilitated land to recognise the risk of ongoing settlement post rehabilitation.

The revision Rev B report, dated 17 February 2025, remains mostly unchanged from the Revision D dated 07 December 2021. Our previous review comments remain valid (Appendix A). In particular:

- Because the GOP TSF does not meet the definition of a dam, a building consent is not expected to be required. It is therefore important that resource consent conditions lock in the measures proposed in this design report to ensure the GOP TSF is built and maintained in accordance with design assumptions.

Further review comments are:

4 That the design backfill batter slopes are reasonably steep at 1.5H:1 V (33.7°). It is not clear how the 2 m thick liner sub-grade will be placed on 1.5H:1V slope. Figure 14 shows 23° slope not 33.7° slope as described in text.

5 Post closure and groundwater pumping cessation to WTP allowing groundwater flow to Ohinemuri River. How will this be monitored and tested for flow and potential contamination post closure and pumping cessation?

6 Section 3.4 Geometric constraints, and 3.6 Identified risks. Plugging of old underground openings in the pit shell could be difficult. Or unseen openings near the pit shell surface. Differential settlement across or breach through old openings leading to liner failure (in-rush risk) has been noted. What methods will be deployed to locate near surface voids?

7 Section 4.8.3 Under liner drainage. Agree that uplift pressure on liner a risk, and that drainage and pumping redundancy required.

8 Section 5.1.2 Groundwater summary notes that: *On complete closure of the GOP TSF, when the GOP TSF drainage system is no longer operated (GOP TSF closure scenario in GHD (2025a)),*

groundwater discharge from the GOP TSF (approximately 50 m^3/day) is estimated to be predominantly towards the Ohinemuri River (OH6). How will this assumption be tested in terms of flow volume and potential adverse contaminants?

9 Section 6 Construction notes that: *The liner works are highly technical and should be completed by a lining contractor with relevant experience in projects of similar size. On site construction should be by overseen by an experienced representative of the Contractor and Designer.* Agree, some construction aspects including placement of the 2 m liner subgrade will require a suitable methodology and experienced contractor.

3.4 B.03 Peer Review of Gladstone Pit TSF Design Report (EGL 2025b)

Previously we noted that the GHD draft design report has been peer reviewed by Trevor Matuschka who is the Designer for TSF1, 2 and 3. Trevor's ongoing review of the design of the GOP TSF will provide additional re-assurance that the design, construction and ongoing management of this facility is consistent with the other TSFs at the site.

EGL now note that that they have reviewed various iterations of this report including Rev B dated 17 February 2025. The peer review document dated 19 February notes the following:

a *In 2024 the report was updated to account for changes in the Mine Plan.*

b *The various reports produced by GHD and that have been reviewed by EGL are summarised in Table 1.*

c *EGL has reviewed the reports summarised in Table 1, provided comments and held discussions with GHD as work on the GOP TSF has progressed.*

d *EGL is satisfied that the information presented in this report covers the relevant items for resource consent application.*

e *We (EGL) recommend the report is also subject to legal and internal OGNZL review.*

f *Full detailed design is required before construction is undertaken and we recommend the detailed design is also peer reviewed.*

3.5 B.04 Proposed Tailings Storage Facility – Storage 3 RL155 (EGL 2025c)

3.5.1 Overview

The new Storage 3 TSF is proposed to provide the tailings storage for the WNP in conjunction with the proposed GOP TSF. Storage 3 has been selected and compared against a range of options summarised in the Tailings Storage and Rock Disposal - Natural Hazard and Option Report (Volume 1 – Ref. 1).

Design for the construction of Storage 3 will be undertaken in accordance with the recommendations and guidelines of the New Zealand Society on Large Dams (NZSOLD) 'New Zealand Dam Safety Guidelines 2024' (NZDSG - Ref. 4). Storage 3 is to be designed as a High Potential Impact Classification (PIC) dam.

The report describes the preliminary design of the proposed Tailings Storage Facility 3 (TSF3). The facility is formed by progressively constructing a large dam "primarily from overburden material that is excavated as part of the process of obtaining ore from the Gladstone and Martha pits" using the downstream construction technique. Mine tailings are placed behind the dam with the surface of the tailings being maintained several metres below the crest level of the dam at any point in time.

3.5.2 Review comments

The Revision 2 report, dated 14 February 2025, remains mostly unchanged from the Revision 0, dated 08 October 2021. Our previous review comments remain valid (Appendix A). Comments listed in T+T technical comments form, dated 10 May 2022 (v2), which have not yet been responded to, also remain valid (Appendix A). However, it has been previously agreed that it is appropriate for these previous comments to be addressed during the detailed design stage.

Further review comment:

10 The report notes that: *The National Seismic Hazard Model (NSHM) was updated in 2022 (Ref. 26). The NSHM numbers are higher, however, do not make a material difference to the assessed performance of the WRS. For consistency, the 2017 study has been applied across the Waihi North Project. In detailed design seismic hazard estimates will be updated.* This update should be a condition of consent for detailed design and construction.

11 Report Section 17.5 Refers to The Building (Dam Safety) Regulations 2022 took effect from 13 May 2024. Storage 3 will need to comply with these regulations once it is commissioned. The regulations do not affect the proposed design or construction. Revision 0 referred to the 2015 version.

12 Section 19 of the report advises that a peer review of the detailed design is recommended by the NZDSG and will be required for building consent. The Peer Review Panel will also undertake independent review of the design.

13 We note that the draft consents (Section 4.9, this report) require peer review of all detailed design documentation for the Waihi North Project.

14 Appendix B, geotechnical slope stability analyses. Tables B3, B4, B5 B7 B15 - Same geotechnical input parameters. Why similar but overall lower FoS and higher seismic displacements? Geometry?

Noted design changes between the Revision 0 report dated 08 October 2021 and Revision 2 report dated 14 February 2025) are included in Appendix C.

3.6 B.05 Northern Rock Stack RL173 Proposed Rock Disposal Facility (EGL 2025d)

This technical report describes the engineering design of three stockpiles of rock and other overburden material excavated from various open pit mines. The stockpiles are referred to as the Northern Stockpile (referred to as Northern Rock Stack (NRS)), the Central Stockpile and the East Stockpile. The report focuses on the NRS which will become significantly larger.

The Revision 2 report, dated 15 February 2025, remains mostly unchanged from the Revision 0, dated 22 October 2021. Our previous review comments remain valid (Appendix A). In particular:

- A building consent is likely not required for the NRS (though EGL have indicated that a BC will be required for the NRS collection pond which will be a large dam). It will be important that the measures proposed by EGL are put in place to ensure that the NRS is built and maintained in accordance with design assumptions.

Further review comments:

15 The report does not reference to the updated National Seismic Hazard Model (NSHM), which was updated in 2022. The slope stability analyses will need to include revised seismic coefficients for detailed design.

16 The report notes that to construct a stable landform, ground improvement work will be required (shear keys, drainage), accurate profiling and zonation and monitoring of pore water

pressure. In addition, monitoring and verification of the earthwork's construction quality and extent. We note that earthworks control and verification will be key and from suitably qualified engineering staff. These elements are covered in the existing draft consent conditions.

17 Is the Duncan (2014) fill strength relationship appropriate for some of the proposed waste rock zones, which may be variably weathered and/or altered (PAF), and have relatively high clay content? Should effective and total stress parameters for the fill be assigned and modelled also?

18 Construction of the rock stack will require close supervision of earthworks and control in accordance with the earthworks Specification (not prepared yet). For example, what fill placement methods (i.e. end tip, track roll or sheepsfoot compactor) to achieve the required design fill strengths? The earthworks Specification will need to clearly define compaction requirements for the various fill zones to achieve required design strengths and slope stability.

19 Fill height staging likely to be key in controlling fill pore water pressures and required dissipation. Will there be limitations on timing and height of fill placement staging?

Noted design changes between the Revision 0 report dated 22 October 2021) and Revision 2 report dated 15 February 2025) are included in Appendix C.

We agree with the EGL recommendation that "*Detailed design is required for the NRS as drains and stability considerations require assessment, and drawings and specifications are required for construction. So, while building consent is not required under the Building Act, a peer review of the detailed design is recommended, to be provided by an appropriately qualified independent party..*"

3.7 B.06 Storage 3 – Tailings Storage Facility – RL155 Dam Breach and PIC (EGL 2025e)

The Revision 1 report, dated 23 January 2025, remains mostly unchanged from the Revision C, dated 23 January 2025. Our previous review comments remain valid (Appendix A), and for that review we noted:

- The approach used by EGL for the dam breach study is in accordance with recommendations in the NZSOLD DSG for a comprehensive dam breach assessment, as well as the specialist bulletin from the Canadian Dam Association (CDA) Technical Bulletin: Guidelines for Tailings Dam Breach Analyses. EGL has referenced the draft version, dated August 2020. A final version is now available dated 2021.
- EGL have stated that the approaches used will also satisfy requirements 2.3 and 2.4 of the Global Industry Standard on Tailings Management (GISTM).

EGL noted the following in this latest report

g *This report presents the results of the dam breach assessment and an assessment of the Potential Impact Classification (PIC) of Storage 3 in accordance with the most recent version of the New Zealand Dam Safety Guidelines (NZDSG) published in 2024 (Ref. 1).*

h *The assessment and findings provided in this report were completed early in the Waihi North Project application development process in 2021/2022. Despite the time that has elapsed since their completion, the assessment and findings remain applicable to the Waihi North Project being applied for under the Fast-track Approvals Act 2024. The geometric parameters of the dam breach remain the same and applicable. Only minor update to the PIC assessment tables to align with the 2024 version of the New Zealand Dam Safety Guidelines has been made.*

Section 12.2.3 Potential loss of life: *As a result, the total incremental Potential Loss of Life for the Rainy-Day breach scenario is estimated to be <u>two</u>.* We note that this is up from <u>one</u> in previous report.

Section 15 Conclusions: Not changed from previous report as follows.

i *The proposed Storage 3 is to be constructed with the embankment crest at RL155. A dam breach study has been undertaken, the consequences of the breach assessed and the Potential Impact Classification (PIC) of the embankment determined in accordance with the guidance in Module 2 of the New Zealand Dam Safety Guidelines. The Storage 3 embankment is assessed to be **High** PIC.*

3.8 B.09 – Willows Rock Stack Technical Report (EGL 2025g)

3.8.1 Background

Engineering Geology Limited (EGL) has been appointed by Oceana Gold (New Zealand) Limited (OGNZL) to undertake a technical report for the new Willows Rock Stack (WRS) for resource consent for the Waihi North Project (WNP). As part of WRS the Willows Collection Pond is also proposed.

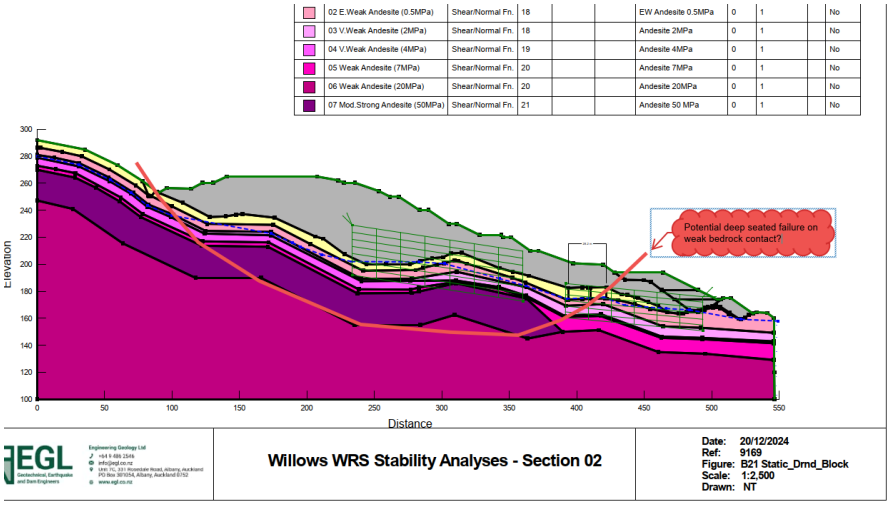
The WRS is proposed as the new operational NAF and PAF stockpile at the Willows Farm Site. The stockpile is required to store up to 1,100,000 m^3 of rockfill from the Wharekirauponga Underground Mine and tunnel development. The stockpile will store both NAF and PAF materials. The waste rock will be placed across one of the east trending gullies on the southern slopes of the valley formed by the Mataura Stream, a tributary of the Ohinemuri River.

3.8.2 Review comments

In general terms, we consider that the document is generally appropriate and consistent with expectations for a *Substantive Fast Track Application* resource consent application. It incorporates a similar design approach and reporting structure to the EGL Northern Rock Stack report (B05, Revision 2 dated 15 February 2025.

20 The report notes that, *the slopes and the ridge are blanketed in ash and residual soils which are low permeability, the gully is hydraulically contained, and the rock material is to be removed before closure, it is proposed not to have an engineered liner like the permanent rock stacks at the Development Site*. We note that these design inferences will require strategically located surface and groundwater monitoring instrumentation to monitor and test these assumptions. The relevant draft consent conditions appear to address this requirement.

21 The waste rock stack will be constructed on gently to moderately inclined sloping ground. Have the computer stability analyses adequately considered global slope stability scenarios in terms of potential deep seated landslide movement being induced by the waste rock stack slope surcharge load (see snip below)? Are there any weak interfaces between underlying successive volcanic lava flow deposits. We have not reviewed the GFR and associated site investigation data.



22

23 Is the Duncan (2014) fill strength relationship appropriate for all the proposed waste rock, which may be variably weathered and altered (PAF), and have relatively high clay content? Should effective and total stress parameters for the fill be assigned and modelled also.

24 With proposed fill placement layer thickness 0.5 m to 5 m, does this assume design fill strength is effectively based on angle of repose friction angle only? Will the fill, or at least some zones, require engineering compaction to achieve design strength? What staging of fill lift heights to allow pore pressure dissipation?

25 The report notes that *the estimates of seismic hazard which are based on NSHM (2022) are higher, however, they do not make a material difference to the assessed performance of the WRS. For consistency, the 2017 study has been applied across the Waihi North Project. The estimate s of seismic hazard will be updated, as appropriate, during the detailed design process.* This required seismic design update should be noted as a consent condition.

26 The report notes that to construct a stable landform ground improvement work may be required (shear keys, drainage), accurate profiling and zonation and monitoring of pore water pressure. In addition, monitoring and verification of the earthwork's construction quality and extent. We note that earthworks control and verification will be key and from suitably qualified engineering staff. These elements are covered in the existing draft consent conditions.

27 *No building consent is required for the WRS or Willows Collection Pond. However, WRS is a notable stockpile on relatively steep ground which could have poor environmental outcomes if it were to fail. Therefore, it is recommended that the detailed design of the WRS and of the Willows Collection Pond is peer reviewed prior to construction. Record of this peer review should be submitted to Waikato Regional Council and Hauraki District Council prior to construction*. This peer review requirement is noted as a draft consent condition.

28 Likely consenting requirements are set out in Section 19.0 of the report and summary of potential risks and mitigation measures are set out in Section 20.0 of the report, which all appear appropriate. The risk associated with poor construction is highlighted, which can be mitigated with appropriate verification and suitable contractor and contract engagement.

3.9 B.12 – PSM – Gladstone Pit Geotechnical Assessment (PSM 2025b)

3.9.1 Background

This report by PSM Consult Pty Limited presents the results of a geotechnical study for the planned open pit mining of the Gladstone Deposit. The report has been prepared for OceanaGold (New

Zealand) Limited (OGNZL) in support of the Fast-track Approvals Act application for the proposed Waihi North Project which includes the establishment of the Gladstone Open Pit.

Various studies for potential open pit mining at Gladstone and other related deposits have been ongoing since around 2017. The planned mining has evolved considerably over that time and this latest iteration entails an open pit that would be converted to an in-pit tailings storage facility (TSF) following the completion of mining. This document addresses the planned pit, incorporates the results of earlier studies as appropriate, and includes other associated work on the shallow groundwater system by GWS and groundwater information used by GHD to design the in-pit TSF.

The conclusions arising from the Preliminary Geotechnical Study included:

- Generally, the pit will be excavated in poor to fair materials, with no materials that would classify as high strength rock similar to the northwest wall of Martha Pit.
- The overall slopes used for initial planning were considered appropriate. However, the planned 15 and 20 m high benches at 50° to 65° were considered optimistic given the general rock character. Bench heights should be limited to 10 m in the upper materials and 15 m in the lower rock zones.
- Although the pit is small, careful engineering studies will be required during early pit development to optimise the slopes in these marginal materials, and this is the aim of the staged pit development.
- This staging would thus provide early exposures of the rock conditions and allow the slope designs in the Gladstone Pit to be confirmed, and the design optimised.

3.9.2 Review comments

In general terms, we consider that the document is generally appropriate and consistent with expectations for a *Substantive Fast Track Application* resource consent application. We make the following observations and comments

29 The report and associated analyses and modelling appear to be based on adequate and suitable geological, hydrogeological and geotechnical data.

30 The approach for modelling pit slope stability and geometry design is appropriate and industry standard.

31 The computer slope stability analyses utilise both Mohr-Coulomb and generalised Hoek-Brown Failure Criterion.

32 Pit slope design has incorporated stability modelling from both structurally controlled kinematic sliding at the inter-ramp scale, (failure along persistent faults and shears that daylight and dip towards the pit), and mass failure, that is, global circular or rotational failure through the weaker soil/rock mass.

33 Section 11.2. Table 11.1: We consider that the assigned strengths appear appropriate, although Mohr-Coulomb appear a little high where some materials described as soils (ignimbrite, volcaniclastic) and the overall comment from Section 4.2.2: *The variability in the geology and poor to fair geotechnical conditions mean it is important that final designs are allowed to be checked early in the mine life.*

34 Slope stability is reliant on accurate groundwater modelling. We note from Section 8.0: *There is currently insufficient* [groundwater] *monitoring to fully define the distribution and degree of the dewatering and depressurisation due to the underground mining. OGNZL plan to install a comprehensive piezometer monitoring network before mining begins, forming part of the Ground Control Management Plan for Gladstone Pit.*

35 Section 12.3.5 Summary: Makes the following comment and recommendations

The stability analyses show that the risk of rock mass failure with current standing water tables and 50% depressurisation is low. However, the 50 % depressurisation needs to be confirmed, and this will be accomplished by implementing the following:

a *A comprehensive piezometer network around the pit to be established before mining commences, which needs to be defined as part of the Ground Control Management Plan and installed before mining commences.*

b *Planning for a comprehensive horizontal drain program in the pit.*

c *Horizontal grading of the berms (that is inclined berms) in the upper flatter sections of slope to direct rainfall runoff and any shallow seepage away from lower slopes.*

d *A staged early pit development to allow the rock mass conditions, geological structure and geology to be confirmed before commitment to final pit crest and overall design slopes.*

36 We recommend that items 36 a to d above should be subject to the detailed design, peer review and consenting process.

37 Section 14 of the report also recommends that a Ground Control Management plan (GCMP) is formatted prior to mining. This would incorporate staged earthworks, comprehensive piezometer network, confirmation of material strengths (and parameters), horizontal drain hole plan and groundworks to control surface and seepage flows.

3.10 Resource consent conditions

We have reviewed the provided resource consent and condition set documentation and consider that the relevant geotechnical and dam engineering related conditions as refenced below appear relevant and appropriate.

3.10.1 Waihi North Project – Schedule 1: Proposed conditions common to the Hauraki District Council and Waikato regional Council consents

The geotechnical conditions referenced as follows are generally appropriate:

<u>Dewatering and settlement</u>

- C43 to C46 Generally appropriate.
- C46a. 1 in 1,000 settlement related tilt between two points is stringent/conservative

<u>Peer review</u>

- C50 to C58 Generally appropriate. C52a. Specifically relates to geotechnical inputs
- C52 The Panel must include technical specialists who between them have demonstrated expertise in the following fields:

i Geotechnical engineering, with recognised experience in:

  - Underground mine construction and mining techniques;
  - Open pit construction and rock mechanics;
  - Design and construction of rock storage facilities; and
  - Design and construction of tailings storage facilities.

<u>Rehabilitation and closure</u>

- C60 to C68.
- Address long term site stability (C62a., C64c., C64f., C65i, C66b, C67a. & e., C68c., C69a. & b.) and risk (C62.b.ii)

3.10.2 Waihi North Project – Proposed conditions for Waikato Regional Council

The various geotechnical conditions in the first three consent sections appear appropriate. The relevant geotechnical conditions for Areas 2 (Willow Rock Stack), 5 (GOPTSF), 6 (Northern Rock Stack and Western Borrow) and 7 (TSF 3), under the following condition set sections, are all similar in content, are worded generally but considered appropriate:

a Design and construction

b Monitoring

c Monitoring and Management Plans

d Monitoring Reports

e Peer Review, and

f Closure

We note the following two suggestions and provide suggestions for alternative geotechnical condition wording, if required, in Section 3.10.3 below.

