

Request for Further Information: OGNZL WNP Resource Consent Application, July 2022.

The OGNZL Consent Application in relation to proposed future mining involved in the Waihi North Project (WNP) has been reviewed by Blastotechnology from the perspective of the potential blasting impacts including vibration, overpressure, flyrock, and fume. This document outlines aspects of the Heilig & Partners (H&P) Blasting Impacts Assessment report which are considered to require additional information or justification.

Documents Included in Review

The following documents were reviewed to provide the necessary background to both the WNP and the H&P Impact Assessment:

Hauraki District Plan – Vibration in the Ground, section 8.3.2

Part A - Overarching Assessment of Environmental Effects.pdf

Part B - B1 CFP and Area 1 Site Specific Assessment of Environmental Effects.pdf

Part B - B2 Area 2 Site Specific Assessment of Environmental Effects.pdf

Part B - B3 Area 3 Site Specific Assessment of Environmental Effects.pdf

Part B - B5 Area 5 Site Specific Assessment of Environmental Effects.pdf

Part E - Part Ec - HDC Consent Conditions.pdf (Conditions 26 to 54)

Part F – Appendix 01-LUC 97-98 105_Martha-extended-project-2019.pdf

Part F - Appendix 01-ML 32-2388.pdf

Part H - 17 - Beca (2022) - Air Discharge Assessment - Waihi Facilities.pdf

Part H - 18 - Beca (2022a) - Air Discharge Assessment - Wharekirauponga Underground Mine.pdf

Part H - 32 - RMA Ecology (2022) - Wharekirauponga frogs - Potential adverse ecological effects.pdf

Part H - 33 - Bioreserches (2022b) - Vibration effects on amphibians (Leiopelmatid frogs).pdf

Part H - 41 - Heilig (2022) - Blasting and Vibration Assessment.pdf

Part I - Draft Air Quality Management Plan 2022_RevA.pdf

Part I - Draft Vibration Management Plan_RevA.pdf

Part K – Records of Title, Area 2



Summary of Impact Assessment Areas Reviewed

The WNP project has been divided into 7 areas in the OGNZL Resource Consent Application, but only some are relevant to the blasting impact assessment as follows:

Area 1: The portion of the underground access tunnels, and the entire WUG mining area located within the Waihi North Biodiversity Project Area. There are no amenity issues and no residences within 5 km. Impacts on only Archey's and Hochstetter's frog species, considered to be a Globally Endangered amphibian species (Part H, 33 - Bioreserches-2022b), were assessed.

Area 2: Access tunnel, including portal, located within the Willows Road farm property located at 132 Willows Road which is owned by Oceana Gold. On the periphery of Area 2 there appear to be 2 privately-owned houses (111 and 122 Willows Road, Sanderson & Tinsley respectively), and two company-owned houses.

Area 3: Dual WUG Access Tunnels (Baxter Road processing plant to WUG). Passes under Golden Valley, Mataura, Oldfield and Wharry Roads (H&P report, section 5) at a depth of around 120 metres. All blasting is underground and the only blasting impact of significance is vibration.

Area 5: Includes the GOP and access tunnel portals for both MUG and WUG (Figure 3, OGNZL B5-Area 5 Site Specific Assessment). Portals appear to be aligned in a S to S-E orientation, along which no private residential structures are located within 1500 metres. The nearest residence appears to be directly south of the portals on Baxter Road at a distance of around 1600 metres, with a significant topological barrier between it and the portals. The final GOP pit footprint will lie approximately 250 metres from the nearest residence to the north, 250 metres to the nearest residence to the west, and approximately 350 metres from the nearest residence to the south-west. There are no sensitive receivers within 1000 metres to the south, south east, or east of the pit. Blasting in GOP will generate vibration and overpressure effects, as well as potential flyrock and fume effects.

Summary of Impact Assessments, H&P Report

Area 1: Surface vibration from underground development and production blasting is to be controlled and monitored, with surface PPV levels inferred by extrapolation of trends from an array of underground monitors, targeting vibration control for Archey's and Hochstetter's frog colonies (Section 15.1). In Section 8.4, a limit of PPV < 15 mm/s is proposed to avoid negative effects on Archey's frog populations. No above ground monitoring is proposed.

