Management Plan

Blasting and Vibration Management Plan

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Department	**Sustainability**
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Approval table

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Document issuance and revision history

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Revision number	Revision date	Section	Page	Description	Effective Date
1	Dec 2013			Initial Plan	01/01/2013
2	Nov 2016			Incorporation of Slevin (SUPA) into Plan	01/11/2016
3	Jul 2017			Incorporation of MDDP into Plan	01/07/2017
4	Mar 2019			Incorporation of Project Martha into Plan	01/05/2019
5	May 2022			Three yearly update, relocation of Pensioner Flats monitor, change to blast windows and alignment to OGNZL EMR standards	01/05/2022
6	July 2022			Removal of three Correnso monitors from the network	01/08/2022
7	July 2023	All	All	Annual environmental material risk update	01/08/2023
7.A	July 2024	All	All	Rejected	05/11/2024
8	Nov 2024			Resubmitted for review	05/11/2024
9	Mar 2026			Updated for WNP	03/03/2026

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1 PLAN OBJECTIVE

The objectives of this Blasting and Vibration Management Plan (BVMP) are to detail the methods to be used by OceanaGold New Zealand Ltd - Waihi (OGNZL) to:

- comply with the relevant conditions of the following Hauraki District Council (HDC) Land Use Consents (LUC): 202.2012 (Correnso Underground Mine project), LUC LUSE-202.2016.544.001 (Slevin Underground Project Area), LUSE-202.2017.664.001 (Martha Drill Drives Project (MDDP)), and LUC 202.2018.857.001 (Project Martha), and land use consents for the Waihi North Project;
- meet OGNZL's Environmental Material Risk Management Plan minimum requirements
- comply with OGNZL's Corporate Environmental Standards related to vibration
- avoid or mitigate unreasonable blasting vibration effects as required by s17 of the Resource Management Act;
- liaise with the HDC and the Waihi community and respond to complaints and concerns as they arise; and
- to minimise to the extent practicable, the impacts of blasting vibrations on the community and ecology (Wharekirauponga Underground Mine only).

2 REFERENCE AND COMPLIANCE

Level	Source
Legislation or Guidelines	• HDC Land Use Consent 202.2012 (Correnso) • HDC Land Use Consent 202.2016.544.001 (Slevin) • HDC Land Use Consent 664.001.2017 (MDDP) • Variation to mining licence 32-2388 • HDC Land Use Consent 97/98-105 (EMMA) • HDC Land Use Consent 202.2018.857.001 (Project Martha) • HDC Land Use WNP Consent Conditions (5 February 2026)
Corporate	• OGC-450-STD-020 OGNZL Environmental Performance Standards
	• OGC-450-GUI-005 Risk Management Guidelines
Site	• WAI-800-PRO-007 Concerns, Complaints and Grievances Procedure
	• WAI-200-PRO-008 Field Monitoring of Blast Vibration

3 BACKGROUND

OGNZL operates an open pit and underground mines in Waihi, New Zealand. Vibration impacts from underground and open pit blasting activities, if managed improperly, have the potential to impact residents' amenity and at higher magnitudes to cause damage to property and heritage items, and to impact on ecological values. Given the proximity of mining operations to the township of Waihi, vibration impacts have been identified as an Environmental Material Risk (EMR) that could create a level 3 or

greater consequence through OGNZL's risk assessment process (Appendix H). A management plan is therefore required to ensure effective control measures and monitoring programs are implemented to manage vibration impacts and comply with relevant regulatory requirements.

The following section sets out the various Project areas covered under this plan.

3.1 Correnso

The Correnso Underground Mine (Correnso) is located within the Correnso Extensions Project Area (CEPA) under residential land in the eastern part of the Waihi township. The required Waikato Regional Council (WRC) consents to undertake the project were granted in December 2012, and the HDC LUC was granted on 18 October 2013.

The first year of operation in Correnso involved development blasting to construct access and orebody drives; stope production blasting began in June 2015. Additional development and extraction have been undertaken into the identified extensions (Empire, Daybreak, and Christina). Mining in the Correnso project area is now complete, with some backfilling remaining to be completed. Underground access to Project Martha will continue to be required through specific Correnso access drives.

The Correnso LUC includes specific conditions that set limits on the permissible vibration level, times and durations of blasts, and the numbers of blast events per day to protect the amenity of the residents.

Although mining in Correnso is currently in abeyance, Correnso monitoring and compliance obligations remain in this plan, in case of blasting in the area being recommenced.