- We recommend that a consent condition be included that all detailed design reporting should include updated seismic design analyses in accordance with NSHM (2022).
- The potential slope instability hazard and risk for each area could be more specifically addressed in the 'Monitoring and Management Plan', although this is implicitly covered as is.

3.10.3 Alternative geotechnical condition wording

The following consent condition wording could be considered and modified for use for geotechnical considerations.

<u>Construction earthworks design and oversight</u>

- The investigation, final design, specification and construction of [TSF/waste rock stacks/structures*]* earthworks shall be carried out or reviewed by a Chartered Professional Engineer practicing in geotechnical engineering or an Engineering New Zealand registered Professional Engineering Geologist.
- A detailed construction methodology shall be prepared and included in the [document] to ensure that the proposed earthworks are staged and carried out in a manner that will not contribute to slope instability, and to ensure that subsoil drainage is installed beneath the [structure] where appropriate and, as a minimum, shall extend beneath the entire length of the floor of the [structure].
- Cut slopes shall be assessed by a Chartered Professional Engineer practicing in geotechnical engineering or an Engineering New Zealand registered Professional Engineering Geologist for the presence of adverse geological conditions including landslide deposits, geological faults and the groundwater seepage. A signed and dated record of each assessment shall be kept including a pictorial representation of the slope showing all relevant geotechnical and geological features, all unanticipated conditions, and including notes describing any recommended mitigation measures. This record shall be incorporated in the completion report [as required by Condition X].
- Prior to placement of the first layer of structural fill at each location the subgrade shall be assessed by a Chartered Professional Engineer practicing in geotechnical engineering or an Engineering New Zealand registered Professional Engineering Geologist for the presence of adverse geological conditions including landslide deposits, geological faults and groundwater seepage. A signed and dated record of each assessment shall be kept including a pictorial representation of the slope showing all relevant geotechnical and geological features, all

unanticipated conditions, and including notes describing any recommended mitigation measures. This record shall be incorporated in the completion report [as required by Condition X].

- Structural fill shall be placed and tested in accordance with the requirements of the [specification/document]. The fill placement records, and fill testing records shall be assessed by a Chartered Professional Engineer practicing in geotechnical engineering or an Engineering New Zealand registered Professional Engineering Geologist. A signed and dated record of each assessment shall be kept, including details of any non-conformances identified along with the remedial actions taken. This record shall be incorporated in the completion report [as required by Condition X].
- On satisfactory completion of earthworks, the consent holder shall submit a completion report and appropriate stability and suitability statements prepared by a Chartered Professional Engineer practicing in geotechnical engineering or Engineering New Zealand registered Professional Engineering Geologist.

Seismic/ Structures

- Following an earthquake event that is likely to have resulted in peak ground acceleration of equal to or greater than [0.19g] in the vicinity of the site, a review of the [structure, e.g. liner geomembrane] shall be prepared by a suitably qualified landfill engineer to confirm the performance of the [structure] is not compromised and shall be submitted to Council.
- Following an event which results in [e.g. slope instability] that have the potential to impact on the [structure], a review of the [structure] shall be prepared by a suitably qualified [geotechnical/dam] engineer to confirm the performance of the geomembrane and stormwater systems is not compromised and will be submitted to Council. This shall be completed within a timeframe agreed with the Council, but shall be no longer than [4] weeks for the initial report.
- The consent holder shall retain an independent testing organisation approved by the [peer review panel] to monitor the construction of the [structure] including the subgrade and to undertake quality assurance (QA) of all components of the [structure] and their installation. QA shall include oversight of the testing undertaken by the contractor, regular observation of the [structure] placement and testing, and a review of all quality control documentation produced by the supplier and contractor.
- On completion of each stage of [structure] installation, a report shall be prepared by the independent testing organisation and shall include all of the test results, a description of the observations undertaken and certification that the [structure] had been installed in accordance with the specification. This report shall be submitted to the Peer Review Panel [Condition X] who will make recommendations to Council on whether the [structure] has been installed in accordance with the specifications. The consent holder shall obtain approval from Council of each stage of [structure] construction prior to any [waste rock / tailings] being placed in the area.
- Subsoil drainage beneath the [structure] shall be maintained and operated permanently throughout the life of the landfill and the approved aftercare period.

4 Applicability

This report has been prepared for the exclusive use of our client Waikato Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:

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Tim Coote - PEngGeol
Senior Principal Engineering Geology

Authorised for Tonkin & Taylor Ltd by:

.....

David Bouma
Project Director

13-Aug-25
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Appendix A T+T technical review, May 2022

Tonkin+Taylor

Job No: 27729.049
16 May 2022

Waikato Regional Council
Private Bag 3010
Hamilton 3240

Attention: Sheryl Roa

Dear Sheryl

Initial Technical Peer Review - letter 1 for Waihi Goldmine Development Projects Resource Consent Documents

This letter presents our Initial Technical Review of the geotechnical and dam engineering and dam safety aspects of various reports prepared to support the resource consent applications for the following projects for Oceana Gold Waihi mining operations:

- Tailings storage facility 3 (new tailings dam)
- Northern rock stack expansion
- Gladstone Pit backfill with tailings

Authority to proceed with this work was provided to Tonkin & Taylor Ltd (T+T) by Waikato Regional Council (WRC) on 27 August 2020 through an Instruction for Service No. WRC2019/2022-521.34, and Purchase Order No. 125483. We have carried out this work under our agreed terms and conditions with the Waikato Local Authority Shared Services.

Scope of review

As requested by WRC, this review is an initial review of a selection of draft documents that will soon be finalised and submitted to support resource consent applications to enable the mine development projects. The focus of this initial review is to assess whether the draft documents provide enough information to enable the T+T review team to undertake a technical assessment, and if not, to advise what further information is required. Our assessment is limited to geotechnical and dam engineering issues, and dam safety.

Initial review has been completed for the following documents:

1. *Waihi North Project - Tailings Storage and Rock Disposal Volume 1 Natural Hazards and Options Assessment EGL Rev C 22 October 2021*
2. *Waihi North Project - Tailings Storage Facility 3 RL155 Dam Breach and Potential Impact Classification, EGL Rev C 5 November 2021*
3. *Tailings Storage and Rock Disposal Volume 3 - Proposed Tailings Storage Facility - Storage 3 RL155* EGL Final 8 October2021, and supporting documents:
    a. Reference 16: Oceana Gold (New Zealand) Limited Waihi Operation, Tailings Storage Facility Storage 3, Geotechnical Factual Report, EGL, 18 Feb 2022.

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   b. Reference 21: Waihi North Project Tailings and Overburden Material Disposal, Exposure and testing of candidate geomembrane materials exposed to tailings and PAF overburden material solutions, M Sadlier, Nov 2021
   c. Appendix B, Reference 1: Seismic Design Spectra for the Martha Hill Mine with Rock ground conditions, GNS Science, September 2017
4. *Waihi North Project - Tailings Storage and Rock Disposal Volume 4 NRS RL173 Proposed Rock Disposal Facility Design Report* EGL Rev 0 22 Oct 2021
5. *Waihi North Project - Gladstone Pit TSF Design Report* GHD 7 Dec 2021
6. *Peer Review Letter (peer review of Volume 2)* EGL Peer Review of GOP TSF Technical Report 1 Dec 2021

We were also supplied for information a Project Description document prepared by Oceana Gold that will support the consent applications.

Our review is limited to review of the supplied documentation for the general design approach and proposed arrangements presented. We have not undertaken independent checks of the presented calculations, models or model results at this stage. We understand that EGL, GHD, and GNS have appropriate internal quality assurance programmes in place that includes checking of calculations, and internal review of report contents.

Our initial peer review services focus on the geotechnical and dam engineering aspects, and dam safety aspects of the proposed works described in the reports. We understand that the review at this stage is to support resource consent applications and also to provide comments that may be relevant to the future detailed design to support the building consent. Further peer review will be required at the next project stages.

We understand the purpose of our peer review services is, on a level-of-effort basis, to provide additional assurance regarding the appropriateness of the EGL / GHD designs. Our services do not constitute a means by which principal design responsibility can be passed onto Tonkin & Taylor Ltd (T+T).

Peer review team

The peer review was undertaken by the following team for this project:

Reviewer	Qualifications, practice area, and job title	Review role
David Bouma	Technical Director, Dams and Rivers BE, ME, CPEng, IntPE, FEngNZ	Lead reviewer, T+T Project Director
Sjoerd van Ballegooy	Technical Director – Geotechnical Engineering PhD, Civil Engineering, BE(hons)	Technical reviewer – geotechnical engineering
John Harris	Geotechnical and dams engineer BSc, MEngSc, CPEng, CMEngNZ	Assistant reviewer

All reviewers have suitable experience and qualifications in the design and construction of dams relevant to their review roles.

Initial review comments

In general terms, the documentation reviewed is appropriate and consistent with expectations for a resource consent application. We have provided general comments within the report and provide some more specific technical comments in the attached comments and responses table.

1 Waihi North Project - Tailings Storage and Rock Disposal Volume 1 Natural Hazards and Options Assessment, EGL, Rev C, 22 October 2021

Purpose and scope of report (extracts)

This report is Volume 1 of a 4-part series of reports on tailings storage and rock disposal for the Waihi North Project. This report documents a review of natural hazards, and the locations and best available technologies for tailings storage and rock disposal for the Waihi Operation. Volume 2 is a technical report on the use of the proposed Gladstone Open Pit

This report covers:

- Waihi Operation location and site description.
- An overview of the climate, geology, hydrology, hydrogeology, and seismicity of the Waihi area.
- An overview of the Waihi Operation existing storage facilities which have performed well geotechnically and environmentally.
- A comparison of the Waihi TSFs with practices seen globally.
- Waihi North Project tailing storage and rock disposal requirements.
- Locations for tailings storage and rock disposal.
- Tailings storage best available technologies.
- Rock disposal best available technologies.
- Assessment of options.
- Proposed Waihi North Project tailings and rock disposal strategy.

In terms of the resource consent process, we assume that the primary purpose of this report is to demonstrate that a thorough process has been used to consider a range of potential options for tailings storage and rock disposal, and to identify the best option to best meet all the required design requirements including "long term security for the disposal of rock and containment of tailings; minimise impacts on groundwater, receiving waters and landform; create rehabilitated landforms that will provide the opportunity for a net gain in terms of biodiversity; minimise risk to people and property."

The report provides a thorough description of the existing site including natural hazards such as high intensity rainfall and seismic hazard which are key inputs to the design of the proposed facilities. The requirements for rock and tailings disposal, potential technologies that could be considered for tailings disposal and why the conventional slurry tailings process is best suited for this site are all described.

A range of potential locations for tailings storage and rock disposal have been considered, and a thorough multi criteria analysis has been used with equal weightings to Technical issues, environmental issues, socio-economic issues including mana whenua issues, and project economics.

This process identified the three selected sites as the highest scoring option: For tailings disposal – new TSF3 and backfill of Gladstone Open Pit (without a lake), and for rock disposal - extension of the existing Northern rock stack.

The report provides a good record of the process that has been used to consider a range of potential tailings disposal technologies and sites, and to consider a wide range of factors in the MCA decision process to select and justify the preferred option. The scoring detail for the MCA decision process is well documented in Appendix A. We have not identified any shortfalls in the information provided in this report.

2 Waihi North Project - Tailings Storage Facility 3 RL155 Dam Breach and Potential Impact Classification, EGL, Rev C, 5 November 2021

The Potential Impact Classification (PIC) process as described in the NZSOLD Dam Safety Guidelines (DSG) is an essential step in the design process for new dams, as it sets the appropriate design standards based on the potential consequences of dam failure. The higher the potential consequences, the higher the dam design standards. The dam breach analysis provides essential data in assessing the potential consequences of dam failure which in turn dictates the PIC.

EGL state the purpose of the report as follows:

The purposes of this dam breach assessment are to:

a. Assess consequences of a hypothetical breach of the Storage 3 TSF to determine the Potential Impact Classification (PIC). The PIC sets the standards for design, construction, and operation of the dam. Dams with higher potential impacts are designed to be resilient to extreme load conditions associated with natural hazards or unlikely scenarios which may occur in operation.
b. Develop maps for the Emergency Action Plan (EAP). The maps are used for planning and managing the unlikely event of a breach.

Breach analysis for tailings dams is specialised in that tailings do not behave in the same way as impounded water. The approach used by EGL for the dam breach study is in accordance with recommendations in the NZSOLD DSG for a comprehensive dam breach assessment, as well as the specialist bulletin from the Canadian Dam Association (CDA) Technical Bulletin: Guidelines for Tailings Dam Breach Analyses. EGL has referenced the draft version, dated August 2020. A final version is now available dated 2021.

EGL have stated that the approaches used will also satisfy requirements 2.3 and 2.4 of the Global Industry Standard on Tailings Management (GISTM).

We have not completed a technical peer review of this report. We assume an independent technical peer review of this report will be completed by others prior to including this report as supporting documentation for the building consent application for TSF3.

However, in scanning thorough the report, it appears to be well presented and in accordance with the comprehensive assessment as recommended in the DSG. The assigned High PIC appears appropriate based on the findings of the report. The dam breach inundation maps are appropriate for inclusion in an emergency response plan which is a critical component of the dam safety management system.

3 Tailings Storage and Rock Disposal Volume 3 - Proposed Tailings Storage Facility - Storage 3 RL155, EGL, Final 8 October2021

EGL state “This technical report has been prepared for resource consent and details a preliminary design for the assessment of environmental effects as required under the Resource Management Act”.

We have not completed a technical peer review of this report. Section 19 of the report confirms the intention to commission an independent technical peer review of the completed detailed design report by others prior to submitting the design for the building consent application for TSF3.

The report describes the preliminary design of the proposed Tailings Storage Facility 3 (TSF3). The facility is formed by progressively constructing a large dam “primarily from overburden material that is excavated as part of the process of obtaining ore from the Gladstone and Martha pits” using the

downstream construction technique. Mine tailings are placed behind the dam with the surface of the tailings being maintained several metres below the crest level of the dam at any point in time.

The preliminary design assumes a High PIC based on the PIC Classification process described in the previous sub-section. This means that the dam is designed to meet the highest standards used in New Zealand for dam design and construction as outlined in the NZSOLD DSG. We understand that the design, construction and operation of TSF3 will also be completed in accordance with internationally accepted practice outlined in "Global Industry Standards on Tailings Management", August 2022.

A thorough geotechnical investigation has been completed to provide EGL with a thorough understanding of the complex foundation conditions for the facility, and the design has been adapted to suit the site. The investigation has resulted in repositioning the embankment location and also the decision to undercut and remove the sensitive soils thereby de-risking the seismic stability.

A site specific seismic hazard assessment has been completed (GNS,2017) in accordance with the approach recommended in the DSG. The seismic parameters developed in this report have been used in assessing the stability of the proposed dam to confirm it meets the DSG recommendations for High PIC dams.

Our review of the geotechnical analyses undertaken to date, and the preliminary design drawings has picked up some relatively minor points of clarification and suggestions for the designer for consideration when completing detailed design documentation. These mainly relate to the seismic assessment cases. The stability analyses presented to date is for the completed dam at its maximum height. We note that the dam will be built in stages. The intermediate stages should also be analysed for stability to ensure they also meet the design criteria for static and seismic stability.

The report confirms the intention to build and operate the facility with sufficient freeboard at all times to contain the maximum probable flood with at least 1m of remaining freeboard. While it is unusual for a large dam not to have a spillway, the TSF3 will have a small catchment and the design and proposed operational regime demonstrates the ability to safely manage the inflow design flood in accordance with the DSG recommendations for High PIC dams. The report does not mention the design of the pump system that will be used to manage the water level in TSF3. The capacity of this pump system, and information on back-up systems should the pumps or pipelines fail is important in maintaining a safe water level in the TSF. More information should be provided on the water level management systems to support the application.

The report outlines in Section 12 an initial review of potential failure modes with commentary on the defensive measures built into the design to prevent each failure mode, as well as the ongoing dam safety management regime that will be in place to pick up early signs of any aspect of dam performance that is not in accordance with design expectations. This enables early intervention if any issues develop with the dam. We would expect the detailed design process would involve a more in-depth failure modes analysis with input from the independent peer reviewer.

The design incorporates a range of instrumentation and monitoring points including piezometers, inclinometers, deformation monitoring points, drain flow monitoring points, and water level monitoring. An active and comprehensive dam safety management system (DSMS) is already in place for the existing TSF1 and 2, and this would be extended to TSF3. The system includes regular inspections by the dam owner, by the dam designer, and by independent specialist dam safety reviewers. The proposed DSMS is in accordance with DSG recommendations for High PIC dams.

4 Waihi North Project - Tailings Storage and Rock Disposal Volume 4 NRS RL173 Proposed Rock Disposal Facility Design Report EGL Rev 0 22 Oct 2021

This technical report describes the engineering design of three stockpiles of rock and other overburden material excavated from various open pit mines. The stockpiles are referred to as the Northern Stockpile (referred to as Northern Rock Stack (NRS)), the Central Stockpile and the East Stockpile. The report focuses on the NRS which will become significantly larger.

Our review comments are limited to the geotechnical engineering aspects of these stockpiles. The stockpiles are not dams and do not affect the existing or proposed tailings dams. We understand that review of hydrogeology and geochemistry aspects has been undertaken by others.

The primary geotechnical consideration is the stability of the enlarged NRS for static and seismic load cases.

A thorough geotechnical investigation has been completed to enable a good understanding of the foundation conditions for the site.

As for TSF3, the seismic load cases have been derived from the GNS Seismic Design Spectra for the Martha Hill Mine with Rock ground conditions dated September 2017. EGL have used the same stability criteria adopted for TSF3 as recommended by NZSOLD for High PIC dams. This approach is considered conservative for a stockpile and provides confidence that the stockpile will remain stable even in large earthquakes, provided it is built in accordance with design assumptions.

It is noted (Section 10.1 of the report) that the "*Geotechnical stability is dependent on management of materials of different strength within stockpile. Weaker material strength in the analyses in the centre of the stockpile with stronger material applied at the outer extents*".

It is therefore critical that the stockpile is constructed in accordance with design assumptions. We understand that a detailed design and specification will be prepared, and the Contractor will be required to build to the design and specification. The report proposes in Section 12.0 a construction management plan, and a Principal's Quality Assurance Plan including as-built records. Section 14 proposes an Operational Management Plan similar to Operational Maintenance and Surveillance (OMS) manual required for the TSFs. This is intended to include installation and monitoring of various geotechnical instruments to enable monitoring of the performance of the stockpile against design assumptions.

For TSF3, a building consent (dams) will be required, and this will provide a regulatory framework to provide confidence that the dam is being built in accordance with the design. However, for the NRS, a building consent is likely not required. It is therefore important that resource consent conditions lock in the measures proposed by EGL to ensure the NRS is built and maintained in accordance with design assumptions.

5 Waihi North Project - Gladstone Pit TSF Design Report, GHD, 7 Dec 2021

This technical report describes the engineering design of the conversion of the Gladstone Open Pit to a Tailings Storage Facility including a closure plan that rehabilitates the area back to what we assume will be farmland. We assume that some land use constraints may be put on this rehabilitated land to recognise the risk of ongoing settlement post rehabilitation.

As the proposed TSF is constructed in a pit, and there are no credible failure modes that could result in release of the tailings or supernatant reservoir out of the pit, the facility does not meet the definition of a dam. GHD have correctly assumed that the PIC process for dams does not apply.

However, because the mine pit is being modified to act as a tailings storage facility, design guidance from the NZSOLD DSG, and ANOCLD Guidelines on Tailings Dams (2019), the Global Industry Standard on Tailings Management have been referred to by GHD in developing the design.

Our review comments are limited to the geotechnical engineering aspects of the GOP TSF. The GOP TSF is not a dam and will not affect the existing or proposed tailings dams. We understand that review of hydrogeology and geochemistry aspects of the design has been undertaken by others.

There will be a period when the GOP TSF has been filled to the proposed final level of RL 1103 m (assumed datum), but before the final capping is placed, that there will be a pond on the surface of the TSF. During this period, there are two risks relating to potential overtopping of the reservoir that GHD have considered. Firstly the risk of a landslide generated from the high ground to the North and South of the TSF sliding into the reservoir and creating a wave. And secondly, for a large rainfall event filling the pond to its crest level.

The first risk is considered in Section 5.5.1 of the report which describes a low risk of the event occurring, and adequate freeboard to prevent overtopping if it did occur.

The second risk relates to overtopping in a flood event. GHD have considered the probable maximum freeboard and calculated a freeboard of 1 m above this level. Section 4.8.1 states *"After a significant rain event, the decant pond level should be reduced to the typical operating volume within 30 days."* The report does not mention the design of the pump system that will be used to manage the water level in the TSF. The capacity of this pump system, and information on back-up systems should the pump fail is important in maintaining a safe water level in the TSF. More information should be provided on the water level management systems to support the application.