Area 2: Overpressure levels at 111 and 122 Willows Road is to be controlled and monitored, though the report suggests that such monitoring will not be permanent ("*Any blasting associated with developing the portals and initial stages of the WUG access decline will involve monitoring the level of overpressure.*", Section 13.3). The monitor data for Favona suggests levels in the range 130 to 142 dBL are likely to be recorded at the portal for blasts up to at least a distance of 350 metres down the decline, equating to 108 to 120 dBL at a distance of 800 metres. With the nearest residential receiver at approximately 800 metres, vibration levels in Area 2 are expected, in the H&P report, to be imperceptible.



Area 3: The H&P report presents modelled surface vibration impact levels for 3 optional tunnel alignments under consideration (Tunnel 2, Tunnel 3, and Tunnel 4, Appendix C) with alignments 3 and 4 each moving progressively eastwards by approximately 120 metres (derived from scaling of Plates 1, 3 and 5 of Appendix C) from alignment 2 and residential structures towards the eastern end of Mataura Rd. Blasting in this area will be underground at a depth of around 120 metres, and minimum distance to surface residential structures is around 140 metres (Section 11.3). Vibration is proposed as the only factor requiring monitoring at the southern end of the WUG Access tunnel in the Waihi East area, potentially affecting houses within approximately 350 metres of the point where the tunnel alignment crosses Mataura Rd and Golden Valley Rd. There are some additional properties above the tunnel alignment which will be affected for a limited period (up to 14 weeks, Section 11.3) by blasting vibration associated with tunnel development. Existing fixed monitors are proposed to cover these monitoring requirements, and roving monitors will be used to address complaints, or areas not well covered by the fixed monitors (Section 15.1, but note there are two sections labelled 15.1 and this reference is to the first instance). Only results from the fixed monitors will be displayed on the website, and presumably only these results will be used to collate compliance statistics.

Area 5: This area includes both the Plant Access Portal area and GOP. Portal blasting is likely to generate perceptible vibration and overpressure disturbance levels to the residents in the Boyd Road – Moore Street areas. GOP blasting is also likely to generate perceptible vibration and overpressure levels, especially to the residents in private housing in the Clarke Street – Heath Road areas, but also to residents on the south side of Barry Road, and to some towards the north-west of the pit (Appendix A, Plates 1 and 2). Flyrock is considered a minor risk for this area in the H&P report, and is unassessed. The Draft Vibration Management Plan (Section 7.5.1) states that all GOP blasts will be video-recorded for post-blast assessment of flyrock control. Fume generation is also considered a potential risk, but no monitoring, reporting, or mitigation measures are mentioned, and Section 3 refers to the OceanaGold Blast Safety Management System for controls over noxious fume from blasting.

Areas of Potential Concern

The H&P assessment report provides adequate details of how, where, and when vibration monitoring and reporting will be conducted, for all WNP blasting sites. It also explains that blasts fired for GOP and the WUG access tunnels will not be coordinated with, or synchronous with, blasting in existing and already-approved mining areas, and different compliance statistics are to be applied.

It is considered that the assessment of blasting impacts for WNP, as presented in the H&P report, is too heavily directed towards vibration impacts and their modelling, monitoring, and reporting, and gives insufficient attention to monitoring, modelling, and mitigating other impacts including overpressure, flyrock, and fume. The issues of potential concern, not adequately covered in the H&P report are considered to be:

1. **GOP Blasting Times:** The recommendation in the H&P report (Section 8.5, Table 2) is for the blasting times in GOP to occur between the hours of 7 am and 6 pm. Potentially, this allows blasting in GOP to occur around the sensitive times when residents have either just woken and are preparing for breakfast, or are preparing for the evening meal. Blasting-based disturbances at both times are expected to attract more complaint and public dissatisfaction. The more restricted



time window for permitted Martha Pit blasting (10 am to 3 pm), was set in recognition of what were considered to be sensitive morning and evening times during which blasting impacts should be avoided.

- 2. Vibration Limits for Archey's Frog:** The H&P report recommends a vibration limit of 95% of PPV < 15 mm/s for WUG, "at any location on the surface above the mine" (Executive Summary, page iii of 41), and Section 8.4 which makes specific mention of Archey's frog. The recommended limit is derived from work at the Golden Cross Mine (Section 8.4) and relates to Hochstetter's frog.