3.2 Slevin

The Slevin Underground Mine is a development between Correnso and the Martha pit. The required consents for Slevin from WRC were in place from the Correnso Extensions Project Area (CEPA) application and the HDC LUC was granted in late October 2016. Access to Slevin was an extension of Correnso's Daybreak ore body and stope production is well advanced.

The Slevin LUC conditions in relation to blast vibration are sufficiently similar to Correnso in terms of permissible vibration level, times and durations of blasts, and number of blast events per day to protect the amenity of the residents and enable the two operations to operate under the same monitoring mechanisms and management plan.

3.3 MDDP

The Martha Drill Drive Project (MDDP) involved installing two exploration drives from the western end of the Slevin development, extending under the southern wall of the Martha pit, to enable exploration under and to the south of the pit. Both the 920mRL and 800mRL drives are completed.

Like the Slevin project, the MDDP LUC conditions in relation to blast vibration are sufficiently like those of the other two LUCs to enable the three operations to operate under broadly the same monitoring mechanisms and management plan. The MDDP area is contained wholly within the subsequent Project Martha Project area and therefore blast vibration monitoring for MDDP is now incorporated into the Project Martha network.

3.4 Project Martha

Project Martha (Martha) is a recently consented project extending operations in, around and under the existing Martha open pit. The required consents to undertake the project were granted by WRC and the HDC in February 2019. Activities include:

- Martha Underground: Development and extraction of ore from under the Martha pit and areas southwest towards Kenny St (Rex ore body), accessed from the existing drives of other OGNZL projects (Correnso, SUPA, and MDDP).
- Martha Pit: The laying back of the northern wall, restoring access to the bottom of the pit and extracting ore accessible as a result of those activities.

Martha's LUC conditions are very similar to the Correnso/Slevin/MDDP LUC conditions for Underground operations, and the previous Extended Martha Mine Area (EMMA) LUC conditions for blasting in the open pit. This has enabled the Underground component of Martha to be incorporated into the same management regime as Correnso/Slevin/MDDP, while blasting in the open pit will be effectively the same as has applied throughout the life of the project.

Note: Although this consent provides for further mining of the Martha pit, there is currently no scheduled start date for this element. Blasting in the pit is therefore not covered by this Plan. OGNZL will submit a revised Plan at least 30 working days prior to restarting blasting in the pit. This revision will also document the management/mitigation of fly-rock and overpressure as these two effects are predominantly a risk of surface mining (when considering impacts on the community).

3.5 Waihi North Project

Waihi North Project (WNP) describes operations involved in a new underground mine, a new pit, a new waste rock stack, and a new tailings storage facility. Blasting-related activities include:

- Wharekirauponga Underground Mine (WUG), a new mine approximately 9 kilometres north of the existing Martha pit and Waihi township.
- Development along 6.5-kilometre to the WUG mine comprising the Willows Access Tunnel, a decline from a portal adjacent to the Surface Facilities Area at Willows Road (Willows SFA) to the northern boundary of the Willows Road Farm, and thereafter a dual access tunnel out to the orebody.
- A 5-kilometre tunnel linking the dual access tunnel back to the existing Processing Plant (WUG Access Tunnel).
- Three borrow areas (western, central and eastern) from which the initial construction material for the TSF3 embankment will be won.
- Gladstone Open Pit (GOP), a new pit west of and adjacent to the existing processing plant.

Updates to this revision of the plan are focussed on WNP tunnel blasting activities for the Willows Access Tunnel and the Wharekirauponga Access Tunnel. Details of management and monitoring for WUG, the borrow areas, TSF3, and GOP will be added to later revisions of this plan for certification by HDC prior to the activities commencing. WNP's LUC conditions are similar to those applicable to the existing and past operations, albeit with some amendments to blasting times and durations events per day and, for blasting in WUG, in the vibration levels due to the distance of the underground mine from any residences.