Section 6 describes measures to be undertaken during construction of the facility to ensure works are completed in accordance with the design. Section 7 describes ongoing operation, maintenance and surveillance systems proposed to ensure the facility is operated in accordance with design assumptions. The proposed systems are intended to be in accordance with NZSOLD and ANCOLD recommendations for tailings dams. This is considered a good approach and is consistent with systems already in place for TSF1 and 2.

Because the GOP TSF does not meet the definition of a dam, a building consent is not expected to be required. It is therefore important that resource consent conditions lock in the measures proposed in this design report to ensure the GOP TSF is built and maintained in accordance with design assumptions.

6 Peer Review Letter (peer review of Volume 2), EGL Peer Review of GOP TSF Technical Report, 1 Dec 2021

We note that the GHD draft design report has been peer reviewed by Trevor Matuschka who is the Designer for TSF1, 2 and 3. Trevor's ongoing review of the design of the GOP TSF will provide additional re-assurance that the design, construction and ongoing management of this facility is consistent with the other TSFs at the site.

As requested, this review provides initial review comments on the draft documentation listed above. We understand that further review will be undertaken following submission of the resource consent application, and for the tailings dam, as part of the building consent process.

Applicability

This report has been prepared for the exclusive use of our client Waikato Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand the purpose of our peer review services is, on a level-of-effort basis, to provide additional assurance regarding the appropriateness of the EGL and GHD design. Our services do not constitute a means by which principal design responsibility can be passed onto T+T.

We understand and agree that Waikato Regional Council may use this report for the purpose of assessing the resource consent applications for the proposed Waihi mine developments.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

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David Bouma
Sjoerd van Ballegooy
John Harris

Authorised for Tonkin & Taylor Ltd by:

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David Bouma (CPEng, IntPE)
Project Director, Technical Director Dams and Rivers

16-May-22

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Appendix A: Technical review comments

PROJECT NAME: Oceana Gold (NZ) Limited. Waihi North Project Proposed Tailings Storage Facility (TSF) 3

DESCRIPTION Resource Consent application compliance assessment

REVIEW STATUS Version 2

LEAD CONSULTANT: DAB

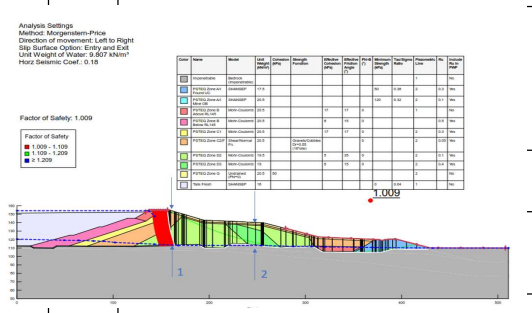
REVIEW STAGE: Resource Consent

LAST REGISTER UPDATE: 10/05/2022

Category Level	Status Level
C1: Critical Issue (to be resolved)	**S1: Resolve before proceeding with next stage of design**
C2: Important Issue (Request change)	**S2: Update during next stage of design**
C3: Discussion Item (Potential change needed)	**S3: Consider during next stage of design**
C4: Note (for consideration - no change needed)	**S4: Closed**

Item No.	Document/Drawing reference	Reviewer Comment	Date	Category level	Designer Response	Date	Reviewer Comment	Date	Status
1	Drawing CI-0541	Sliver of fill on downslope side of road - how will this be compacted?	10/05/2022						
2	Drawing CI-0621	Detail 18 - don't understand the concrete plug in existing soil natural pipes?? Is there an underlying issue with the soil? Also, why is it called filter zone?	10/05/2022						
3	Drawings	Details do not have cross references to plan drawings or other sections, difficult to tell where they are referring to	10/05/2022						
4	Design	Is compatibility between dam zones addressed? Also refer to Report Section 18.0, Point 5.	10/05/2022						
5	Design	What happens to leachate pumps and treatment after closure? No more expected?	10/05/2022						
6	Design	Stability and drainage of TSF1A with tailings being stored against it. Esp at lower levels which could fill drains and embankment may no longer drain. Where is the decant pond in relation to TSF1A? Drains to be extended - do they have sufficient capacity for the additional seepage?	10/05/2022						
7	Report Section 11.8	Refererecend drawing and section numbers are wrong.	10/05/2022						
8	Report Section 11.10	Geotextile beneath the embankment is not accessible for maintenance or replacement. Accept they are assumed to be blocked after closure, but what if they begin to block before closure? Endorse replacing this with granular filter as proposed.	10/05/2022						
9	Report Section 11.12	How has the additonal liner thickness been shown to be minor benefit? Does this reduce resilience for EQ deformation?	10/05/2022						
10	Failure modes assessment	FM1 - Typically filters are included in high PIC dams as defense against internal erosion.	10/05/2022						
11	Report Section 13.2	Please clarify the reference used for embankment seismic shakedown settlement, as it does not appear to be in the document reference list.	10/05/2022						
12	Report Table 9	What about freeboard scenarios for RL 135m and RL 145m or other intermediate crest levels? What are the operating procedures or limits on tailings storage for the partially constructed dam? Noting that the lower crest heights will have lower storage volumes for the 1m freeboard height.	10/05/2022						
13	Report Section 13.5	At what point does the HDPE liner become redundant to the design performance? What is the expected serviceable life of the HDPE liner under both expected and adverse conditions during its service life?	10/05/2022						
14	Report Section 13.9	Confirm that this application does not cover these collection pond dams?	10/05/2022						
15	Report Section 18	Point 5 states that one of the main risks for the embankment is DS stability during construction - appears that stability has only been assessed post-construction?	10/05/2022						
16	Report Appendix B Table B4	Effective strength parameters and pore water pressure applied for undrained materials. Presumambly this is simply for calculating the effective stresses to calculate the shear strengths? If so, please explain in the report.	10/05/2022						
17	Report Appendix B Table B5	No explanation given in the report of how / why the soil parameters have been adjusted for the seismic case. Is it to recognise cyclic softening and/or cyclic degradation from peak to residual? Which methods / references used to downgrade the pareameters?	10/05/2022						

18	Report Section 4.2 and Appendix B Table B3	In Section 4.2 Zone A defined as low permeability zone from mine overburden material. In Appendix B there are three different types of Zone A material, with very different origins and different strengths. Not clear which are be used in the stability analyses. The stability analyses safety factors and displacements will be affected by which one is used.	10/05/2022						
19	Report Section 4.2	Zone E not shown in the drawings	10/05/2022						
20	Drawing WAI-983-080-DWG-CI-0516 Rev C	Undercut of sensitive tuff soils in Paleo Gully proposed to improve the stability. The report needs to clearly state the purpose. The extent and depth of the undercut seams to be indicative on the drawings. No notes are provided on the drawings for the methodology of confirming the depth and extent. Also the report is fairly light on detail. This is a critical part of the stability and settlement strains of the embankment. Section 11.5 indicates undercuts of 20m to 34m? Visually scalling of the drawing cross section indicates the undercut is greater than 20 deep. Has stability and dewatering of the underscut been considered?	10/05/2022						
21	Report	For the seismic evaluation of the embankment is there any further detailed design assessment work planned in support of the building consent application? For eaxmple dynamic time history analyses? Or will it only be based on the simplified Bray and Macedo (2019) method as presented in Appendix B of the report? If the latter, then sesnitivity analyses are recomended as part of the building consent application phase.	10/05/2022						
22	Report Section 6 & 10.1 & Appendix B Secion 6.2	For the 2500-year seismicity, the deaggregation plots in the seimic hazard report show the contribution from the Hikurangi Subduction is slightly larger than the contribution from the Kerepehi Fault at the spectral period of 0.5s and more so at 1.0s. For the 10,000-year seismicity, the deaggregation plots in the seimic hazard report show the contribution from the Hikurangi Subduction becomes very dominant at the spectral periods of 0.5s and 1.0s and the Kerepehi Fault has significantly less contribution. Given the height of the TSF-3, the natural period is expected to be around 0.5s. Therefore, we consider it would be prudent to evaluate the expected embankment deformations for a Hikurangi Subduction event, given that the Mw for such an event will be an order of magnitude larger and that the amount of embankment deformation is sensitive to Mw.	10/05/2022						
23	Report Section 6 & 10.1 & Appendix B Table B12	The use of an average magnitude may be misleading given there are two predominant contributions for spectral accelerations of 0.5s, particulary for the 10,000-year seismicity. Namely the crustal earthquakes (typically Mw = 6) and Hikurangi Subduction (typically Mw 8 to 9). Suggest splitting into two 10,000 year assessments for subsequent stability analyses. First check to assessess the displacements using a 10,000-year crustal event with a lower magnitude and a second check for a larger magnitude Hikurangi Subduction event.	10/05/2022						
24	Appendix B Table B8	Mean magnituide - not relevant at the larger spectral accelerations . Refer to Comment 24	10/05/2022						

25	Appendix B Section B7	Embankment shearwave velocity is based on correlations from flat sites. The values need adustment for an embakment with lower confining stresses. Also the upper bound relationship appears to have been used. This may be unconservative when used as an input into the Bray and Mocedo (2019) stability analyses. A weighted approach for the different methods would be more appropriate.	10/05/2022						
26	Appendix B Sections B8	The embankment amplifation factors are for the PGA (spectral accelerations at T = 0s). However, the Bray and macedo (2019) method needs spectral accelerations. Are the amplication factors appropriate for spectral accerations of T = 0.5s?	10/05/2022						
27	Appendix B Sections B9	Any adjustments to the embankment amplification factors (comment 27) will require the values in Table B14 to be updated	10/05/2022						
28	Appendix B Sections B10	The co-seismic deviatoric shear deformation of the slide mass within the embankment has been estimated using the Bray and Macedo (2019) shallow crustal earthquake prodedure. For the reasons outlined in comments 23 and 24 the Hikurangi subduction zone earthquake makes up a significant portion of the 2500 and 10,000-year sesimicity and hence should be evaluated using the Subduction earthquake proceedure (i.e. need to do both a shallow crustal earthquake evluation as well as a subduction earthquake check	10/05/2022						
29	Appendix B Sections B10	The estimated period of the slide mass appears to be based on the shear wave velocity from the embankment crest (point 1 in the image below). However, the Bray and Macedo (2019) method requires the "average" shear wave velocity of the slide mass. This means that the shear wave velocity is overestimated for the slide mass, particularly for the full height case. The "average" shearwave velocities should be based on the profile at the centroid of the sliding mass (point 2 on the image below).	10/0						
30	Appendix B Table B15	The slide mass velocity column needs to be updated based on comments above. This will increase the Ts and hence the the spectral accelerations will need to be repicked	10/0						
31	Report Section 13.1 Table 8 and Appendix B Tables B6 and B7	OBE and SEE displacement estimates might need to be updated based on the comments above	10/0						
32	Report Appendix B	Comment on validity of perfectly circular slip surfaces vs optimised slip surfaces. Almost all of the stability analyses presented are circular. Consider whether optimisation should be applied and then pick the most realistic and most conservative.	10/05/2022						
33	Report Appendix B	No stability analyses presented for RL 135m and RL 145m or other intermediate crest levels? Based on the drawings, for the intermediate crest levels the downstream slope of the embankment looks steeper and also less keyed in	10/05/2022						

Appendix B Specific technical comments table, August 2025

PROJECT NAME: Oceana Gold (NZ) Limited. Waihi North Project Proposed Tailings Storage Facility (TSF) 3

DESCRIPTION Resource Consent application compliance assessment

REVIEW STATUS Version 2

LEAD CONSULTANT: DAB

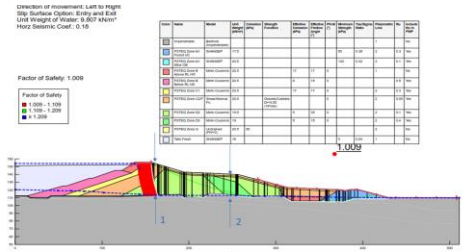
REVIEW STAGE: Resource Consent

LAST REGISTER UPDATE: 8/08/2022

Category Level	Status Level
C1: Critical Issue (to be resolved)	**S1: Resolve before proceeding with next stage of design**
C2: Important Issue (Request change)	**S2: Update during next stage of design**
C3: Discussion Item (Potential change needed)	**S3: Consider during next stage of design**
C4: Note (for consideration - no change needed)	**S4: Closed**

Item No.	Document/Drawing reference	Reviewer Comment	Date	Category level	August 2022 check	August 2025 check	Designer Response	Date	Reviewer Comment	Date	Status
1	Drawing CI-0541	Sliver of fill on downslope side of road - how will this be compacted?	10/05/2022		Drawing not updated	No response yet					
2	Drawing CI-0621	Detail 18 - don't understand the concrete plug in existing soil natural pipes?? Is there an underlying issue with the soil? Also, why is it called filter zone?	10/05/2022		Drawing not updated	No response yet					
3	Drawings	Details do not have cross references to plan drawings or other sections, difficult to tell where they are referring to	10/05/2022		Drawings not updated	No response yet					
4	Design	Is compatibility between dam zones addressed? Also refer to Report Section 18.0, Point 5.	10/05/2022		Not addressed	No response yet					
5	Design	What happens to leachate pumps and treatment after closure? No more expected?	10/05/2022		Not addressed	No response yet					
6	Design	Stability and drainage of TSF1A with tailings being stored against it. Esp at lower levels which could fill drains and embankment may no longer drain. Where is the decant pond in relation to TSF1A? Drains to be extended - do they have sufficient capacity for the additional seepage?	10/05/2022		Not addressed	No response yet					
7	Report Section 11.8	Refererend drawing and section numbers are wrong.	10/05/2022		Not addressed - no drawing 521	No response yet					
8	Report Section 11.10	Geotextile beneath the embankment is not accessible for maintenance or replacement. Accept they are assumed to be blocked after closure, but what if they begin to block before closure? Endorse replacing this with granular filter as proposed.	10/05/2022		No change, but none required	No response yet					
9	Report Section 11.12	How has the additonal liner thickness been shown to be minor benefit? Does this reduce resilience for EQ deformation?	10/05/2022		No change	No response yet					
10	Failure modes assessment	FM1 - Typically filters are included in high PIC dams as defense against internal erosion.	10/05/2022		No change	No response yet					
11	Report Section 13.2	Please clarify the reference used for embankment seismic shakedown settlement, as it does not appear to be in the document reference list.	10/05/2022		No change	No response yet					
12	Report Table 9	What about freeboard scenarios for RL 135m and RL 145m or other intermediate crest levels? What are the operating procedures or limits on tailings storage for the partially constructed dam? Noting that the lower crest heights will have lower storage volumes for the 1m freeboard height.	10/05/2022		Not addressed	No response yet					
13	Report Section 13.5	At what point does the HDPE liner become redundant to the design performance? What is the expected serviceable life of the HDPE liner under both expected and adverse conditions during its service life?	10/05/2022		Not addressed	No response yet					
14	Report Section 13.9	Confirm that this application does not cover these collection pond dams?	10/05/2022		Not addressed	No response yet					
15	Report Section 18	Point 5 states that one of the main risks for the embankment is DS stability during construction - appears that stability has only been assessed post-construction?	10/05/2022		Not addressed	No response yet					
16	Report Appendix B Table B4	Effective strength parameters and pore water pressure applied for undrained materials. Presumambly this is simply for calculating the effective stresses to calculate the shear strengths? If so, please explain in the report.	10/05/2022		Not addressed	No response yet					
17	Report Appendix B Table B5	No explanation given in the report of how / why the soil parameters have been adjusted for the seismic case. Is it to recognise cyclic softening and/or cyclic degradation from peak to residual? Which methods / references used to downgrade the pareameters?	10/05/2022		Not addressed	No response yet					

18	Report Section 4.2 and Appendix B Table B3	In Section 4.2 Zone A defined as low permeability zone from mine overburden material. In Appendix B there are three different types of Zone A material, with very different origins and different strengths. Not clear which are be used in the stability analyses. The stability analyses safety factors and displacements will be affected by which one is used.	10/05/2022		Not addressed	No response yet					
19	Report Section 4.2	Zone E not shown in the drawings	10/05/2022		Not addressed	No response yet					
20	Drawing WAI-983-080-DWG-CI-0516 Rev C	Undercut of sensitive tuff soils in Paleo Gully proposed to improve the stability. The report needs to clearly state the purpose. The extent and depth of the undercut seams to be indicative on the drawings. No notes are provided on the drawings for the methodology of confirming the depth and extent. Also the report is fairly light on detail. This is a critical part of the stability and settlement strains of the embankment. Section 11.5 indicates undercuts of 20m to 34m? Visually scalling of the drawing cross section indicates the undercut is greater than 20 deep. Has stability and dewatering of the underscut been considered?	10/05/2022		Not addressed	No response yet					
21	Report	For the seismic evaluation of the embankment is there any further detailed design assessment work planned in support of the building consent application? For eaxmple dynamic time history analyses? Or will it only be based on the simplified Bray and Macedo (2019) method as presented in Appendix B of the report? If the latter, then sesnitivity analyses are recomended as part of the building consent application phase.	10/05/2022		Not addressed , but no change required at this stage	No response yet					
22	Report Section 6 & 10.1 & Appendix B Secion 6.2	For the 2500-year seismicity, the deaggregation plots in the seimic hazard report show the contribution from the Hikurangi Subduction is slightly larger than the contribution from the Kerepehi Fault at the spectral period of 0.5s and more so at 1.0s. For the 10,000-year seismicity, the deaggregation plots in the seimic hazard report show the contribution from the Hikurangi Subduction becomes very dominant at the spectral periods of 0.5s and 1.0s and the Kerepehi Fault has significantly less contribution. Given the height of the TSF-3, the natural period is expected to be around 0.5s. Therefore, we consider it would be prudent to evaluate the expected embankment deformations for a Hikurangi Subduction event, given that the Mw for such an event will be an order of magnitude larger and that the amount of embankment deformation is sensitive to Mw.	10/05/2022		Not addressed	No response yet					
23	Report Section 6 & 10.1 & Appendix B Table B12	The use of an average magnitude may be misleading given there are two predominant contributions for spectral accelerations of 0.5s, particulary for the 10,000-year seismicity. Namely the crustal earthquakes (typically Mw = 6) and Hikurangi Subduction (typically Mw 8 to 9). Suggest splitting into two 10,000 year assessments for subsequent stability analyses. First check to assessess the displacements using a 10,000-year crustal event with a lower magnitude and a second check for a larger magnitude Hikurangi Subduction event.	10/05/2022		Not addressed	No response yet					
24	Appendix B Table B8	Mean magnituide - not relevant at the larger spectral accelerations . Refer to Comment 24	10/05/2022		Not addressed	No response yet					
25	Appendix B Section B7	Embankment shearwave velocity is based on correlations from flat sites. The values need adustment for an embakment with lower confining stresses. Also the upper bound relationship appears to have been used. This may be unconservative when used as an input into the Bray and Mocedo (2019) stability analyses. A weighted approach for the different methods would be more appropriate.	10/05/2022		Not addressed	No response yet					
26	Appendix B Sections B8	The embankment amplifation factors are for the PGA (spectral accelerations at T = 0s). However, the Bray and macedo (2019) method needs spectral accelerations. Are the amplication factors appropriate for spectral accerations of T = 0.5s?	10/05/2022		Not addressed	No response yet					
27	Appendix B Sections B9	Any adjustments to the embankment amplification factors (comment 27) will require the values in Table B14 to be updated	10/05/2022		Not addressed	No response yet	Analysis Settings Method: Morgenstern-Price Direction of movement: Left to Right				

28	Appendix B Sections B10	The co-seismic deviatoric shear deformation of the slide mass within the embankment has been estimated using the Bray and Macedo (2019) shallow crustal earthquake prodedure. For the reasons outlined in comments 23 and 24 the Hikurangi subduction zone earthquake makes up a significant portion of the 2500 and 10,000-year sesimicity and hence should be evaluated using the Subduction earthquake proceedure (i.e. need to do both a shallow crustal earthquake evluation as well as a subduction earthquake check	10/05/2022		Not addressed	No response yet					
29	Appendix B Sections B10	The estimated period of the slide mass appears to be based on the shear wave velocity from the embankment crest (point 1 in the image below). However, the Bray and Macedo (2019) method requires the "average" shear wave velocity of the slide mass. This means that the shear wave velocity is overestimated for the slide mass, particularly for the full height case. The "average" shearwave velocities should be based on the profile at the centroid of the sliding mass (point 2 on the image below).	10/05/2022		Not addressed	No response yet					
30	Appendix B Table B15	The slide mass velocity column needs to be updated based on comments above. This will increase the Ts and hence the the spectral accelerations will need to be repicked	10/05/2022		Not addressed	No response yet					
31	Report Section 13.1 Table 8 and Appendix B Tables B6 and B7	OBE and SEE displacement estimates might need to be updated based on the comments above	10/05/2022		Not addressed	No response yet					
32	Report Appendix B	Comment on validity of perfectly circular slip surfaces vs optimised slip surfaces. Almost all of the stability analyses presented are circular. Consider whether optimisation should be applied and then pick the most realistic and most conservative.	10/05/2022		Not addressed	No response yet					
33	Report Appendix B	No stability analyses presented for RL 135m and RL 145m or other intermediate crest levels? Based on the drawings, for the intermediate crest levels the downstream slope of the embankment looks steeper and also less keyed in	10/05/2022		Not addressed	No response yet					