It is proposed that the vibration levels will not be measured on the surface due to issues of access. Instead, it is proposed (Section 15.1 – note that there are two sections labelled 15.1, and this reference is to the second instance) that vibration levels will be monitored using underground sensors and recording equipment, and algorithms will be used to extrapolate measured underground levels to "likely" levels on the surface. It is also proposed that the accuracy of the extrapolations will be confirmed periodically by simultaneous monitoring on the surface. The report further states that the extrapolated vibration levels "... will be used to determine compliance with the permissible vibration criterion specified by the ecologists."

The RMA Ecology memo dated 19 June 2022 (Part H-32), page 3, states "... mining operations at Golden Cross suggests both species can tolerate vibration of 2–10 mm/s for Hochstetter's frog (Attachment B) and 2 mm/s (maybe up to 4 mm/s) for Archey's frog". The RMA Ecology report acknowledges that the Golden Cross data does not indicate a vibration disturbance threshold, but the H&P report recommendations for 15 mm/s (Section 8.4) seem high, and without justification or qualification in terms of associated observation/monitoring of vibration effects on the Archey's frog population.

Further, the reporting of the monitoring results has not been addressed, and no mention is made in the H&P report as to the type of monitor to be used at WUG (permanent or roving). It seems likely that it will involve roving monitors. Historically, roving monitors are used to address complaints and the results of monitoring are reported to HDC, but not included in the BlastHub database, or used for assessing compliance. The monitoring and extrapolation is expected to be a manual task.

- 3. Separation of Vibration Effects:** In relation to the monitoring of vibration levels from both GOP and the southern end of the WUG Access tunnels, the H&P report (Section 15.1) states "*it would be beneficial to maintain the existing monitoring sites that were used for Favona and Correnso with the latter relevant for the Plant Access Tunnel.*" If existing permanent monitors are used for GOP, sections of the WUG access tunnels, and blasting within the Correnso mining area, it is unclear how the different impacts will be derived for each source of vibration. Separation of events for the purposes of independent reporting is likely to require manual intervention, which may introduce reporting delays and, potentially, uncertainty and ambiguity.
- 4. Overpressure Monitoring:** Overpressure from blasting is addressed in the H&P report in Sections 6.2, 12, 13, Appendix E and Appendix G, and a limit of 120 dBL is proposed (Section 8.5,



Table 2), in alignment with the District Plan (Section 8.3.2.3 (2b)). The Summary of Effects (Section 16) makes no reference to overpressure effects at any location.

Basic modelling is presented in Section 12 using an unreferenced “*common reference equation*” which fails to take into consideration the very large degree of scatter and very large error of prediction. This is also unsupported by any historic monitoring from Waihi mining operations. Importantly, local residents, and even experts, are unable to distinguish between the separate effects of vibration and overpressure disturbance inside a house. Overpressure induces similar disturbance effects to residential and commercial structures as does ground vibration.

Realistically, compliance with the proposed absolute overpressure limit of 120 dBL is likely to be challenging, especially for blasts in the upper levels of GOP for houses between Clarke St and Heath Rd. Further, levels of 120 dBL are easily perceived and likely to attract complaint. The H&P report acknowledges the potential compliance difficulty in Section 13. The mining operations will need to be able to demonstrate compliance with the limit. However, the statistics of compliance, and compliance for any particular event, can not be realistically demonstrated when the level is only measured quarterly, or in response to an unlikely complaint which specifically identifies overpressure.

While Plate No. 1 in Appendix E presents overpressure contours, there is no indication whether these contours are average or maximum impact contours, unlike the vibration impact assessment contours.

5. **Firing Time Restrictions for Near-Portal Blasting:** Evidence from Favona near-portal blasting shows peak levels at the portal of up to 142 dBL (H&P report, Appendix F). Based on this evidence, levels around 120 dBL at the nearest potentially-affected residences in Willow Road at 800 metres separation distance are anticipated.

The H&P report acknowledges that compliance with peak overpressure levels from the portal, and near-portal, blasting is likely to be difficult (Section 13) “*Compliance with 120dBL is only expected to be achieved through strategic placement of the portal, effective shielding of properties through topographical and vegetation barriers, potential barricades in the decline, well implemented blast designs and practices and an adequate separation distance to the sensitive receivers.*”

Table 2 in Section 8.5 of the H&P report proposes night time blasting, subject to stringent vibration limits, but makes no mention of more stringent overpressure limits.