4 CONSENT CONDITION REQUIREMENTS

The full conditions relating to blasting in the Land Use Consents are included as Appendix A, B, C, D and E respectively. The key performance conditions are summarised below in

Table 1. The conditions include a range of requirements as follows:

- Blasting must be approved by the Mine Manager prior to being undertaken
- OGNZL to apply best endeavour measures to minimise blasting impacts
- A vibration or blasting management plan is required
- Fixed monitoring locations to be established (excludes WUG access tunnels and dual tunnels)
- Monitoring system to be automated to allow prompt analysis of results
- Monitoring to be conducted by suitably trained personnel using equipment compliant with the current Australian/NZ standards
- Vibration monitoring is required of all blast events
- Complete records are to be kept for each blast event
- Maintaining a website to present monthly mining plan and to log vibration results from the latest twenty blast events (excludes blast events in the dual access tunnels and WUG)
- A roving vibration monitor to be employed to record vibrations following complaints, and used to determine any need for additional fixed monitors
- Structural conditions surveys to be completed on selected properties prior to blasting commencement (applies to Correnso, Martha underground, Waihi North Project). The Correnso and Martha Underground surveys were completed prior to the commencement of mining these orebodies.
- Protocols for responding to complaints of blast-related property damage
- Reporting and mitigation actions required in the event of the vibration standards being breached
- Summary report on results, complaints and responses to HDC each quarter
- Systematic storage of records, reports and complaints
- Monitoring of Union Hill heritage features (apples to Correnso)
- Structural survey of the Cornish Pumphouse (Martha open pit and underground)

Table 1: Summary of Blast Vibration Conditions

Project Name	Project Type	Vibration Limit		Blast Windows		No. Blast Events	Maximum Blast Event 95%ile Duration (s)			Maximum Blast Event	Overpressure	AEP Applicable
		Average Dev/Prod	Maximum (95%ile)[1]	Days	Times	per Day	Production	Development	Combination	Duration (s)	(dBL)	
Martha	Open pit[2]		5[3,4] 5[3,4]	Monday-Friday[5] Saturday	1000-1500 1000-1200						128	
Martha	Underground	2/3[6]	5[7]	Monday-Saturday[5]	0700-2000	3	9	12	12	18		Yes
Gladstone	Open pit		5 1	Monday-Friday[5] Saturday	1000-1500 1000-1200						120	Yes
Correnso	Underground	2/3[6]	5[7]	Monday-Saturday[5]	0700-2000	3	9	12	12	18		Yes
Slevin	Underground	2/3[6]	5	Monday-Saturday[5]	0700-2000	3	9	12	12	18		Yes
MDDP	Underground	2	5	Monday-Saturday[5]	0700-2000	3		12		12		Yes
WNP borrow pits	Open pit		5 1	Monday-Saturday[5] All other times	0700-1800						120	Yes
WUG access tunnels[8]	Underground		5 1	Monday-Saturday[5] All other times	0700-2000			12		12	120	Yes
WUG dual tunnels	Underground		15									
WUG	Underground		15									

NOTES:
1 Determined over a rolling six-month period
2 Covers both the mining licence and EMMA
3 Must not exceed 10mm/s
4 Peak component vibration level at Cornish Pumphouse shall not exceed 25mm/s
5 Excluding public holidays
6 Compliance to be assessed separately for development and production blast events
7 Where practicable, production blasting to be restricted to the 1330 meal break
8 Includes the Willows and WUG access tunnels
9 Safety/maintenance blasts are allowed in the Martha and the WNP access tunnels at any time, within a vibration limit of 95% no greater than 1mm/s and a maximum duration of 2 seconds.
For the Correnso, Slevin and MDDP underground mines, these blasts have the same vibration and duration limits but cannot occur between 2000 to 0700 hours.
10 Simultaneous underground blasts must meet the vibration limits
11 All blasts within each blast event to be initiated at the same time while meeting vibration limits and minimising duration.
Restrict blast event durations to the minimum consistent with safe and efficient mining operations.

4.1 Definitions

Many of the consents contain a list of definitions as follows, with the applicable project indicated in brackets:

- A Blast Event is defined as an individual blast or number of linked individual blasts.
- A Development Blast is an event containing only development blasts. A development blast is defined as any blast
    - having a maximum instantaneous charge weight per hole of no more than 7 kilograms of explosive (Correnso, Slevin), or
    - used for creation or enlargement of a tunnel for the purposes of mine construction or access (Martha)[1].
- A Production Blast is defined as any blast:
    - in which a single hole contains a maximum instantaneous charge weight of more than 7 kilograms of explosive. Slot blasts are deemed to be production blasts (Correnso, Slevin), or
    - any blast that is not a development blast (excluding any blast for maintenance / safety purposes) (Martha)[1].
- Blasts outside of normal hours are subject to very low vibration limits. These blasts are typically for maintenance / safety purposes, (i.e., breaking over-sized rocks, trimming / slashing of backs, walls, and floors, firing of mis-fired explosives and removal of bridged stopes). The maximum vibration limit is typically a 95th percentile of 1mm/s and a maximum duration of 2 seconds.