PROJECT NAME: Oceana Gold (NZ) Limited. Waihi North Project. Documents B1 to B6, B9, B12 and Consent Documents

DESCRIPTION Substantive Fast Track Application Compliance Assessment

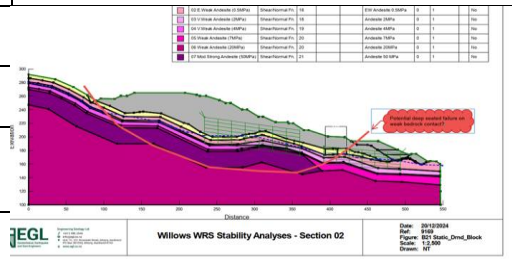
REVIEW STATUS Version 2

LEAD CONSULTANT: DAB

REVIEW STAGE: Resource Consent

LAST REGISTER UPDATE: 13/08/2022

Category Level	Status Level
C1: Critical Issue (to be resolved)	**S1: Resolve before proceeding with next stage of design**
C2: Important Issue (Request change)	**S2: Update during next stage of design**
C3: Discussion Item (Potential change needed)	**S3: Consider during next stage of design**
C4: Note (for consideration - no change needed)	**S4: Closed**

Item No.	Document/Drawing reference	Reviewer Comment	Date	Category level	Designer Response	Date	Reviewer Comment	Date	Status
1	B.01	Update seismic design inputs per NSHM (2022) for detailed design and NZSOLD Dam Safety Guidelines 2024. Recommended condition of consent.	12/08/2025						
2	B.02	How will the 2 m thick liner sub-grade will be placed on the 1.5H:1V slopes.	12/08/2025						
3	B.02	Figure 14 shows 23° slope not 33.7° slope as described in text.	12/08/2025						
4	B.02, Section 3.6	What methods will be deployed to locate near surface voids?	12/08/2025						
5	B.02, Section 4.9	Is 1 m thick NAF cap sufficient?							
6	B.02, Section 5.1.2	How will the assumption of post closure/pumping flows of 50 m3/day to the Ohinemuri River and associated water quality be tested?	12/08/2025						
7	B.02, Section 5.3	Update seismic design inputs per NSHM (2022) for detailed design and NZSOLD Dam Safety Guidelines 2024. Recommended condition of consent.	12/08/2025						
8	B.04	Update seismic design inputs per NSHM (2022) for detailed design and NZSOLD Dam Safety Guidelines 2024. Recommended condition of consent.	12/08/2025						
9	B.04, Appendix B	Tables B3, B4, B5 7 B15 - Same geotechnical input parameters. Why similar but overall lower FoS and higher seismic displacement values? Has there been a change of dam geomety or other design change?	12/08/2025						
10	B.05	Update seismic design inputs per NSHM (2022) for detailed design and NZSOLD Dam Safety Guidelines 2024. Recommended condition of consent.	12/08/2025						
11	B.05	Is the Duncan (2014) fill strength relationship appropriate for some of the proposed waste rock zones? Should effective and total stress parameters for the fill be assigned and modelled also?	12/08/2025						
12	B.05	Fill height staging likely to be key in controlling fill pore water pressures and required dissipation. Will there be limitations on timing and height of fill placement staging?	12/08/2025						
13	B.05	Specification will need to clearly define compaction requirements for the various fill zones to achieve required design strengths and slope stability.	12/08/2025						
14	B.09	Have the computer stability analyses adequately considered global slope stability scenarios in terms potential deep seated landslide movement being induced by the waste rock stack slope surcharge load (see adjacent image)?	12/08/2025						
15	B.09	Is the Duncan (2014) fill strength relationship appropriate for some of the proposed waste rock zones, Should effective and total stress parameters for the fill be assigned and modelled also.	12/08/2025						

16	B.09	Will the fill lifts be compacted? How? What timing and height staging requirements?	12/08/2025						
17	B.09	Update seismic design inputs per NSHM (2022) for detailed design and NZSOLD Dam Safety Guidelines 2024. Recommended condition of consent.	12/08/2025						
18	B.12	Section 11.2. Table 11.1: Are Mohr-Coulomb strength parameters suitably conservative enough. Appear a little high where some materials described as soils (e.g. ignimbrite, volcaniclastic)	12/08/2025						

Appendix C Noted report design changes

- **B.04**
- **B.05**

B.04 Design changes

11.1 Design concepts

The RL155 crest height provides a total storage volume of approximately 8,100,000 m^3.

- Up from 7,000,000 m^3 in previous report.

The length of the new section of the Southern Uphill Diversion Drain is approximately 2500 m.

- Down from 2,950 m in previous report

Section 11.2 Collection Ponds

The total footprint of Storage 3 TSF, including the extent of the stockpile and uphill diversion drain, is approximately 120 ha.

- Up from 115 ha in previous report

11.7 Local borrow areas

New report section, summarised as follows

- Construction Timeline: Storage 3 construction will begin before MOP and GOP.
- Need for Alternative Materials: Alternate sources for starter embankment fill required.
- Borrow Areas Overview: Three local borrow areas designed to supply NAF fill.
- Borrow Area 1 (Central): Located east of East Stockpile; ~260,000 m^3 of fill.
- Borrow Area 2 (Eastern): Northeast of embankment; divided into 2A (400,000 m^3) and 2B (1,250,000 m^3).
- Borrow Area 3 (Western): Within Northern Rock Stack footprint; ~495,000 m^3 of fill.
- Additional Fill Source: East Stockpile depletion to provide ~930,000 m^3 of fill, can be PAF or NAF.
- Excavation Techniques: Drill and blast methods required for material extraction.
- Seamless Sequencing: Borrow area usage and stockpile depletion staged for embankment raising.

11.18 Tailings storage capacity and surface profile

The storage capacity at RL155 is approximately 8,100,000 m^3.

- Up from 7,000,000 m^3 in previous report.

The design flood is the runoff from a 72-hour probable maximum precipitation (PMP) rainfall event. The PMP volume is approximately 840,000 m^3.

- PMP volume up from 618,000 m^3 in previous report.

Section 11.19 Construction aspects

Table 3 includes addition of Local and East borrow volumes. Carried through to Tables 4 and 5.

13.1 Embankment geotechnical stability

Satisfactory factors of safety for the key design cross sections and design cases. OBE and SEE design cases record increased but acceptable slope displacements.

We note lower FoS and higher slope displacement results than those recorded in the Revision 0, dated 08 October 2021. The input parameters are the same. Reason for difference is not explained. Has there been a change in geometry or other assumptions?

13.4 Free board scenarios

Initial estimates indicate that for Storage 3, the top of the tails beach will need to be at least 2.9 m below the minimum crest level and the normal operation water level will need to be 4.1 m below the minimum crest level. This allows for storage of the IDF (from a 72-hour PMP) above the maximum normal water operation level, with 1.0 m of freeboard remaining.

Highlighted numbers previously 2.5 m and 3.5 m.

- Table 9 format unchanged but some values have.
- RL135 and RL145 interim level scenarios not included (per previous T+T review comment).
- Latest freeboard values for RL155 have increased

Section 14 Drawings

Same drawing set

Section 16.1 Dam safety management, general

Additional text in current report

Existing resource consents for Storage 1A and Storage 2 require a Tailings Storage Facility Monitoring Plan (TSFMP). The TSFMP covers monitoring for structural integrity (dam safety) as well as monitoring for groundwater and environmental effects. The structural integrity monitoring in the TSFMP duplicates the monitoring elements included in the OMS Manual.

The Building (Dam Safety) Regulations 2022 took effect from 13 May 2024. They are concerned with the safety of existing dams. They require dam owners to submit a PIC assessment for all large dams to the Regional Authority. The PIC assessment must be certified by a Recognised Engineer. If they classify as Medium or High they will require a Dam Safety Assurance Program (DSAP) that will require certification by a Recognised Engineer. Annual certificates will need to be submitted by a Recognised Engineer that certify compliance with the DSAP. The TSFs at Waihi will comply with the proposed Dam Safety Regulations.

17.5 Building (Dam Safety) regulations 2022 (new report section)

The Building (Dam Safety) Regulations 2022 took effect from 13 May 2024. They are concerned with the safety of existing dams. Storage 3 will need to comply with these regulations once it is commissioned. The regulations do not affect the proposed design or construction.

18 Resource consent – potential risks and mitigation measures

New item related to borrow areas

The construction of the Storage 3 starter embankment will require local borrow areas to source soil and rock. Borrow areas located within the Storage 3 site (1 - Central, 2A, and 2B – Eastern) provide up to 1,910,000 m3 of NAF soil and rock and are shown in Drawings 0511 to 0513. A large proportion of the rock will require drilling and blasting.

Figures

Figures 16 to 20 omitted

Appendix A Drawings

Same drawing set with various updated 2024 and 2025 revision updates (see below)

EGL Engineering Geology Ltd
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info@egl.co.nz
Unit 7C, 331 Rosedale Road, Albany, Auckland
PO Box 301054, Albany, Auckland 0752
www.egl.co.nz
Geotechnical, Earthquake and Dam Engineers

DRAWING REGISTER AND TRANSMITTAL NOTICE
SHEET 1 OF 1

Client: OCEANA GOLD (NEW ZEALAND) LIMITED

Job No. 8983

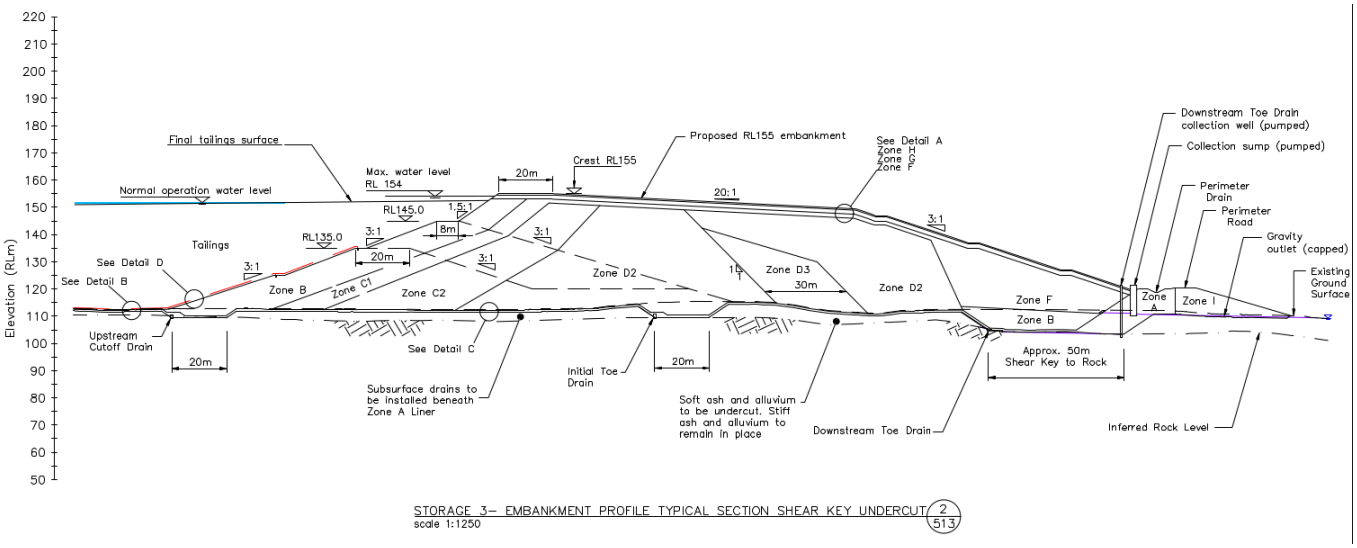
Site/Project: WAIHI NORTH PROJECT-STORAGE 3

DAY	16	19	04	10	17				
MONTH	07	07	10	12	02				
YEAR	21	21	21	24	25				

Drawing No.	Drawing Title	Revision							
WAI-983-080-DWG-CI-0500	Locality Plan and Index - Storage 3 - Tails / Waste Rock 080	C		D					
WAI-983-080-DWG-CI-0101	Site Plan - Waste Disposal Area - Tails / Waste Rock 080	B			C				
WAI-983-080-DWG-CI-0511	Layout Plan - Storage 3 RL135 Embankment - Tails / Waste Rock 080	D			E				
WAI-983-080-DWG-CI-0512	Layout Plan - Storage 3 RL145 Embankment - Tails / Waste Rock 080	D			E				
WAI-983-080-DWG-CI-0513	Layout Plan - Storage 3 RL155 Embankment - Tails / Waste Rock 080	C			D				
WAI-983-080-DWG-CI-0516	Sections - Storage 3 - Tails / Waste Rock 080	C			D				
WAI-983-080-DWG-CI-0517	Sections - Storage 3 - Tails / Waste Rock 080	C	D		E				
WAI-983-080-DWG-CI-0518	Sections - Storage 3 - Tails / Waste Rock 080	C	D		E				
WAI-983-080-DWG-CI-0519	Sections - Storage 3 - Tails / Waste Rock 080	C			D				
WAI-983-080-DWG-CI-0520	Sections - Storage 3 - Tails / Waste Rock 080	C			D				
WAI-983-080-DWG-CI-0541	Sections - Storage 3 Uphill Diversion - Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0556	Sections - Storage 3 Perimeter Bund - Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0608	Sections - Storage 3 Collection Pond - Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0620	Layout Plan - Storage 3 Subsurface Drain - Tails / Waste Rock 080	B			C	D			
WAI-983-080-DWG-CI-0621	Details - Storage 3 Subsurface Drain- Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0622	Details - Storage 3 Subsurface Drain- Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0626	Layout Plan - Storage 3 Leachate Drain - Tails / Waste Rock 080	B			C	D			
WAI-983-080-DWG-CI-0627	Details - Storage 3 Leachate Drain - Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0639	Details - Storage 3 Drainage - Tails / Waste Rock 080	B							
WAI-983-080-DWG-CI-0690	Layout Plan - Storage 3 Closure - Tails / Waste Rock 080			B	C				

Of note

- Downstream construction
- Shear key beneath embankment in vicinity of 'Paleo Gully' feature.
- Zoned construction
- Underdrainage



STORAGE 3– EMBANKMENT PROFILE TYPICAL SECTION SHEAR KEY UNDERCUT (2/513)
scale 1:1250

Appendix B Stability assessment

Tables B3, B4, B5 7 B15 - Same geotechnical input parameters

All satisfactory FoS and seismic slope displacements. Similar but different results with lower FoS and higher seismic displacements

B.05 Design Changes

1 Introduction

This technical report has been prepared for consents under the Fast-track Approvals Act and details a design for the assessment of environmental effects as required

Some of the rock at Waihi is potentially acid forming (PAF) if left exposed to air and water and therefore the NRS will have design and operational features to prevent and to contain any acid drainage. They include earth liners (base and cap), subsurface drainage beneath the liner (subsoil drains), subsurface drains on top of the liner (leachate drains) and the addition of limestone to provide both a geotechnically and geochemically stable landform of earth and rock during operation and closure.

3.1.2 Stockpiling requirements

Updated and summarised as follows:

The Development Site has potential storage for 1.0 million cubic meters (Mm^3) of NAF material and up to 1.5 Mm^3 of PAF material. However, construction has reduced the East Stockpile's capacity. Around 3.6 Mm^3 of material will be used for the construction of Storage 3's embankment, while the total overburden from different sources amounts to 9.3 Mm^3. The backfill materials from MUG and WUG require stockpile management. High mercury NAF or PAF materials will be directed to Storage 3, and the GOP TSF needs 2.5 Mm^3 of backfill. The maximum stockpiling capacity is 7.5 Mm^3, with operations typically using 3 to 5 Mm^3 and closure reducing this to 0.5 to 1.5 Mm^3.

6.0 Seismic hazard

Does not reference the National Seismic Hazard Model (NSHM) was updated in 2022 (Ref. 26)

Table 1: Summary of proposed geotechnical design criteria is unchanged

8.2 Uphill diversion drain sizing

Additional text

At closure the upper reaches of the existing Northern Uphill Diversion Drain will be redirected to Storage 2, which will provide detention and control of flows in the drain.

For sections of the uphill diversion drain that are to be permanent, the drain should be designed to pass a 1 in 100-year flow. This will be able to rely on the detention provided by Storage 2 closure pond.

8.4 Northern rock stack collection pond sizing

Reference to building consent requirement.

The NRS Collection Pond is likely to have a capacity greater than 20,000 m^3 and have a downstream embankment height greater than 4 m high. This will mean that the collection pond will be classified as a large dam under the Building Act and will require a Building Consent. Design, construction, and operation will need to be in accordance with the New Zealand Dam Safety Guidelines (NZDSG) (Ref. 9). A dam breach assessment will need to be undertaken to determine its Potential Impact Classification (PIC). The PIC sets the design criteria under the NZDSG. It is likely the dam will be assessed as a Low PIC dam.

9.8 Northern rock stack collection pond

Reference to building and resource consent requirements

We recommend that a detailed design report, drawings, and specification is prepared for the NRS Collection Pond because it is likely to meet the definition of a large dam in the Building Act and will

need to be designed, constructed and operated in accordance with the NZDSG (Ref. 9). If the dam is a Medium PIC it will need to have a formal dam safety management system and require annual Intermediate Dam Safety Reviews to be undertaken. The Collection Pond requires both resource consent and building consent.

9.10 NRS Local borrow (new report section)

The NRS local borrow provides Storage 3 starter embankment construction material. Its location is shown in Drawing 0715 and 0731. This borrow is within the proposed Northern Rock Stack footprint and will be in rhyolite rock below downslope of the Northern Uphill Diversion Drain. Some of the rock will require drilling and blasting. The cut will be lined with Zone A where PAF rock is placed. The proposed slopes for this additional borrow cut are 1 vertical to 3 horizontal to allow for Zone A lining.

9.11 Construction aspects

Table 2 Northern rock stack undercut volumes now includes additional volume from NRS local borrow (western) = 495,000 m^3

10.1 Stability assessment

Same FoS and slope displacement values for design sections 1 and 2 as previous report.

11 Drawings

Same list

12 Construction management

Unchanged

13 Erosion and sediment control

Unchanged

14 Operation, maintenance and surveillance

Unchanged

15 Consenting requirements

15.1 Northern rock stack – stockpile and infrastructure

Uphill drain sizing

For the sections of the drain which are only required during operation, the uphill diversion drain is sized for a minimum requirement of a 10 year ARI (Average Recurrence Interval) flow, equal to the existing resource consent conditions (RC971307, RC971309, Condition 4).

Added

For sections of the uphill diversion drain that are to be permanent, the drain is designed to pass a 1 in 100-year flow. The design has been discussed in Sections 9.6 and 10.3.

The proposed local borrow of up to 495,000 m3 of soil and rock from the foundation of NRS as shown in Drawing 0715. Some of the rock will require drill and blasting.

Detailed design is required for the NRS as drains and stability considerations require assessment, and drawings and specifications are required for construction. So, while building consent is not required under the Building Act, a peer review of the detailed design is recommended, to be provided by an appropriately qualified independent party. The requirement for detailed design peer review of the stockpile could be a resource consent condition.

16 Summary of potential risks and mitigation measures

Unchanged.

PAF control and slope stability

Shear key at downstream toe. 10 m high 3H:1V slopes

17 Conclusions

Unchanged

Figures

20 figures, unchanged

Appendix A Drawings

Same set with revisions to the following 5 drawings dated 13 December 2024

- 0715 NRS local borrow footprint area added
- 0731 NRS borrow excavation profile
- 0770 NRS local borrow footprint area added
- 0772 NRS local borrow footprint area added
- 0780 Additional of borrow area? Not visible on Drawing

Appendix B Stability analyses

Same as previous report

- No reference to updated NSHM, which will be required for detailed design

Computer output

Modelled combination of effective stress parameters with Ru, and undrained (kPa) strength parameters. Appropriate for modelling short term increased pore water pressures.

The report notes that *The project includes three local borrow areas. Borrow Area 1 (Central) and Borrow Area 2 (Eastern) are located within and adjacent to the footprint of the proposed TSF3. Borrow Area 3 (Western) is located within the footprint of the NRS, downslope of the Northern Uphill Diversion Drain Alignment.*

Borrow Area 3 within the NRS footprint is shown in Drawing 0715. This has 495,000 m^3 of material which is required for the construction of Storage 3 starter embankment.