6. **Monitoring, Reporting, and Mitigation of Fume and Flyrock:** Section 3 of the H&P report acknowledges fume (taken to refer to both carbon monoxide and nitrous oxides, or NOx) in the statement “*It is known that combinations of highly confined blasts, soft and weathered ground types, water saturated ground types, highly fractured ground types and blasts with high powder factors present as conditions that have a higher risk of producing post blast fumes.*”, while at the same time asserting a “*...very low likelihood of a post-fume event when blasting at GOP.*”



Contemporary mining in every country within Blastechonology's consulting experience features at-least-occasional strong generation of NOx fume when using bulk emulsion-based explosives, with an example of a particularly severe, but not uncommon, case taken from the internet shown below.



The sight of clouds of NOx gases is confronting and alarming even to those who are not directly impacted by them, and some people will experience eye irritation and respiratory problems upon exposure to the highly-visible NOx gases.

NOx fume generation is particularly prevalent in soft rock, wet-hole conditions (as noted in the above extract from the H&P report) which are likely to be at least occasionally present in the upper-pit zones of GOP. Post-blast fume, if/when generated will be visible to, and will potentially impact upon, residences between State Hwy 2 and the pit, and between Mataura Road and the pit.

While direct measurement of concentrations is neither practical nor suggested, there are well-established and widely accepted visual rating systems which can be applied to video records (e.g. Australian Explosives Industry and Safety Group, Code of Practice, Prevention and Management of Blast Generated NOx Gases in Surface Blasting, Appendix 2), and which can be used as triggers for review of blasting practices and/or explosive product selection. The H&P report makes reference to the OceanaGold Blast Safety Management System, but provides no details as to how that system pertains to the control, monitoring, mitigation, and reporting of fume.

Flyrock assessment receives little attention in the H&P report. The greatest flyrock risk comes from GOP blasting, and while section 7.1 provides expectations as to blasthole charging in GOP, no assessment of maximum flyrock projection distances is made.



Section 14 deals with mitigation of vibration and overpressure effects, but makes no mention of fume and flyrock effects.

7. **Blast Impact Monitoring and Reporting:** OGNZL has a detailed and open Vibration Management Plan (VMP), but no similarly-detailed plan for other impacts, and the VMP may not be the most appropriate place to look for controls and management plans for overpressure, flyrock and fume.

Requests for More Information

More detail is requested in relation to each of the matters mentioned above, summarised as:

1. There is insufficient justification for the proposed blasting hours for GOP, and further assessment/rationale is required to explain and demonstrate why the resultant effects are considered appropriate .
2. There is insufficient justification of the 15 mm/s vibration limit for WUG blasting (Section 8.4) – noting the tolerance levels referenced in the RMA Ecology report (page 3) as being 2-10 mm/s for Hochstetter’s frogs and 2mm/s and maybe up to 4mm/s for Archey’s frogs (and noting the disclaimer in the footnote of page 3 of the RMA Ecology report that 10mm/s may have been for only one blast). Further assessment/rationale is required to explain and demonstrate why the resultant effects are considered appropriate. The assessment does not specify the type of monitor (fixed or roving), the frequency with which the results of monitoring will be reported, and any support monitoring of the effects of elevated vibration levels on Archey’s frog populations.
3. Independent reporting of WUG and other separately-consented blasting impacts from permanent monitors which record events from multiple sources is considered necessary to accurately monitor the levels proposed to be achieved. Depending on firing times, it may be difficult to separate different events, requiring manual intervention in the reporting process. How will the data be unambiguously assigned to a specific project/source, and can the separate compliance statistics be reliably collated?
4. Justification for irregular monitoring of overpressure levels from GOP blasting, given the high potential for associated complaints is considered necessary. Please explain how compliance can be demonstrated without monitoring every blast?
5. What restrictions, if any, are proposed on the firing time of portal, and near-portal, blasts to ensure overpressure disturbance levels can be reduced to appropriate night-time levels? What is proposed in respect of strategic placement of each portal to achieve effective shielding of overpressure and flyrock impacts?
6. What is the potential flyrock impact area around portals and GOP blasting, and how will the potential ejections be managed/mitigated? Will, or can, the monitoring and reporting of flyrock and fume be incorporated into each GOP blast event report using video records and a rating system like the AEISG Code of Practice?
7. Is the Vibration Monitoring Plan the appropriate place for specifying appropriate control, reporting and mitigation procedures for overpressure, flyrock and fume, given the importance of each of these factors to public perception of blasting impacts?