Predictability of blasting times is recognised as a means of reducing and mitigating blast vibration effects for people. Therefore, it is of benefit to the community for OGNZL to restrict its Martha underground blasting events to regular blast windows where practicable.

Martha underground blasting is permitted to occur up to three times at any time between 7am and 8pm, Monday to Saturday, during which OGNZL will use best endeavours to fire:

- Blasts during the shift changes and meal breaks; and
- Production blasts during the midday meal break, when residents are more likely to be at work or busy at home.

For the WNP, development of the WUG Access Tunnel and the initial phases of the WUG decline will be managed and constrained in a manner similar to the Martha Underground. Once the WUG development extends beyond the reception of any private residences, blast timing, frequency and duration will be extended outside of the normally permissible underground blast windows. For the dual tunnels and WUG, more lenient blast limits recognise the distance between the blast area and the nearest properties being sufficient to attenuate vibration levels to undetectably low values. The proposed vibration magnitude is set to be protective of ecology (in particular, Archey's frog).

In recognition of its obligation to minimise blast effects on people, OGNZL will endeavour to keep each firing in areas other than the dual access tunnel and WUG close to a similar time each day and within each window to the extent practicable. In setting these timing targets, it must be recognised that underground mining is a complex undertaking, and that many factors can influence OGNZL's ability to have prepared each blast ready to fire at set times each available day.

For maintenance and safety reasons there may be times when blasting must occur outside the three targeted one-hour windows outlined above. These may not occur at night (2000 hrs to 0700 hrs) for

[1] While not explicitly stated in the consent, the same definition applies to WUG and its access tunnels.

Correnso, Slevin and MDDP, but may occur at any time for the underground components of Martha and WNP providing relevant vibration limits are complied with.

Compliance with the 95-percentile limit shall be determined:

- separately for development blast events and for production blast events (excluding the Martha pit and WNP),
- based on the highest recorded vibration for each blast event measured at any monitor located at a sensitive receiver (there may be occasions where we monitor nearer to the tunnel to collect vibration data to assist with the vibration predictions),
- where the blast type is assigned on a monitor-by-monitor basis according to the blast with the minimum scaled distance from each monitor, and
- based on a six-month rolling average.

At the start of each project, i.e. prior to six months of blasting, compliance with the 95-percentile limit is based on the initial 100 blasts of each type during which compliance is determined by no more than five exceedances occurring (WNP), or no more than one exceedance of 5mm/s in every 20 consecutive blast events (Martha).

Where an average limit is set, compliance shall be determined:

- separately for development blast events and for production blast events,
- determined separately for each blast monitor based on the total number of blast events in a six-month rolling period,
- where the blast type is assigned on a monitor-by-monitor basis according to the blast with the minimum scaled distance from each monitor, and
- only once the initial 100 blasts of each type have been fired.

As per Table 1 these requirements do not apply to the WNP.

5 BLAST NOTIFICATION

The notification system set out in the remainder of this section does not apply to the dual access tunnels or to WUG as blasting in these components will cause little to no effect on any private residence.

Prior and timely notification of an impending blast event can reduce the vibration effect for some people. In addition to advertising daily planned blasts on its website, OGNZL has to date implemented a daily manual process of advising residents of impending blasts, via email, txt, or phone. OGNZL has also implemented an automated Blast Notification System, comprising receiver units that will be offered to any concerned property owner/occupier within the project areas. The shot firer shall use the system to signal the impending production blast event prior to initiating the blast; initially 30 seconds. The delay between the notification signal and the firing of the shot may be adjusted from time to time, based on community feedback, to give the optimal practical warning time. The Blast Notification System will only be employed for blasts with a probable PPV of greater than 2 mm/s undertaken in the meal break (1330 – 1430) window.

While the automated Blast Notification System is the preferred method, there may be special circumstances where it is appropriate to retain one or other of the original notification methods.

5.1 Website

OGNZL will continue to provide blasting advice on its website (www.waihigold.co.nz/blast-times/) for its current operations. This will include all underground operations, and provide the following:

5.1.1 Monthly

At the start of each month, a plan showing the areas to be mined (and hence blasted) during that month shall be prepared and loaded onto the site (https://www.waihigold.co.nz/newsletters/mining-matters/). The downloadable pdf version of the plan shall also be available and hard copies made available to the Waihi Information Centre & HDC Waihi Service Centre.