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21 August 2025

J-NZ0199-005-L-Rev0

Sheryl Roa
Principal Consents Officer
Waikato Regional Council
Private Bag 3038, Waikato Mail Centre
Hamilton, 3240

Waihi North Project: Review of Proposed Conditions – Fast-track Approvals Act 2024

Dear Sheryl,

Mine Waste Management Limited (MWM) was retained by Waikato Regional Council | Te Kaunihera ā Rohe o Waikato (WRC) to the review the proposed Conditions for the Waihi North Project (the Project) that has been lodged by Oceana Gold (New Zealand) Limited (Oceana Gold) as an application under the Fast-track Approvals Act 2024.

This letter provides our subject matter expert (SME) review of geochemistry related matters. The review was completed by Dr Paul Weber, Principal Environmental Geochemist for MWM who is recognised internationally as a SME in the field of acid and metalliferous drainage (AMD).

PREVIOUS ASSESSMENTS

Previously MWM has provided the following reports to the WRC following a detailed review of the documents submitted to assess the potential environmental effects of the Project:

- MWM, 2022. Technical Review for the Waikato Regional Council: Environmental Geochemistry Waihi North Project – OceanaGold (New Zealand) Limited. MWM report J-NZ0199-001-R-Rev0 dated 3 May 2022.
- MWM, 2022. Technical Review for the Waikato Regional Council: Environmental Geochemistry Waihi North Project – OceanaGold (New Zealand) Limited. MWM report J-NZ0199-001-R-Rev0 dated 17 August 2022.
- MWM, 2023. Review: Section 92 Response Review for Waihi North: Environmental Geochemistry. MWM Letter J-NZ0199-003-L-Rev0 dated 16 January 2023.
- MWM, 2025. Review: Section 92 Response Review for Waihi North: Environmental Geochemistry. MWM Letter J-NZ0199-004-L-Rev0 dated 16 January 2025.

Several requests for further information (RFI) were provided. These RFI were provided in a Microsoft Excel Spreadsheet to the applicant, and the matters were discussed between Oceana Gold, its consultants, and Dr Paul Weber. This RFI Spreadsheet was used as the basis for the assessment of the proposed Conditions for the Project.

REVIEW OF CONDITIONS

WRC requested that MWM review draft Conditions to ensure that the key environmental geochemistry risks for the Project were addressed and that suitable management processes were in place. The Conditions reviewed were:

- Waihi North Project - Schedule 1: Proposed Conditions Common to the Hauraki District Council and Waikato Regional Council Resource Consents.
- Waihi North Project - Proposed Conditions for the Waikato Regional Council.

Matters to be Clarified

A number of comments that were of lesser importance were provided as comments back to the WRC. The following matters, that are of higher importance are provided.

AMD Classification

- Clarification is required throughout the Conditions that 'acid rock drainage' (ARD) is not restricted to rocks that generate acidity (e.g., potentially acid forming (PAF)) but can also include rocks that generate neutral metalliferous drainage (NMD) including rocks that are classified as PTEL (potential for trace element leaching – high mercury).
    - ARD should be added to the definitions of the Conditions and further clarification should be provided on what ARD means. For instance: ARD includes acidic drainage from PAF materials and potentially circum-neutral drainage from materials such as those classified as PTEL. Otherwise, AMD should be used and a definition provided that includes the risks associated with ARD and NDM.
    - The document discusses management processes for PAF materials (e.g., capping of PAF material), however PTEL materials should also be managed in a similar manner. Further clarification is required.
- Further work is required to validate the classification criteria for PAF and non-acid forming (NAF) materials. Column leach testing should be undertaken to validate the classification threshold that uses a neutralisation potential ratio (NPR) of 1 (i.e., confirm NAF materials will not generate acidity in the long term). The work program should be certified by the WRC and it should be used to validate/refine the Waste (rock) Classification Protocol.
- Draft Conditions (i.e., SC2.K.5 uses the incorrect NAF classification criteria). It would be more appropriate to state that the NAF materials are classified in accordance with the Waste (rock) Classification Protocol.
- The sampling requirements provided in the draft Waste Classification Protocol are high-level and further explanation is required. The updated sampling criteria can then be certified by the WRC as being appropriate.
- It is recommended that the following documents, not identified in the draft Conditions, should be certified by the WRC:
    - Waste (rock) Classification Protocol.

- Detailed Design Reports (to ensure, where required, that AMD management processes are addressed).

General

- Monitoring is required to confirm that oxygen is excluded from waste rock stacks. This should be a Condition, unless it will be contained within the management plans. Elevated oxygen concentrations should be a trigger for a risk-based review of material management processes.
- The management of nitrogenous compounds, derived from the use of nitrogen-based explosives requires further consideration. There should be a consent condition that addresses the storage and use of nitrogen-based explosives.
- Low permeability layers used to cap PAF materials requires further consideration. It is recommended the design criteria are included in the various management plans.
- Proposed Consent Condition SC5.O.4 and SC6.J.4 state: "*Placement of selected, coarse waste rock as the initial layer on the low-permeability layer of the stockpile footprint to act as a leachate drainage layer*". This will enable oxygen ingress into the facility. This should be avoided to minimise AMD risks.
- A study should be undertaken to assess AMD sludge management options after closure of the TSF and any potential risks to the receiving environment. This study should be completed before closure.

CLOSING REMARKS

Please do not hesitate to contact Paul Weber at +64 3 242 0221 or paul.weber@minewaste.com.au should you wish to discuss our letter in greater detail.

MINE WASTE MANAGEMENT LIMITED

Paul Weber, Ph.D. MAusIMM CP(Env)
Director, Principal Environmental Geochemist

Sheryl Roa

From: Sheryl Roa
Sent: Monday, 18 August 2025 11:57 am
To: John Kyle
Cc: Polly Smith
Subject: Waihi North Project - Paul Webers Comments
Attachments: J-NZ0199-005-L-RevA Expert Geochemistry Review Waihi North Project.pdf

Kia ora John,

Please find attached draft comments on the consent conditions from Paul Weber. In addition to those comments we have the following suggested changes to the consent conditions (apologies for the double up with Paul's letter).

- Paul and I consider that the approach in G7 would also be good for the management of nitrogen based explosives, to stop the leaching of nitrates to ground/surface waters

G7 is:
"Refuelling and lubrication activities must be carried out a distance from any water body, ephemeral water body, or overland flow path, that is sufficient to ensure that any spillage can be contained and not enter surface water."

We suggest the following new conditions to reduce the likelihood of nitrogen based explosives from entering ground and/or surface water:

The storage of nitrogen-based explosives must be at a distance from any water body, ephemeral water body, or overland flow path, that is sufficient to ensure that any spillage can be contained and not enter surface water. Any permanent storage facility for nitrogen-based explosives must prevent any loss of nitrogenous compounds to groundwater.

Within six months of the commencement of this consent the consent holder must develop a management plan that defines the operational processes and performance targets around ANFO storage and spill management, blast management, and nitrate-impacted material management. The plan should define performance monitoring requirements around blasting including components such as misfires, sleep time, explosive loading, partial or incomplete detonation, and auditing of actual consumption against blast design requirements to identify loss due to spillage. This plan must be supplied to the Waikato Regional Council for certification. The plan may be updated by the Consent Holder at any time and if any changes are made then submitted to the Waikato Regional Council for certification.

- We suggest changes to h and i in G14;

  h. Details of sediment control structures that are managing run-off from PAF materials;
  i. Identification of specific sediment disposal practices for ~~any PAF material within these~~ sediment control structures that receive runoff from PAF materials

- We suggest a new requirement to measure for Total Nitrogen in the discharge from the treatment plant and a condition restricting the mass load of nitrogen in the discharge to water consent from the treatment plant.

  "The Consent Holder must measure the Total Nitrogen in the discharge." Or it could be added to Table G18?.

"The annual mass load of nitrogen discharged from the site must not exceed 13 tonnes per year." The 13 tonnes being the current mass load coming from the treatment plant discharge. This is based on the WRC document "Water quality and sources of nitrogen and phosphorus in the Hauraki rivers" dated 2016.

The Company may need to undertake monitoring for nitrogen and have continuous flow monitoring. This will mean understanding when N is high and when it's low to assign a nitrogen concentration to a variable flow rate. For instance, at high flows the concentration might be diluted.

- G18 suggest that the units be added in Table 2 for **Temp (°C)** and **Criteria for Total Ammonia (g/m³)**

- SC1.D.10 –Suggest that a limit for pH is added to Table 1 (e.g., pH 6-9). Given this is within a stream it would seem reasonable.

- SC2.F.7 –Suggest that an advice note be added as follows:

  "Characterisation of in-situ material, other than topsoil and subsoils, should be undertaken prior to the removal of materials to inform management requirements".

- SC2 F11 – suggest the following change:

  " Oxygen traps (goose necks or similar approved technique) ..."

- SC2 F 17 Monitoring – suggest including a condition be added to valid and characterise the assumptions made with respect to oxygen exclusion from the Willows Rock Stack.

  "During construction of the Willows Rock Stack the Consent Holder must install oxygen probes to validate design criteria and confirm that cxygen is excluded beyond 8m of the edge of the Willows Rock Stack"

- SC5.G.6 – Suggest that referencing the WQ is required to make the condition clearer if monitoring indicates the presence of sulfate in the g/w – *"If monitoring indicates the presence of sulfate in the groundwater then monitoring of the groundwater quality down-gradient of any such storage pad must be undertaken and meet the limits specified in G18."*

- C1A – Acronyms we suggest the an acronym be added for AMD Acid and Metaliferous Drainage and that Acid Rock Drainage more correctly refer to Acid Metaliferous Drainage throughout the conditions.

- C1A – RL – is the definition correct? Should it be Relative Level rather than Reduced level?

- C65 d. needs rewording and suggest the following:

  Applying sufficient lime to any area where potentially acid forming material is identified during validation sampling undertaken in accordance with (c) to achieve a Neutralisation Potential Ratio of 1.2 for the upper 0.6 metres of in-situ material prior to rehabilitation of the area;

- C69 suggest that the reference to low permeability is further defined or provide an advice note on this matter further to state that the permeability of this layer requires further studies using a risk based assessment.

- SCF27 – should include surface water in the report ?

- SC2. F28 Peer Review title – please replace with **Technical Review.** Also suggest that b. ii include geochemical issues.

- SC2. J.5 d. – Suggest including the requirement to monitor for EC
- SC2. J12 – Given the data is G18 is based on unfiltered samples – how comparable with the data be?

Sheryl Roa | PRINCIPAL CONSENTS ADVISOR | Regional Consents, Resource Use
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18 August 2025

Sheryl Roa
Principal Consents Advisor
Waikato Regional Council
By email

Dear Sheryl

WAIHI NORTH PROJECT - WHAREKIRAUPONGA MINE DEWATERING ASSESSMENT - TECHNICAL REVIEW OF EFFECTS ON GROUNDWATER AND SURFACE WATERS

1.0 Introduction

This technical review of resource consent applications by Oceana Gold New Zealand Ltd to establish the Wharekirauponga Mine (WUG) has been undertaken to support the Waikato Regional Council assessment for the purposes of the Fast Track Approvals Act 2024.

The review has been focussed on assessing the information provided on the predicted environmental effects of the project on the local water resources in the area of the mine.

The approach used in this review follows the following lines of enquiry:

- how well does the information characterize the existing water resources environment – what uncertainties and gaps remain that are relevant to understanding the potential effects.
- how well does the information predict the potential effects of the proposed mining activities on the water resources.
- are the mitigation measures proposed likely to reduce the residual potential effects to minor.
- how well are the proposed monitoring and contingency measures likely to manage the effects.
- Do the draft Conditions (OGNZL D.04 WRC Conditions - Clean Version - 28 July) enable management of the effects.

The following reports have been reviewed in conducting this assessment:

- FloSolutions 2023a, Wharekirauponga Underground Project, Hydrogeologic Conceptual Site Model, Preliminary Draft for Consultation, 12 December 2024.
- FloSolutions 2023b, Wharekirauponga Underground Project Numerical Groundwater Model, Preliminary Draft for Consultation, 12 December 2024.
- WWLA 2024a, Assessment of Groundwater Effects – Wharekirauponga Deposit, Preliminary Draft for Consultation, 21 November 2024.
- WWLA 2024b, Assessment of Potential Wetland Drainage Effects Wharekirauponga - Edmonds Catchment, Preliminary Draft for Consultation, 24 May 2024.

- WWLA 2024c, Assessment of Groundwater Effects – Tunnel Elements – DRAFT, 2 September 2024.
- WWLA 2024d, Wharekirauponga Downstream Reach Investigations, Draft, 30 August 2024.
- WWLA 2025, Wharekirauponga Shallow and Deep Groundwater Fate, Preliminary Draft for Consultation, 16 January 2025.
- GHD 2024, Wharekirauponga Hydrology (WAI-985- 000-REP-LC-0063), Modelling Report Draft, 2 September 2024.
- Interra 2024, Groundwater Modelling for the OGC Waihi Project: Predictive Uncertainty Quantification, Preliminary Draft for Consultation, September 2024.
- Wharekirauponga Underground Mine, Water Management Plan, March 2025.
- Draft Consent Conditions - D.04 WRC - Underground Activities Conditions – 28 July 2025.

2.0 Characterisation of the Existing Water Resources Environment

The existing hydrogeological environment is primarily described in FloSolutions 2023a. The site conceptual model (CSM) has the objective of drawing the available information together into a cohesive picture of the groundwater system using regional scale and site investigations and interpretations made with data acquired since 1980. Elements of the conceptual model are discussed below.

2.1 Data Sources

Investigations have utilised a wide range of standard investigative tools to enable connection and reinforcement of a range of information outputs to build the conceptual model. Limitations on physical access to areas of the site and limitations to scale of the investigations themselves have constrained the characterisation process and outcomes. Nevertheless, some 149 drillholes and 6,000 m of drilling from 8 drill pads has been completed up to 2023. This information has been supplemented by 30,000 m of surface geophysical survey (CSAMP) which helps to characterise rock porosity, pore fluids, and the presence of certain mineral assemblages. 29 continuous groundwater pressure monitoring points are in operation and 57 tests for ground permeability completed. Five continuous stream flow monitoring stations have been in operation since 2019 and around 50 stream gauging sites have been used for 1 or more separate stream gauging measurements.

The subsurface investigations are clustered around the main gold bearing veins where the mining operations are to be carried out.

Notwithstanding the limitations on access and environmental constraints the level of information gathered from the investigations is considered sufficient to identify and generally characterise the key elements of the CSM for the purposes of assessing effects from the underground proposed mine. However, more investigation and monitoring is required to reduce uncertainties in some of the predictions. For example, at Waihi, there is currently 110 active groundwater monitoring points servicing the underground mining operations; which is more than 3 times the number installed at Wharekirauponga. However, many of the monitoring points at Waihi were installed progressively over the years as mining progressed and opened up new areas to effects.

This adaptive management approach is common for the development of complex underground mines in order that specific refinements to a base monitoring network can be applied to best anticipate the effects of particular mining activities. This also allows for the continual development of the CSM. This approach is limited at WUG due to access constraints for surface drilling of piezometers.

Hydrological and hydrogeological domains

The proposed mine sits in the mid to upper reaches of the 14.5 km^2 Wharekirauponga surface water catchment that drains to the Whangamata Harbour approximately 12 km downstream of the site. Most of the catchment is within forest reserve. The assumption made by the reports is that the groundwater and surface water domains are coincident. Given the potential influence of structural elements (geological faults) this interpretation is reasonable for the upstream and midstream catchment but uncertain in the downstream section where the groundwater discharge zones are not well defined.

2.2 Geology

Critical geological elements of the CSM are:

- the clay altered weathered layer up to 50m thick at the top of the rhyolite tuff and rock domes that host the vein system.
- a silicified zone that infills and surrounds the veins and is exposed in the stream beds in the local area of the mine.

The conceptual model presented suggests that the top layer of the tuff and rhyolite domes that extends throughout the Wharekirauponga catchment was deeply weathered prior to emplacement of the andesite cover materials. In the vicinity of the vein system where drill hole information is available this weathered zone has been hydrothermally altered by the upwelling geothermal fluids which have changed the clay content of the minerals in the weathered zone. Hydraulic tests of this altered material indicates a lowering of its permeability by an order of magnitude resulting in a barrier effect to vertical movement of groundwater, notably groundwater recharge through the rhyolite tuff unit. Geophysical information has been used to estimate the area of extent of the clay alteration to cover most of the of the Wharekirauponga catchment.

This interpretation is considered to be uncertain given the lack of supporting drilling intersection. The reports have addressed this uncertainty by way of numerical groundwater modelling which has improved the confidence but only to a level where general conclusions can be drawn about the scale of effects of the mining. This is discussed further below.

The permeability characteristics of the silicified zone where it is exposed in the stream beds local to the vein systems is poorly understood. No direct measurements have been made of stream bed infiltration or identification of discrete leakage features. Clearly, this is important for assessing the prospects for any stream leakage that might be induced by the proposed mine dewatering activities. A 17 day pumping test was undertaken in July/August 2025 to test the potential interconnection between groundwater in the future mine and surface water in the local streams but the test was compromised in this objective by high rainfall conditions that affected shallow groundwater levels. However, base aquifer parameters were obtained that indicate a reasonably conductive vein system, as expected.

Otherwise, data on the hydraulic properties of the hydrogeological units at the site is limited considering the heterogeneous nature of the fractured rock in the groundwater flow domain. Measured permeability values range by more than 2 orders of magnitude for most units with the key units, the vein systems and the host rock, having overlapping ranges. More detailed examination shows that the zone of overlap is near the vein system, likely representing the transition zone between the veins and the less fractured host rock. Away from the vein system the rock exhibits low fracturing in drill core and low permeability.
No permeability measurements are available for the barrier unit (the clay alteration zone) and it has been assigned a low vale based on visual examination in drill core.

2.3 Water Flows

Groundwater flow paths have been developed using the normal method of interpreting the changes in water levels from drillholes fitted with pressure measurement sensors. In addition, stream low flow measurements (when the stream flow consists predominantly of groundwater) have helped to identify groundwater discharge zones. The spread and density of available data points within the groundwater flow domain is limited and closely bunched which means considerable interpretation has had to be used to develop groundwater level contours. There is no data on groundwater levels away from the vein systems and assumptions have been made to align groundwater flows with topography towards known groundwater sinks.

For example, the shallow groundwater system near the EG vein is defined by just 6 six measurement sites. Ground topography has then been overlain to produce estimated groundwater level contours. This is a commonly used procedure in hydrogeology but does require a good knowledge of changes in the underlying geology and groundwater levels immediately adjacent to the streams. In this case the interpretation presented is considered reasonable.

Interpretation of the flow regime in the vein system as presented is problematic. Currently, no definitive regime has been developed with any certainty in terms of connection to the shallow groundwater system, recharge and discharge zones. Possible regimes have been presented and groundwater modelling has been used to identify scenarios. Interpretation has been provided that the EG vein groundwater system discharges along an extension to the Edmonds Fault at a distal downstream location at the edge of the Wharekirauponga catchment. A 5 l/s spring that has been observed in this location is currently thought to be the expression of this discharge but more field investigation is needed to firm up this interpretation. This is acknowledged in Section 9 of FloSolutions (2023a).

Hydraulic conceptualisation of the warm spring is uncertain – there is an assumption that it is caused by the nexus of the EG Fault and a cross-fault but currently there is little understanding of how the spring is driven to flow and why it appears to be unconnected to the deep system which in that area is at a lower pressure. The consent application acknowledges this spring will be unable to be retained during mining and will be lost.

Water Chemistry

Radon has been used as a tracer to separate old (deep) and young (shallow) groundwater age. While very useful as a tool for this purpose, the results do not help to identify the deep groundwater discharge zones at the bottom of the catchment. This may simply be due to the lower relative groundwater throughflow in the deep system compared to the shallow system which thus overpowers the signature.

Overall Assessment

Characterisation of the deep groundwater system in terms of throughflow quantities and discharge zones is a limitation to locking down a complete conceptual model. Without these fundamental aspects understood the ensuing analysis of effects of the proposed mining activity is limited.

There is also uncertainty about the potential for induced leakage from the streams into the mine once dewatering begins. However, the field detection of currently existing strong vertical groundwater gradients and/or an unsaturated zone above the deep system at heads 20 m to 40 m below stream level suggests that the potential for leakage may be limited. This observation is positive for avoiding reductions in natural stream flows within the WKP catchment.

Potential Effects of Mining Activities

Prediction of the potential effects on the groundwater and surface water resources has been undertaken by 3D numerical groundwater modelling using standard modelling software. Two modelling stages were completed where the initial model undertaken by FloSolutions was further refined by Interra to improve its predictive reliability. However, as acknowledged by both modelling teams the accuracy and representativeness of the CSM described above is fundamental to the reliability of the predictions made by this modelling.

It is stated that mining of the ore body in the EG Vein will occur for approximately 12 years between elevations of 180 mRL down to -300 mRL.

The modelling has been applied in ways to account for elements of the conceptual model where there is a lack of supporting field data. The method involved testing the uncertainties in the hydraulic properties of the key geological units that host the veins: the north and eastern rhyolite domes, the rhyolite tuff and the altered clay zone. However, no uncertainty analysis was done to check the configuration and extent of the geological units within the model; in particular, the extent and continuity of the clay alteration zone, which has been largely deduced from limited drilling information and geophysical interpretation. Some of the uncertainty runs attempted to cover this by increasing its permeability towards that of the overlying units, thereby reducing its influence on groundwater flow patterns. This is considered a reasonable approach but not a substitution for gaining actual field information.

The modelling has focused on predicting the potential reductions to baseflows in the streams within the catchment which are considered to be the prime concern for the effects of the mining on the water resources. Baseflow reductions can arise from drawdown of shallow groundwater that is predicted to extend over an area of some 5 km x 2 km orientated north-south. The downstream drawdowns are predicted to extend to just short of stream monitoring site WKP01.

The results confirm the expectation that there is a material risk for reduction in stream baseflows from the mining, mainly in the area of the mining and downstream reaches. The model predictions are for 3% to 7% reduction in baseflows from sub catchments around the mine and 3% downstream. When uncertainty is accounted for the maximum baseflow reductions rise to 10% to 20% and 7%, respectively. These ranges of baseflow reduction are replicated by the refined groundwater modelling undertaken by Interra and the surface water modelling undertaken by GHD.

A desktop assessment has been produced to provide an indication of the likelihood that any wetlands in the area of mining effect would be fully or partially drained. Reference has been made to the MfE[1] definition of wetlands which is based on an area being inundated or saturated for at least 14 consecutive days during the growing season. 18 wetlands, 9 of which potentially have groundwater inputs were identified within the catchment from topography assessment. As no field information was available as to groundwater levels at these sites, assumptions were made about the potential effect of water table lowering on deep drainage rates as a proxy.

In concept this approach is logical but quite arbitrary and highly unreliable as an assessment of quantum of effects on the wetlands. While the modelling concluded that the wetlands could be supported by rainfall alone, irrespective shallow groundwater lowering, this conclusion can only be taken as indicative at best pending considerably more field work and further analysis.

[1] Ministry for the Environment (MfE), 2021. Wetland delineation hydrology toll for Aotearoa New Zealand. Wellington: Ministry for the Environment.

In relation to effects on other water users in the catchment the reports state that the nearest user is 5 km downstream from the WUG mine and that effects on this and other users will be less than minor. This review agrees with that conclusion.

3.0 Overall Assessment

FloSolutions state the groundwater modelling to be at Class 2 level which according to Barnett et al[2] is defined as applicable for:

- providing estimates of dewatering requirements for mines and excavations and the associated impacts.
- evaluation and management of medium risk impacts.

The reference states that Class 1 level modelling is required to *evaluate high risk impacts*.

Interra prefer to use a more recent reference[3] to assess the model reliability but nevertheless this reviewer considers the degree of reliability of the assessments is appropriately described by the Class 2 definition.

Potential effects on wetlands and riparian vegetation are still not well understood but that should develop through baseline monitoring.

4.0 Proposed Mitigation and Contingency Measures

The WUG Water Management Plan sets out a range of mitigation measures that could be applied to address more than minor effects on stream baseflows and wetlands which would be triggered using a Trigger Action Response Plan (TARP) approach. They range from providing supplementary water to key stream reaches to grouting up the ground above the mine to seal off any leaks connecting the surface waters to the mine. A decision tree is provided that shows what and when the measures would be undertaken. These measures are considered reasonable as they have been applied successfully at other sites.

5.0 Proposed Monitoring

Proposed monitoring is to cover shallow groundwater levels adjacent to the streams above the mine (7 piezometer pairs), stream flows in the immediate vicinity and downstream of the mine (6 sites) and water levels in 7 wetlands. Addition control sites outside the main stem Wharekirauponga catchment are to be established to provide reference information. Mine water inflows will also be measured to compare against model predictions. Trigger and response values are to be assigned to each monitoring point based on baseline monitoring before mining starts.

The monitoring network and approach is considered reasonable at this stage of the project. Changes may need to be made in future as further knowledge of the natural systems is increased during the baseline period.

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[2] Barnett, B., Townley, L. R., Post, V., Evans, R. E., Hunt, R. J., Peeters, L., . . . Boronkay, A. (2012). Australian groundwater modelling guidelines. *Waterlines report*.

[3] Peeters L.J.M., Middlemis H., 2023. Information Guidelines Explanatory Note: Uncertainty analysis for groundwater modelling, A report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of Climate Change, Energy, the Environment and Water, Commonwealth of Australia, 2023.

6.0 Proposed Consent Conditions

The condition set covered in this review is considered to be well structured and comprehensive. It places considerable onus on the consent holder to anticipate and mitigate any effects from the mining. While there are some remaining uncertainties about the CSM as discussed above, the conditions are sufficiently rigorous to ensure that any unexpected effects will be addressed and mitigated in a timely manner.

An Expert Groundwater Management Panel is to be formed (Condition UG.30) to review and provide recommendations to Waikato Regional Council, the Department of Conservation, and the Consent Holder on the adequacy and appropriateness of reports required to be provided by the consent holder.

A meeting was held with the applicant on 15 August to discuss minor amendments to the draft condition set listed above. Once these are completed the underground conditions will be considered appropriate by this reviewer.

7.0 Limitations

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Waikato Regional Council and Oceana Gold New Zealand Ltd. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Waikato Regional Council for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Yours faithfully

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19 August 2025

Sheryl Roa

Principal Advisor – Consents

Waikato Regional Council

Sheryl.Roa@waikatoregion.govt.nz

Re: Comments on Waihi North Fast Track Application and Conditions: Freshwater Ecology

Dear Sheryl

You have asked me to comment on the relevant application documents and draft conditions submitted by Oceana Gold NZ Ltd (OGNZL) in support of their application for the Waihi North project. I have focused on those documents that have been updated since my last review and have briefly perused other water-related documents to assist with my review. I have not repeated the findings of any of my earlier reviews.

In your emails of 28 and 29 July 2025 you posed 2 specific questions/queries which relate to the potential effects of dewatering activities associated with the development and operation of the Waihi Underground mine (WUG) on surface waters. You also provided a review prepared for WRC by PDP (dated 21 March 2023 and updated 18 August 2025) which focussed on assessing the information provided on the predicted environmental effects of the project on the local water resources in the area of the mine.[1] The updated report included comment on proposed conditions.

This report provides a response to those questions. I have also provided comment on the relevant conditions and other application documents as appropriate.

[1] Pattle, A. (2025) Waihi North Project – Wharekirauponga mine dewatering assessment – technical review of effects on groundwater and surface waters. Draft dated 21 March 2025.

Q1. What might be the impact on the reduction in wetted area at critical times within these streams with no mitigation assumed?

Boffa Miskell (BML) (2025)[2] (for the Applicant) undertook an assessment of potential effects of dewatering on surface waters. Their assessment relied on predicted flow statistics derived by GHD (2024)[3], groundwater modelling by Flosolutions (2023)[4], a dewatering effects assessment by WLA (2024)[5] and instream habitat modelling assessments by NIWA (2024)[6]. I note that the BML report does not discuss the low flow trigger levels proposed in the Water Management Plan (see discussion below).

The NIWA (2024) assessment calculated an Area Weighted Suitability (AWS) value, which is the average wetted area of stream per (unit of length) that is suitable for use by an aquatic species or class of species. AWS takes into account the distribution of pool, riffle, and run habitat types within a study reach, as well as the distribution of depth, velocity and substrate within these habitat types, and the preferences (i.e., habitat suitability curves) of each species/class. Total suitable instream habitat (m) for a species/class is calculated by multiplying AWS (m/m) by reach length (m). This report used flow statistics provided by GHD (2024), along with field-derived data from representative stream reaches in tributaries and the main stem of the Wharekirauponga Stream, to calculate predicted changes in habitat availability for a range of taxa under average-case and worse-case scenarios based on the 7-day MALF (Mean Annual Low Flow). NIWA also determined the 7-day MALF that would be required to keep impacts on suitable instream habitat within -5% for all biota groups.

BML compared the predicted 7-day MALF values (from GHD) with the predicted 7-day MALF required to provide no less than 5% of suitable habitat for all biota groups (from NIWA). Of the modelled stream catchments, predicted changes in 7-day MALF values were greatest for Thompson Stream.

BML undertook a similar analysis for wetted width, using predicted wetted widths (from GHD). I could not find a specific criterion that BML employed to determine an acceptable level of reduction in wetted area, although I note that an assessment is still made. For example, predicted changes in wetted area at the Thompson Stream site range between 3.04% and 3.10% and are stated to be *"within acceptable margins of change to instream habitat."* I've assumed BML used the same criterion as for the 7-day MALF i.e. no more than a 5% reduction.

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[2] Boffa Miskell Limited (2025). Wharekirauponga Stream Natural State: Effects of potential flow changes on natural state and aquatic ecology. Report prepared by Boffa Miskell Limited for Oceana Gold NZ Limited.

[3] GHD (2024). Wharekirauponga Hydrology: Modelling Report. Report prepared for Oceana Gold NZ Limited by GHD, 19 June 2024. (I note an updated version of this report dated 27 January 2025).

[4] Flosolutions (2024). FY2023 Hydrogeology Support for WUG. Numerical Groundwater Model.

[5] WWLA (2024). Waihi North Project – Wharekirauponga Mine Dewatering Studies - Summary of Effects on Groundwater and Surface Waters. Draft letter dated 2 September 2024.

[6] NIWA (2024). Instream Habitat of the Wharekirauponga Stream and Tributaries. Report prepared for Oceana Gold Limited, August 2024. (I note an updated version of this report dated 9 September 2024).

On this basis, the reduction in wetted width at all sites would be considered unlikely to result in significant adverse effects (as the maximum predicted reduction in wetted width was 3.10% for Thompson Stream). BML has not proposed any mitigations (as they consider all effects to be less than minor) but has proposed to continue monitoring of watercourses within the Wharekirauponga Stream, with the purpose being to confirm the outcomes of this assessment and that there are no effects on the natural state and ecological values.

It could be argued therefore that, without any proposed mitigation, effects would be no more than minor. However, the above assessments of effects are highly reliant on the predictions regarding the effects of dewatering on the shallow aquifer and the understanding of the extent and significance of connections between the shallow aquifer and surface water bodies. The PDP (2025) review of the information used to derive this information is therefore relevant to the above assessment. Any uncertainties identified in that review inherently create uncertainties in the outcomes of assessments that utilise that information. In their updated review, PDP (2025) concludes "*While there are some remaining uncertainties about the CSM [Site Conceptual Model] as discussed above, the conditions are sufficiently rigorous to ensure that any unexpected effects will be addressed and mitigated in a timely manner.*" This provides me with a degree of comfort that the effects are likely to be no more than minor, subject to the strict adherence to conditions and the adoption of an adaptive management approach.

Q2. What is you view on the proposal to supplement water into the waterways if the underground alert and respond levels occur. i.e. if these are triggered then the company proposes 3 potential responses – grouting, reinjection or supplementing the flow of the stream.

The Applicant has prepared a Water Management Plan[7], which includes measures to address potential effects of dewatering of WUG on surface waters (as well as monitoring and triggers for response aimed at mitigating inflows to the WUG and changes in groundwater level/pressure). Monitoring of surface water flows at 4 locations within the Wharekirauponga catchment and at 4 control sites is proposed. Monitoring data is to be recorded at 15 minute intervals and collected via a telemetered system. Stream Low Flow Trigger Levels have been set for each location (as m^3/day), below which actions are required. There are two Stream Flow Triggers proposed: Alert Trigger Levels and Respond Trigger Levels.[8]

a) Alert Trigger Levels – based on the calculated 7-day MALF for specific locations within the Wharekirauponga catchment and indicative of low flows. The tigger value signifies a defined low flow period, which presumably is 7-days (although this is not specified

[7] Lane, M. (2025) Wharekirauponga Underground Mine Water Management Plan, March 2025.
[8] Although not referenced in Lane (2025), the derivation of the trigger values is included in GHD (2025) report.

in the GHD report). If monitoring indicates flows equal to or less than these levels, investigation is required to determine whether measuring inaccuracy or potential climatic drivers explain the flow reduction. If the low flow event cannot be attributed to these factors, then it is assumed that mine dewatering has caused the event (subject to confirmation). WRC and DOC are then to be notified within 5 days and appropriate mitigation measure(s) are to be developed and presented to WRC and DOC within 40 working days of the low flow even occurring.

b) Respond Trigger Levels – indicative of flows that are lower than expected flows and which signify a potential departure from known trends, thereby triggering a response. This trigger level incorporates a rolling average rainfall from the preceding 30 days and is based on simulations of flow/rainfall relationships. A flow less than the trigger level may indicate a loss of water due to mine dewatering that necessitates immediate investigation and implementation of a mitigation response. A report must be prepared by a suitably qualified and experienced professional and provided to WRC and DOC no later than 40 workings days after the low flow event. The report must set out the investigations undertaken, the data reviewed, an explanation of the triggering event, and recommendations for implementing mitigation required to address any loss of stream flow. Any mitigation must be developed and presented to DOC and WRC within 40 working days and then implemented as soon as practicable once approved.

Comment: This means it would be at least 80 working days before any mitigation is put in place. What happens in the interim? Also, I note that the Respond Trigger Level is defined (in WRC Condition UG.7 as the "bottom line compliance limit the activities must be managed to achieve". Given that the Respond Trigger Level is indicative of a "potential departure from known trends" I question whether this is sufficiently protective.

Mitigation actions are proposed to be implemented only if a confirmed link between dewatering and a measurable impact on shallow water that, if not mitigated, would likely lead to a material reduction in stream flow. Mitigations proposed include:

- Supplementary water (only during low flow periods)
    - Local borehole pumping – use existing boreholes near the affected stream to supplement low flows.

      Comment: This is reliant on a good understanding of groundwater/surface water connections to ensure no reduction in flows elsewhere in the network. Any uncertainties in this understanding represents a potential risk of adverse effects on the water quality or ecology of the receiving waterbodies.
    - Mine-intercepted groundwater, which may need treatment prior to discharge.

Earlier studies [9] showed differences between surface and groundwater quality, including that groundwater quality data showed a significant variance in composition between sampling locations compared to surface water data and that groundwater quality data is generally elevated in iron, manganese, copper and zinc relative to surface water data

Comment: No details of the treatment required to ensure minimal effects on water quality or ecology of the receiving waterbodies is provided.

- Grouting – which involves sealing cracks and fissures through which shallow groundwater reports to the mine to create a low permeability blanket. This can be undertaken pre- and post-development.

- Reinjection – capture groundwater inflowing to the underground mine and reinject back into selected locations of an affected overlying aquifer. The viability and effectiveness of reinjection would need to be confirmed prior to being implemented.

Comment: I am aware of examples where augmentation of base flows using groundwater derived from dewatering activities has been proposed (e.g. Taharoa Sand Mine, which is a surface mine). However, the WMP offers little detail as to how these mitigations are to be implemented, nor has an assessment of the potential effects of these mitigations appear to have been presented in the relevant reports or in evidence (which I would expect to see required as a conditions of consent). I therefore do not consider there is sufficient information as yet to determine if such mitigations are appropriate, practical or will achieve the anticipated outcomes without adverse effects. I understand that any such mitigations are likely to be subject to a separate resource consent process, where such information would need to be obtained.

WRC conditions UG.15 to UG.18 address the potential recharge for mitigation purposes of effects on Natural State Water Bodies and wetlands using groundwater. UG.17 specifies a limited range of water quality parameters to be analysed. Given the measured differences in quality of groundwater and surface water previously discussed, I would recommend analysing for the full suite measured in the Mitchell Daysh Pump Test application, along with analysis of the intended receiving environment quality.

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[9] Mitchell Daysh (2023) Pumping Test – Wharekirauponga Catchment Resource Consent Application Part B Assessment of Effects. 4 December 2023. At [2.2].

Comments on other reports

Document A. 10: Part A – Waihi North Project – Substantive Application – Report Management and Monitoring

Table 7-1 Summary of Key Management and Monitoring Measures for the WNP

Under the section "Wetland and Freshwater Ecology" it states:

"Implementation of an Instream Work Aquatic Ecology Management Plan (part of the ELMP-WA, provided in Part H) which outlines how the above will be implemented, monitored and maintained to deliver the biodiversity offset proposed."

Comment: I can't find any reference to the *Instream Work Aquatic Ecology Management Plan* in the ELMP or in any condition set.

BML (2024) Freshwater Ecology report

BML (2024) states *"there is merit in specific review of the monitoring data for Thompson Stream to confirm the underlying low permeability layer and the effect that has on predicted stream flows and ecological values."*

Comment: I note that this review is not currently included as a condition of consent or as an action within the proposed Ecological and Landscape Management Plan. I propose that such a condition be added to the condition suite.

Comments on Proposed Conditions for the Waikato Regional Council

General conditions which apply to all Waikato Regional Council Consents

Condition G18 With respect to the proposed receiving environment standard for manganese of 2.0 g/m^3, I refer you to my recent memo on this matter[10]. In that memo I noted that, based on OGNZL's annual monitoring of receiving environment sites in the Ohinemuri River, a maximum of 0.073 mg/l was recorded across all sites between 2020 and 2024, which is 27-fold below the current limit for the Ohinemuri of 2.0 mg/l. I note that Boffa Miskell present historical ranges for a range of parameters in the Freshwater Ecology report (e.g. Table 24 and Table 36), with historical maxima for some parameters being much lower than the consent limits. In my view, this represents an opportunity to review the appropriateness of the discharge consent limits for the Ohinemuri River.

I also consider it would be helpful to specify that these receiving environment standards relate to the Ohinemuri River and tributaries. This would be particularly important given the

[10] Phillips, N (2025) Change to Manganese Limit. Letter report to Sheryl Roa, 8 May 2025. Streamlined Environmental.

Applicant's proposal to potentially supplement low flows in the Wharekirauponga catchment with groundwater. I note WRC Condition SC1.D.11 specifies limits for some parameters in groundwater used for recharge and WRC Condition SC1.D.10 specifies receiving environment limits for Wharekirauponga Stream after reasonable mixing).

Condition G19 references the ELMP referred to in Condition C4. However, that condition is included in the Combined HDC and WRC condition set and should probably be referenced.

Condition G20 states "*Stream diversion and enhancement measures must be consistent with Type 1, Type 2 or Type 3 diversions shown in the ELMP*", however there are no details of the diversions in the ELMP and no reference to diversion types. Rather, these details are included in the **Draft Stream Diversion and Development Plan** (dated 26 February 2025) (which is Appendix 14 to the Freshwater Ecological Assessment report). I would recommend that this Plan be specially referred to in the condition and included as a section of the ELMP.

I also note that the Freshwater Ecological Assessment report includes as Appendix 15 a **Draft Stream Enhancement Riparian Planting Plan**. I could not find reference to this plan in the condition set and neither is it included in the ELMP. I note it is referred to on several occasions within the Substantive Application Report. I would recommend that this Plan be specially referred to in the condition and included as a section of the ELMP.

Condition G23 relates to undertaking early works where early ecological benefits can be obtained and states "*Those early works must be implemented no later than the planting season that precedes the diversion work being commenced, as far as is practicable.*" Given the acknowledged time lag before stream ecological benefits are likely to be achieved for diverted streams, I would expect planting associated with diversions to have been completed earlier than the season immediately prior to the diversion work commencing.

Conditions 29 – 32 refers to a **Waihi Area Water Quality Management Plan**. I am unable to find this plan amongst the list of documents on the Fast Track website, in the Substantive Application or relevant technical reports. Therefore, I cannot comment on these conditions.

Underground activities in Areas 1, 2, 3 and 5.

Condition UG.7 – UG.10 Refer to my discussion above regarding Flow Trigger Values.

Condition UG.19 (c) I note there is no requirement to assess potential effects of any proposed grouting (and no further details in the Wharekirauponga Underground Mine Water Management Plan of how this would be achieved).

Condition UG.29 How does the timing of adjusting the timing of Compliance Trigger Levels relate to the reporting requirements in Conditions UG.25 to UG.28?

Condition UG.33 It may be helpful to also include an aquatic ecologist on this Panel (noting in **Condition UG.36** that the Panel may co-opt other specialist members).

Area specific conditions – I note in the comments section of various consents that reference is made to "fish salvage and relocation". This should be "aquatic fauna salvage and relocation" as per the Aquatic Fauna Salvage and Relocation Plan in the ELMP

Comments on Proposed Conditions for the combined Hauraki District Council and Waikato Regional Council

Condition C11 As stated in Condition G20, there are additional management plans presented in the Freshwater Ecology Report that I consider should be included in the ELMP.

Condition G17 I assume that the Cultural Practices Plan is intended to assist the Applicant to undertake activities in a culturally appropriate manner? How will relevant elements of the Cultural Practices Plan be reflected in ELMP E.g. protocol(s) for handling of indigenous flora and fauna? Perhaps link to Condition C11 and also to the conditions under Cultural Awareness Programme (Condition C19)?

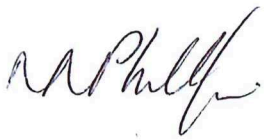
Conditions C47A and C47B As stated in Condition G20, there are additional management plans presented in the Freshwater Ecology Report that I consider should be included in the ELMP.

Overall conclusion

I consider that there remain some uncertainties regarding the potential magnitude and extent of effects on surface flows arising from the uncertainties in the models on which the effects assessment has been based. However, I consider any unexpected effects are likely to be appropriately addressed through the proposed baseline and ongoing monitoring, and the proposed adaptive management approach.

I trust the above is useful. I'd be happy to discuss any of the above matters with you further if necessary.

Yours sincerely



Dr Ngaire Phillips

Director/Aquatic Ecology & Ecotoxicology Specialist

27 Grey St
Cambridge 3434
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Papawera geological consulting

22 August 2025

Sheryl Roa
Principle Advisor Consents
Waikato Regional Council

Dear Sheryl

Re: Waihi North Project & Wharekirauponga Mine Dewatering Assessment - Technical Review of Effects on Natural Inland Wetlands and Significant Areas of Wetland

This technical review of resource consent applications by Oceana Gold New Zealand Ltd to establish the Wharekirauponga Mine (WKP) has been undertaken to support the Waikato Regional Council assessment for the purposes of the Fast Track Approvals Act 2024.

Previous letters I have sent you (7 March 2022, 27 November 2024) report in detail on my findings from site visits to the Mataura, Gladstone and Favona wetlands (each viewed from a distance), and TB1 Wetland (brief walk through 23 Feb 2022). I have not visited the Whaerekirauponga wetlands.

I have read and considered the information contained within a suite of application documents listed in Appendix 1 and *Waihi North Project - proposed conditions for the Waikato Regional Council.*

1. Summary points

1. I recommended a suite of amendments to the proposed WRC conditions for the wetlands above the Wharekirauponga underground mine and Mataura Wetland, as outlined in Table 1.

2. I consider that;

    - the Mataura, Gladstone and Favona wetlands meet the definition of Natural Inland Wetlands (NIW) in the National Policy Statement-Freshwater Management 2020 (NPSFM) and the criteria for significance in the Waikato Regional Policy Statement. None of these wetlands will be directly adversely affected by the proposal but may be affected by reduced water inflow and increased sediment input. Enhancement of the Mataura wetland has been offered by the applicant.

- the TB1 wetland meets Waikato Regional Policy Statement criteria and is therefore subject to drainage Rule 3.7.4.7 in the Waikato Regional Plan if drains are constructed within in.

- the TB1 wetland appears to encompass sections of gully tributaries that early air photographs (1975, 1991, 1999) indicate were, at least in part, formerly wetlands, and therefore potentially represent restoration of a former natural inland wetland, subject to discretionary activity s45D of the National Environmental Standards 2020.

3. I recommend a new condition be added to address the loss of approximately 0.6 ha of wetlands in TB1. This should require compensatory wetland creation to a similar standard. Wetlands can be established very quickly, and there are several locations where this can be undertaken within the project area, e.g. along the Service Trench route, or within the highly degraded wetland east of the proposed Collection Pond to eventually link up with the proposed wetland planned for the Collection Pond at the end of its life.

2. Recommended Amendments to Proposed Conditions

Table 1 presents a set of recommended amendments to the proposed WRC conditions. All proposed changes are in red font. Underlines are suggested inclusions, strikeouts suggested deletions, italics suggested amendments. Explanatory comments are provided in column 3. Note that in addition to these proposed amendments I recommend adding an offset condition to provide for loss of wetlands in Tributary 1 and TBS1 above the Northern Rock Stack.

More detailed justification is provided in the following sections of this letter.

Table 1: Recommended amendments with justification to the proposed WRC conditions (D.04 WRC conditions clean version - 28 July).

	Condition as per WAIHI NORTH PROJECT - PROPOSED CONDITIONS FOR THE WAIKATO REGIONAL COUNCIL	**Justification/ Explanatory notes from Karen Denyer**
	Baseline Data Collection Ahead of Mining Activities	
UG.6	The Consent Holder must undertake two years of baseline data collection prior to the commencement of mining activities at the Wharekirauponga Underground Mine. The purpose of the baseline data collection is to confirm key hydrological and hydrogeological statistics (including seasonal variations where appropriate) of the hydrological and hydrogeological systems in the Wharekirauponga Catchment in such a way as to enable actual and potential material changes to those systems as a result of activities authorised by this consent to be identified through monitoring and addressed through management responses by the Consent Holder.	Bioresearchers recommend monitoring vegetation, including wetland Dominance and Prevalence scores in the WUG wetlands. I support that and suggest adding swamp maire health assessments, given this is a threatened species and it is a good early indicator of change in wetland hydrology. The purpose is to determine what effects, if any,

	The baseline data collection should include ecological condition of the wetlands listed in Table UG.13.T plus Adams 9 and 10 wetlands, as outlined in Condition UG.10. The baseline data collection must be undertaken in accordance with the Wharekirauponga Underground Mine Water Management Plan referred to in Condition C4.	changes in hydrology have on the wetland ecological values to ensure adequate mitigation if remedial works are unsuccessful. This should include vegetation plots, an assessment of Prevalence and Dominance scores, and indicator foliage of swamp maire (where present) – I propose adding them to UG.10.
	Compliance Limits – Natural State Waterbodies and Natural Inland Wetlands Potentially Affected by Mining Activities	
UG.7	Other than for flows associated with the re-emergence of the warm spring located nominally at NZTM E1850258, N5868719, the mining activities authorised by this consent must not cause the natural flows of any surface water body identified as a Natural State Water Body in the Waikato Regional Plan or a natural inland wetland as defined in the National Policy Statement for Freshwater Management and identified as being potentially affected by mining activities in the Wharekirauponga Hydrology Modelling report prepared by GHD Limited to fall below the relevant Respond Trigger Levels set out in Condition UG.10. and Condition UG.13.	Notes to this condition states that: *This is the bottom line compliance limit the activities must be managed to achieve.* The natural state water bodies do not include any wetlands (only the waterways that border Kopuatai). Therefore any conditions limited to NS waterways will not apply to natural inland wetlands or significant wetlands under the WRPS.
	Natural State Water Bodies and Natural Inland Wetlands	It may be less confusing to bundle NSWBs and NIWs together. Splitting them, and cross referencing across the two, sets up potential loopholes.
UG.8	To ensure compliance with Condition UG.7, and in accordance with the Wharekirauponga Underground Mine Water Management Plan referred to in Condition C4, the Consent Holder must implement a monitoring programme which is capable of identifying when any reductions in the natural flows of Natural State Water Bodies or natural inland wetlands are occurring as a result of the mining activities authorised by this consent. As a minimum the monitoring programme must: a. Measure and record the daily volume of water pumped from the underground mine; b. Provide data on the dewatering effects on groundwater at different levels (shallow and deep) in the vicinity of the Wharekirauponga Underground Mine;	As noted above, this condition should specifically refer to natural inland wetlands, because NSWBs do not include wetlands. Clause d should also refer to UG.12 which is where the monitored wetlands and control sites are listed. Otherwise this condition sets up a loophole - UG.8d says monitor wetland water levels as per UG.9 but

	c. Measure and record daily rainfall data specific to the catchments above the Wharekirauponga Underground Mine; and d. Provide data on the stream flow of Natural State Water Bodies and water levels within Natural Inland Wetlands above and in the vicinity of the Wharekirauponga Underground Mine, and at control sites in similar nearby catchments that will not be affected by mining activities, as set out in Condition UG.9. and UG.12.	UG.9 as written does not include any wetlands. Further, the WUMWM Plan includes trigger levels for wetlands which I consider should, for clarity, be included in the conditions. I recommend they be added to UG.12 or inserted as a new condition.
UG.11	In circumstances where a Respond Trigger Level has not been exceeded, but investigations undertaken in response to an Alert Trigger level required by Condition UG.14 demonstrate that mining activities are giving rise to unanticipated effects on flows within the Natural State Water Bodies identified in Table UG.10.T, or Natural Inland wetlands identified in Table UG13.T, the Consent Holder must commission a suitably qualified and experienced professional approved by the Waikato Regional Council to investigate. If the investigation finds it to be necessary, the Consent Holder must implement mitigation measures in accordance with the Wharekirauponga Underground Mine Water Management Plan, and as detailed in the Trigger Action Response specified in Condition UG.19(b).	
	~~**Natural Inland Wetlands**~~	Suggest bundle NSWBs and NIWs together as their conditions intertwine
UG.12	In accordance with the Wharekirauponga Underground Mine Water Management Plan referred to in Condition C4 the Consent Holder must develop and implement a wetland monitoring programme which is capable of identifying when any reductions in the natural water levels of Natural Inland Wetlands occur as a result of the mining activities authorised by this consent, and any consequential adverse ecological impacts. As a minimum the monitoring programme must include the monitoring methods specified in Condition UG.8, and: • Measure and record the natural water levels in Natural Inland Wetlands that are potentially affected by mining activities and at a wetland control site in a similar nearby catchment that will not be affected by mining activities (as per Condition UG.13); and • Measure and record (through visual inspection) characteristics associated with natural water levels in Natural Inland Wetlands that are potentially affected by mining activities (as per Condition UG.13). These to include: o Signs of composition shifts towards dryland plant species measured using national wetland delineation protocols for Dominance and Prevalence from representative vegetation plots within each wetland listed in UG.13.T.	The term "*characteristics associated with natural water levels*" would benefit from specific examples to clarify what is intended by this condition. Bioresearchers included some good recommendations regarding wetland monitoring that I propose are included in UG 12. I would also recommend adding reference to visual monitoring of swamp maire foliage, as it is a good indicator of change in hydrology, being very sensitive to drought with visual change in foliage.

<table>
<tr>
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Visual sign of swamp maire foliage desiccation recorded via photo points and a % desiccated foliage score for selected trees.
Increase in % cover of invasive non-native Facultative, Facultative Upland or Upland plant species, including pampas and blackberry.

Compare the monitored wetland levels required against the Alert Trigger Levels identified in the Wharekirauponga Underground Mine Water Management Plan, and activate Condition UG.14 when:
1. The groundwater level of the piezometer adjacent to a wetland drops to a level below the base of the wetland; and
2. The wetland water level drops below the lowest level previously recorded in the baseline monitoring database for that wetland.

</td>
<td>Trigger conditions for wetlands are included in the WUMWM Plan and for clarity, should be included in the conditions (as they are for streams) to ensure changes in wetland levels will trigger an alert even if the stream monitoring does not.</td>
</tr>
<tr>
<td>UG.13</td>
<td>
The monitoring programme required by Condition UG.12 must be implemented at the locations listed in Table UG.13.T below.
Table UG.13.T: Monitoring Locations
<table>
<tr><th>Natural Inland Wetland</th><th>Map Reference NZTM2000 (Approximate)</th></tr>
<tr><td>Edmonds 16</td><td>1849962, 5867471</td></tr>
<tr><td>Edmonds 17</td><td>1849822, 5867407</td></tr>
<tr><td>Edmonds 18</td><td>1849887, 5867447</td></tr>
<tr><td>Edmonds 20</td><td>1849779, 5867359</td></tr>
<tr><td>Edmonds 22</td><td>1849708, 5867243</td></tr>
<tr><td>Adams 3</td><td>1850260, 5869204</td></tr>
<tr><td>Adams 4</td><td>1850028, 5869249</td></tr>
<tr><td>Waiharakeke (Control Site)</td><td><s>1848909, 5864926</s> replace with a location within a wetland of similar size/structure/composition/ ecological setting and hydrology to the affected wetlands</td></tr>
</table>
</td>
<td>Adams 9 and 10 were proposed to be monitored in the Wharekirauponga Underground Mine Water Management Plan, however OG confirmed via email that further investigation indicated these sites will not be affected. Given the uncertainty I suggest that they be included in a proposed condition to monitor ecological condition of potentially affected wetlands in the event that any dewatering is unable to be adequately remedied.
Based on the maps I am unable to determine if the Waiharakeke site is a wetland, but it would appear not to be. The control must be in a wetland site comparable to potentially affected wetlands. </td>
</tr>
<tr>
<td>UG.14</td>
<td>
If the Alert Trigger Level in Condition UG.10 has been reached at any of the Table UG.10.T Natural State Water Bodies, or if an Alert Trigger Level in Condition UG.12 has been reached at any of the Table UG 13.T Natural Inland Wetlands, the Consent Holder must:

Check and verify the water level monitoring data and groundwater level data from piezometers within and near to the Natural Inland Wetland sites listed in U.13.T for the period leading up to the trigger event for accuracy and inconsistencies;
Check and verify the water level monitoring data at the identified Natural Inland Wetland control site, or at similar suitable locations, for evidence of similar or trending water level patterns and / or alignment

</td>
<td>Triggers should apply to monitored wetlands as well as streams, in event of de-watering of wetlands that are not directly hydrologically linked to streams. The WUMWM Plan includes wetland level triggers.
As recommended by Bioresearchers ecological condition should also be monitored. There will likely be a </td>
</tr>
</table>

	with the expected rainfall / water level trends, and potential climatic drivers of the observed data; • Undertake a physical inspection of the listed Natural Inland Wetlands potentially affected by mining activities to assess the water level of those wetlands and the in the adjacent groundwater; and • Remeasure wetland ecological baselines (at a minimum vegetation plots and foliage condition of swamp maire) to determine the extent of any adverse ecological impact. Time of remeasurement should account for any anticipated lags between dewatering and ecological response. • Include a summary report of the Alert Trigger Level occurrences, in the report required by Condition UG.26. If the Respond Trigger Level in Condition UG.10 has been reached at any of the Table UG.10.T Natural State Water Bodies, the Consent Holder must assess the water levels both within and adjacent to the wetlands to determine whether any changes, or differences of water level within any pair of monitors, indicate a potential dewatering effect. If changes beyond the expected natural variation are found, the Consent Holder must commission a suitably qualified and experienced professional approved by the Waikato Regional Council to investigate the matter, and prepare a report as set out in Condition UG.27. If the investigation finds it to be necessary, the Consent Holder must implement appropriate mitigation measures in accordance with the Wharekirauponga Underground Mine Water Management Plan, and as detailed in the Trigger Action Response Plan (as per Condition UG.19(b)).	time lag between onset of dewatering and change in ecological condition, but swamp maire are very sensitive to water level changes/ drought and their leaves shrivel up very quickly.
UG.18	Discharge of groundwater for mitigation purposes must not occur unless the groundwater analysis undertaken pursuant to Condition UG.17 demonstrates that the discharge will comply with Condition UG.16. In the event that the mitigation actions outlined in Condition UG.14 fail to recharge any of the natural wetlands listed in UG.13.T, and in the opinion of a suitably qualified ecologist, approved by the WRC, that the wetland values, including the health of swamp maire (*Syzygium maire*) are likely to be irreparably degraded, an offsetting or compensation package should be developed to ensure the project results in no net loss of wetland habitat, wetland ecological value, or the local population of swamp maire.	The conditions as proposed do not include a consequential action should remedial actions fail to protect the values of natural inland wetlands. Bioresearchers recommend, and OG propose (pg 448 Part A - Waihi North Project – Substantive Application): "*If these measures are unsuccessful, inadequate or otherwise unable to be undertaken, an offsetting or compensation package will be developed to address any residual effects and ensure that the project results in no net loss of wetland habitat or wetland ecological value.*" If this is covered by a condition further into the set of conditions a cross-reference would suffice. However, note recommendation for specific

		reference to swamp maire, being a threatened species that is highly vulnerable to reduced water levels in wetlands.
SC2.F.29	Prior to any ~~disturbance or reclamation of the Mataura Wetland authorised by this consent the Consent Holder:must undertake baseline monitoring of the Mataura Wetland vegetation and confirm the hydrological conditions that sustain this vegetation.~~ *work that may affect flows that sustain the Mataura Wetland authorised by this consent, the Consent Holder must prepare a Mataura Wetland Restoration and Monitoring Plan (MWMRP) for certification by the Waikato Regional Council. This plan must include:* *a. Baseline description of the existing Mataura Wetland vegetation, and confirmation of the hydrological conditions that sustain its ecological values and the expected restored state.* *b. A map delineating the extent of the Mataura Wetland including any buffer area proposed* *c. A proposed monitoring and a reporting framework, including the results of the monitoring and any remedial works undertaken to address adverse effects on hydrology.* ~~The results of this monitoring must be reported to the Waikato Regional Council.~~	OG have confirmed that no disturbance will take place within the Mataura wetland and that it will be restored. Proposed amendments reflect that intention.
SC2.F.30	At five yearly intervals following the certification of the Mataura Wetland Restoration and Monitoring Plan (MWMRP) referred to in Condition SC2.F.29. ~~commencement of activities authorised by this consent~~, the Consent Holder must monitor the condition of the Mataura Wetland vegetation and the hydrological conditions that sustain it. Where there have been significant changes in the existing wetland flora or soil moisture levels such that the ecological value or extent of the wetland has been adversely affected the Consent Holder must: a. Characterise and assess the source of the change; and b. Take all necessary measures to ensure that the ecological health and extent of the Mataura Wetland is restored to at least preconstruction baseline conditions. The results of this monitoring and any actions taken to ensure compliance with (b) must be provided to the Waikato Regional Council.	Amendment to reflect recommended change to SC2.F.29
New	No construction or disturbance works may occur within the area identified as the Mataura Wetland. As part of the integrated mitigation package, the Mataura Wetland will be restored by stock fencing, weed and pest control and ecologically appropriate planting.	New condition to confirm that works will not lead to the loss of the Mataura wetland values
New	An ecological restoration plan (ERP) shall be developed and implemented to offset the loss of the wetlands in TB1. The ERP will include measures to	New condition to offset the loss of the TB1 wetland

	ensure a like-for-like offset in terms of wetland extent, quality and composition.	

3. Wharekirauponga Underground Mine Water Management Plan March 2025 (WUMWM Plan)

1. The WUMWM Plan forms the basis of proposed consent conditions related to monitoring for potential adverse effects on water flows and wetland water levels from dewatering the proposed underground mine.

2. I support the list of wetlands proposed for monitoring in the WUMWM Plan, but note the response from OG via email that Adams 8 and 9 are no longer considered at risk of dewatering and will be removed from Table UG.13.T. However, given their proximity to areas that are at risk, and the uncertainty of the groundwater connections data, I recommend that baseline ecological data be collected for Adams 8 and 9 in the event of the need to offset any unanticipated adverse effects of the activity.

3. The control site for wetland water level monitoring must also be a wetland of similar type and hydrology to the potentially affected wetlands. The coordinates provided in the conditions do not appear to be within a wetland. The WUMWM Plan should be amended to ensure the control site is a suitable wetland site and allowance for this in the conditions (i.e. by removing the current control site co-ordinates and requiring identification of a suitable site approved by WRC).

4. Bioreseachers (2025) Proposed Wharekirauponga Underground Mine Wetland Ecological Effects Assessment include sound proposals for monitoring wetlands, including ecological values. These should be incorporated into the conditions, or into the WUMWM Plan. This will be important if remedial actions fail to redress dewatering, in order to determine if, and to what extent, offsetting or compensation for loss of wetland values is required.

5. I suggest adding foliage assessment of swamp maire (*Syzygium maire*) to the visual monitoring of the listed wetlands (Condition Ug.13) within which it occurs. Swamp maire plants readily react to reductions in water level and can indicate water stress. Any loss of this threatened species linked to dewatering should be mitigated.

6. Alan Pattle (Pattle Delamore Partners) advises in a letter to you (21 March 2025) that "*while the modelling concluded that the wetlands could be supported by rainfall alone, irrespective shallow groundwater lowering, this conclusion can only be taken as indicative at best pending considerably more field work and further analysis*." Given these uncertainties it will be important to ensure that the wetland hydrology and ecology monitoring methodology is robust and approved by appropriately qualified assessors for WRC.

4. Waihi wetlands assessments

4 a. Mataura, Favona Gladstone

1. I have only seen these sites from afar but based on their vegetation cover and the Boffa Miskell assessment (2025) the Mataura, Favona and Gladstone sites meet both the Natural Inland Wetland (NIW) protocols and the WRC significance criteria.

2. Boffa Miskell also note that "*none of the wetlands identified in the project footprint have been recognised as Significant Natural Areas in the HDP*". While this excludes these wetlands from HDP rules relating to significant natural areas, it does not exclude them from application of the WRC criteria and Waikato Regional Plan rules. The authors of the HDP SNA work[1] include a disclaimer stating: "*The absence of an existing natural area from this data set does not imply that such a site is not, or cannot be considered, a significant natural area, a significant area of indigenous vegetation or significant habitat for indigenous species. Such areas should be assessed when and if required.*"

3. None of these wetlands are anticipated to be directly impacted, but the Mataura site may experience some loss of surface water. I note the proposed condition SC2.F.9 refers to consented "*disturbance or reclamation of the Mataura Wetland*" but have not found any indications in the ecological reports that this wetland will be directly affected.

4. An additional site within Tributary 1 has been identified as a natural inland wetland by Boffa Miskell. This area is shown as a riparian restoration site in Boffa Miskell Figure 35 and presumably will not be adversely affected by the proposed activities.

5. I support the proposal (Part A - Waihi North Project – Substantive Application, page 458) to restore the Mataura site and take steps to protect the threatened (Nationally Vulnerable)[2] swamp maire trees within it. Proposed Condition SC2.F.29 refers to "disturbance or reclamation of the Mataura Wetland authorised by this consent" but OG have confirmed via email to you (11 August 2025) no works are proposed in the wetland and the condition needs modifying.

6. For avoidance of doubt, I recommend a new condition to read words to the effect:

   "*No construction or disturbance works may occur within the area identified as the Mataura Wetland. As part of the integrated mitigation package, the Mataura Wetland will be restored by stock fencing, weed and pest control and ecologically appropriate planting.* "

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[1] Gerry Kessels, Suzanne Porter, Britta Deichmann and David Riddell (Kessels & Associates) Ryan Clark and Derek Phyn (Environment Waikato) 2010. Significant Natural Areas of the Hauraki District: Terrestrial and Wetland Ecosystems. Waikato Regional Council Technical Report 2010/08.

[2] Conservation status of vascular plants in Aotearoa New Zealand, 2023 Peter J. de Lange, Jane Gosden, Shannel P. Courtney, Alexander J. Fergus, John W. Barkla, Sarah M. Beadel, Paul D. Champion, Rowan Hindmarsh-Walls, Troy Makan and Pascale Michel.

7. OG propose amending Condition SC2.F.29 to read:

> *"Prior to any work that may affect flows that sustain the Mataura Wetland authorised by this consent the Consent Holder must undertake baseline monitoring of the Mataura Wetland vegetation and confirm the hydrological conditions that sustain this vegetation."*

However, I recommend amending Condition SC2.F.29 to focus on the intended restored state, rather than the current degraded vegetation dominated by non-native species.

"Prior to any work that may affect flows that sustain the Mataura Wetland authorised by this consent, the Consent Holder must prepare a Mataura Wetland Restoration and Monitoring Plan (MWMRP) for certification by the Waikato Regional Council. This plan must include:

a. *Baseline description of the existing Mataura Wetland vegetation, and confirmation of the hydrological conditions that sustain its ecological values and the expected restored state.*
b. *A map delineating the extent of the Mataura Wetland including any buffer area proposed*
c. *A proposed monitoring and a reporting framework, including the results of the monitoring and any remedial works undertaken to address adverse effects on hydrology. "*

4 b. TB1 wetland and WRP Significance Criteria

1. A wetland above the Northern Rock Stack (labelled TB1) will be dewatered via a stream diversion and buried under a new rock pile as part of the proposed activities.

2. Ian Boothroyd for Boffa Miskell stated in a 10 November 2021 memorandum to Oceania Gold that "*This area has been planted but the dominant naturally occurring vegetation includes tall fescue, swamp millet, buttercup and Machaerina rubiginosa. This means that the plants at this feature have the characteristics of a natural wetland.*"

3. In their freshwater assessment for the consent application, Boffa Miskell (2025, report B.43, pg i) state that they applied the Waikato Regional Policy Statement criteria to wetlands, however they did not apply them to the TB1 wetland[3].

4. Boffa Miskell consider that wetland areas in TB1 were constructed and therefore exempt from the NPSFM natural inland wetland definition. However, the WRP significance criteria, developed prior to the NPSFM, are not limited to wetlands that meet the NPSFM Natural Inland Wetland definition.

5. Boffa Miskell consider that both the Gladstone and Favona wetlands meet the WRPS criteria "*based largely on the restoration of the wetland*"(pg 17) , but do not apply the same logic to the revegetated TB1 wetland areas.

[3] Report B.43 (Part 1) lists the WRP criteria but does not systematically assess all wetlands within the project area against them.

6. When I visited TBI in 2022, I noted that the site had many features that indicated it was a wetland under the RMA: topographically the gullies are low-lying; the soil was wet during the visit; facultative and obligate wetland species have self-established (including *Persicaria hydropiper, Paspalum distichum, Juncus effusus,* and *Isachne globosa*); and flowing water was present. All of the planted species were native and appropriate for restoring wetlands.

7. I conclude, based on my site visit, that, as with the restored Gladstone and Favona wetlands, the TB1 wetland meets Criterion 6 of the WRC criteria for determining significance of indigenous biodiversity, being "*wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/ pasture communities) that has not been created and subsequently maintained for or in connection with: waste treatment; wastewater renovation; hydro electric power lakes (excluding Lake Taupō); water storage for irrigation; or water supply storage;*"

8. I note that silt ponds are not among the list of inclusions in Criterion 6, and further that the site has not been subsequently maintained as a silt pond – therefore the wetland does not meet the exclusions in the WRP Criterion 6.

9. Given the national depletion of wetlands to less than 10% nationally, the site also meets Criterion 4:

   "*It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.*"

10. If the site is to be modified via the creation of drains within the wetland, then it may trigger the WRC Discretionary activity rule 3.7.4.7.

    3.7.4.7 Discretionary Activity Rule – Drainage of Wetlands
    The following activities: the creation of drains ... within a wetland that is an area of significant indigenous vegetation and/or significant habitat of indigenous fauna are discretionary activities (requiring resource consent).

4 c. TB1 wetland and the NPS FM

1. The NPSFM definition of natural inland wetland excludes:
   "*(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*

   (c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or.."

2. Boffa Miskell 2025 (B.43) consider the TB1 wetland meets the exclusion, stating (s 11.1.8) that:

   "*A wetland feature occurs within the TB1 stream corridor. This wetland has been formed from a former silt pond that was developed as part of the construction of the TSF2*"

   ..This feature is not a natural inland wetland, as described in the NPSFM, because it is a deliberately constructed wetland as part of a re-routed watercourse and arising from a former created silt pond." (s 11.1.8)

   ..The planting of the decommissioned silt pond at TB1 is part of the OGNZL's predecessor Company's commitment to "beyond compliance" outcome as opposed to it being a requirement to offset impacts on or restore an existing or former wetland."

3. When considering whether a wetland meets wetland exemption (b) it is pertinent to consider
    a. whether a naturally occurring wetland existed in that location at some stage in the past and
    b. what the intention was behind the restoration – ie to offset a consented activity, or to restore a former wetland?

4. I can see from Google Earth images that sometime between 1999 and 2003 a small (c60 sqm) pond was constructed within the site and later filled in, and that areas of the TB1 wetland (within and beyond the footprint of the pond) have been densely planted sometime between 2004 and 2010.

5. However, air photographs taken from the1960s to 1999[4] indicate to me that a seepage wetland with dense, herbaceous vegetation occurred in the current location of the TB1 wetland *prior* to excavation of the channels the construction of the pond and re-routing of part of the waterway. Even if that vegetation was later excavated to create open drains, the images indicate a wetland formerly occupied the location. This negates NPSFM exemption (c).

6. When the consent was processed for the NRC tailings, the wetland was probably degraded by livestock and may have been dominated by exotic species. In that state it would not have met the Waikato Regional Council significance criteria, or been considered under the policy framework at that time (this was prior to the NPS-FM policies and definitions).

7. The TB1 gully system today exhibits natural wetland conditions: high water table and self-established wetland plant species. The area of wetland planted since 2004 (>4000 sqm) extends well beyond the footprint of the decommissioned silt pond, including into south-west draining tributary arms, formerly in herbaceous vegetation, that have not been re-routed and that would not have been influenced by the pond's construction. The entirety of TB1 could not have arisen from infilling of a small silt pond.

8. I conclude therefore that the area was most likely a former wetland, degraded by farming activities, which has been restored. Therefore because the activity was "***to restore**, an existing **or former** natural inland wetland*" exemption (b) of the NIW definition does not apply. It is impossible to determine now if that area would have met the NPSFM exemption (e) pasture exclusion.

9. The NPSFM affords councils the discretion to accept the loss of natural inland wetlands for certain mining purposes in s3.22:

    "The loss of extent of natural inland wetlands is avoided, their values are protected, and their restoration is promoted, except where:

        (e) the regional council is satisfied that:

        (i) the activity is necessary for the purpose of:

[4] See Appendix 3 for images and further explanation

(A) the extraction of minerals (other than coal) and ancillary activities; or ... and

(ii) the extraction of the mineral will provide significant national or regional benefits; and

(iii) there is a functional need for the activity to be done in that location; and

(iv) the effects of the activity will be managed through applying the effects management hierarchy; "

10. The National Environmental Standards Freshwater Management (2020) provides a discretionary consent pathway for modification of natural inland wetlands for mining and ancillary activities (s45D).

(1) Vegetation clearance within, or within a 10 m setback from, a natural inland wetland is a discretionary activity if it is for the purpose of the extraction of minerals and ancillary activities.

(2) Earthworks or land disturbance within, or within a 10 m setback from, a natural inland wetland is a discretionary activity if it is for the purpose of the extraction of minerals and ancillary activities.

(3) Earthworks or land disturbance outside a 10 m, but within a 100 m, setback from a natural inland wetland is a discretionary activity if it—

(a) is for the purpose of the extraction of minerals and ancillary activities; and

(b) results, or is likely to result, in the complete or partial drainage of all or part of the wetland.

(4) The taking, use, damming, or diversion of water within, or within a 100 m setback from, a natural inland wetland is a discretionary activity if—

(a) the activity is for the purpose of the extraction of minerals and ancillary activities; and

(b) there is a hydrological connection between the taking, use, damming, or diversion and the wetland; and

(c) the taking, use, damming, or diversion will change, or is likely to change, the water level range or hydrological function of the wetland.

(6) A resource consent for a discretionary activity under this regulation must not be granted unless the consent authority has first—

(a) satisfied itself that the extraction of the minerals will provide significant national or regional benefits; and

(b) satisfied itself that there is a functional need for the extraction of minerals and ancillary activities in that location; and

(c) applied the effects management hierarchy.

11. My assessment is that we cannot discount that TB1 is a restored natural inland wetland, and therefore its loss as a result of the proposed activities should be offset via like for like re-instatement elsewhere on the project site. Numerous suitable locations exist including:

c. The highly degraded wetland immediately east of the proposed Collection Pond near TB1 (labelled TB1-2 by Boffa Miskell)[5].

d. Damp depressions along the Services Trench route

Karen Denyer
Director and Principal Ecologist
Papawera

[5] Letter from Ian Bothroyd Boffa Miskell to Kathy Mason Oceania Gold, 2 December 2020

APPENDIX 1

Documents I reviewed to inform the contents of this letter

Part A – Substantive application report

A.05. Section 2 – project description (PDF, 11.9MB)
A.09.Section 6 – effects assessment (PDF, 2.4MB)
A.10. Section 7 – effects management and monitoring (PDF, 224KB)

Part B – Technical reports
B.27.Assessment of groundwater effects, Wharekirauponga deposit (PDF, 6.8MB)
B.28. Groundwater predictive uncertainty quantification (PDF, 3.8MB)
B.32. Wharekirauponga hydrology modelling report (PDF, 10.2MB)
B.43. Freshwater ecological assessment part 1 (PDF, 45.9MB)
B.43. Freshwater ecological assessment part 2 (PDF, 16.5MB)
B.44. Wharekirauponga stream potential flow changes (PDF, 9.9MB)
B.45. Wetland hydrological assessment part 1 (PDF, 43MB)
B.45. Wetland hydrological assessment part 2 (PDF, 37.9MB)
B.45. Wetland hydrological assessment part 3 (PDF, 50.1MB)
B.45. Wetland hydrological assessment part 4 (PDF, 23.9MB)
B.46. wetland ecology effects assessment (PDF, 9.6MB)
B.47. Wharekirauponga underground mine: overall summary of ecology matters (PDF, 2.6MB)

Part C – Project maps and technical drawings
C.12. Loss of river extent (PDF, 2.1MB)

Part D – Proposed approval conditions
D.04 WRC conditions clean version (DOCX, 7.6MB)

Part H – Management plans
H.01 - Wharekirauponga underground mine ecology and landscape management plan (PDF, 10MB)
H.02 - Waihi area ecology and landscape management plan (PDF, 10MB)

Part I – RMA rules triggered
Cover and RMA rules assessment (PDF, 639KB)

Letter Ian Boothroyd (Boffa Miskell) to Oceania Gold 2 December 2020

Letter Ian Boothroyd (Boffa Miskell) to Oceania Gold 10 November 2021

APPENDIX 2

Wetland definitions

The Act (RMA 1991) defines wetlands as: "*permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals*[6] *that are adapted to wet conditions.*" The term natural ecosystem is not defined but the Act defines natural and physical resources as: " *includes land, water, air, soil, minerals, and energy, all forms of plants and animals (whether native to New Zealand or introduced), and all structures)".*

The NPSFW requires councils to map, monitor and control activities in and around natural inland wetlands. The policies start from the premise of a site being a natural wetland if it meets the definition of wetland in the RMA, and then applies several exclusions to determine whether an RMA wetland is a natural inland wetland.
The NPSFW 2020 defines natural wetlands thus:

natural inland wetland means a wetland (as defined in the Act) that is not:

- *(a) in the coastal marine area; or*
- *(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*
- *(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or*
- *(d) a geothermal wetland; or*
- *(e) a wetland that:*
- *(i) is within an area of pasture used for grazing; and*
- *(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless*
- *(iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply*

[6] An expert witness statement published by MfE 22 November 2024 deems it generally unnecessary to prove that a putative wetland supports wet-adapted fauna in order to meet the RMA wetland definition. This is because the experts agree it is virtually inconceivable that any area that otherwise satisfies the wetland delineation protocols would be devoid of wet-adapted meiofauna (e.g. nematodes, tardigrades, rotifers, earthworms). https://environment.govt.nz/publications/expert-statement-wetland-delineations-and-animals-adapted-to-wet-conditions/

APPENDIX 3

Assessment of evidence that TB1 is a restored former wetland

Early air photographs (1969, 1971, 1974, 1982, 1994, 1999) clearly indicate the presence of shallow densely vegetated gullies with short-stature emergent vegetation in the location of TB1 wetlands. The lack of shadows (visible in the same images for taller vegetation) in early images indicates the vegetation was likely herbaceous, with some scattered woody plants visible in later images which had expanded by 1999. The texture and colour of the gullies differ from the surrounding pasture prior to the construction of the silt pond and re-routing of the stream.

In my 30+ years of experience field-assessing wetlands, this image feature usually indicates the presence of obligate or facultative wetland herbaceous species such as *Juncus* rushes, *Carex* or *Cyperus* sedges, Mercer grass, creeping bent, swamp millet, willow weed, buttercup species, or, if very wet, reed sweet grass. Some of these species are noted by Ian Boothroyd (letter to Oceania Gold, 10 November 2021) as naturally occurring in the TB1 wetland.

The gully areas in the early air photos also resemble similar aged images of locations that I have visited and know to be areas of swamp millet and other herbaceous wetland species (see Figure 2). However, note that it is impossible to determine if the historic areas of wetland met the pasture exclusion test of the NPSFM because individual species cannot be identified from the images.

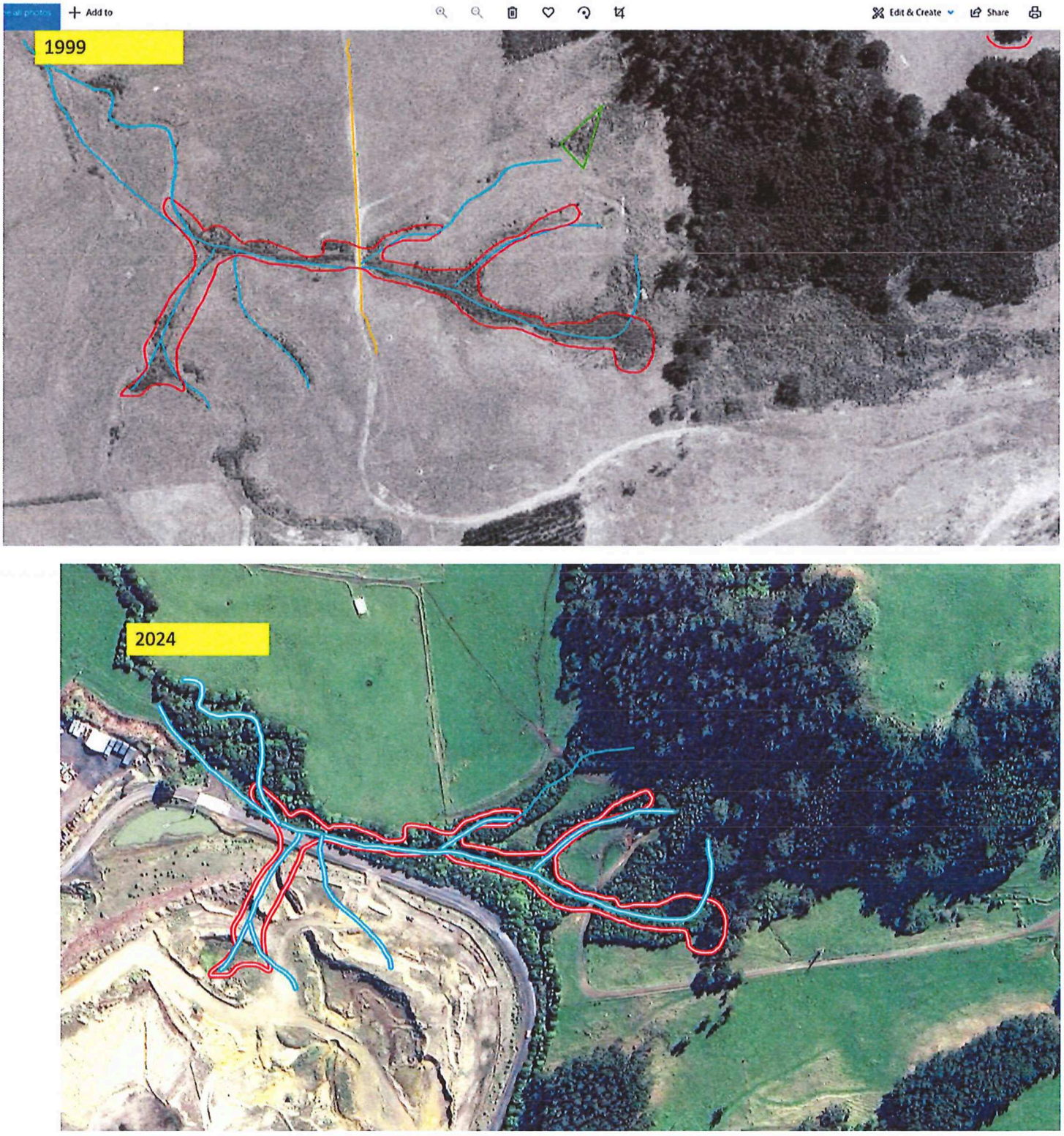

Figure 1: Location of TB1 gully; top 1999 dark low stature seepage vegetation visible within the footprint of the current TB1 wetland (outlined in red). Blue is approximate location of stream channels, yellow is farm road to provide a stable reference point for comparison. Only a portion of the gully system has been re-routed to expand the mine facilities, and much of the topography where the current wetlands are situated remains largely unchanged based on the images.

Figure 2: Top (1999) shows TB1 wetland location in 1999, indicated by darker vegetation than surrounding pasture. The green area with similar texture was delineated as passing the national wetland protocol's Prevalence test by Boffa Miskell[7] (PI<=3). Lower image (1990) shows a Waikato site that is currently a seepage dominated by swamp millet and delineated by Dr Beverley Clarkson as a natural inland wetland (see Appendix 3: Field trials Example 1, Ministry for the Environment. 2022. Pasture exclusion assessment methodology. Wellington: Ministry for the Environment.). The wetland in the lower image (orange box) is structurally and tonally similar to an image of the TB1 site (orange box) captured around the same time.

[7] Letter from Ian Bothroyd Boffa Miskell to Kathy Mason Oceania Gold, 2 December 2020