While OGNZL will use its best endeavours to restrict its blasting to the work areas defined on the plan, it is recognised that operational constraints must dictate and may lead to deviations from the plan during the month.

For the Wharekirauponga Access Tunnel only, at the start of each calendar month a two-dimensional plan showing the existing Access Tunnel and the proposed areas where blasting will occur and where the face of the Access Tunnel will progress during that month, will be loaded onto OGNZL's website. A hard copy of the plan will be available for collection from the Waihi Information Centre and HDC's Waihi Service Centre.

5.1.2 Daily

Each morning, the intended times, locations and depths of the planned production blast events for that day will be provided on the website.

As soon as practicable following each blast event, the vibration magnitude recorded at each of the vibration compliance monitors will be presented on the website. The site will keep a running display of the last twenty blast events. Getting the data onto the website promptly requires automation, and it is not practicable to manually interrogate the results for erroneous data; as such, the results remain provisional until verified.

6 MANAGEMENT OF EFFECTS

6.1 Mine Planning and Mining Methods

The size of blast and hence the management of blasting effects starts with appropriate mine planning and design.

Management of blast vibration therefore needs to be a critical consideration in all areas of mine design and planning. For example, the selection of the sub-level spacing determines the length of blast holes and hence the charge weight that can be effectively applied when production blasting. All aspects of mine planning and design will be appropriately applied to achieve a balance between productivity, cost-effectiveness and vibration minimisation.

Mine planning typically utilises modified Avoca technique for most stoping but may require the use of Overhand Cut and Fill mining methods in the upper levels of the orebody. Cut and fill mining is not a particularly cost-efficient or productive mining method, however it may be necessary in the upper levels to minimise vibration at the surface. Once there is sufficient separation between the surface and the areas being mined, mining can revert to more productive methods, e.g., modified Avoca or transverse stoping.

6.2 Blast Design

6.2.1 Introduction

Construction to the approved mine plan determines the maximum length of blasthole for the production blasts, which are the blasts more likely to generate elevated vibration levels. The parameters then available for adjusting blast design are;

- The blasthole diameter;
- The explosive density; and
- The uncharged length of blasthole (stemmed length).

These parameters need to be selected to ensure blasting results in sufficient fragmentation of the blasted rock while achieving consent compliance and minimising detrimental vibration effects. Blasting at the Martha pit since 1989 and at the first underground mine, Favona, since early 2005 has provided an excellent base of experience for the ongoing and future open pit and underground blast design and vibration management.

The vibration data from these projects have been analysed using techniques consistent with the recommendations provided in the Australian Standard AS2187 and/or other accepted methods of analyses. The equation typically used to predict the level of vibration at Waihi for a given explosive quantity and distance has the following form (Equation 1):

$$PPV = K \times \left(\frac{d}{\sqrt{w}}\right)^{\beta}$$

where:

PPV = peak particle velocity (vector sum), expressed in mm/s;

K = an attenuation constant;

d = the distance between the blast and the monitor, expressed in m;

w = the Maximum Instantaneous Charge (MIC), in kilograms;

β = a constant, which for Waihi has been determined as -1.49; and

$d/\sqrt{w}$ = the scaled distance term

To provide an initial default blast design, the 95% design relationships to be used will use the following values for K;

Type of Blasting	K Value
Underground development	1990
Underground production	2525
Open pit & borrow area production	3520
WUG	1990

6.2.2 Blast Design Procedures

In practice, these relationships are likely to require modification based on the results of the vibration recording for each mine area. The application of statistics and in particular the design of a blast via an amended vibration relationship similar as outlined above does not need to occur for every blast. The practice used throughout is to:

1. Use the above equation as the starting point for the initial blasts at any new element of the operation, but to be conservative in charging the blast-holes until there are sufficient data to confirm or refine this relationship.
2. Apply the previous blast design once it is demonstrated to achieve compliance with the consent conditions and the objectives of this Plan, with adjustments where the previous recorded vibrations dictate.
3. Undertake statistical analyses using the recorded blast data to update the above applicable relationship for designing the ongoing blasting.
4. Adopt a conservative charge weight, i.e. less than indicated as applicable by the adjusted 95% design relationship, for the initial long-hole production blasts until there are enough data to confirm or refine this relationship.
5. Apply the maximum calculated charge weight to the blast designs once it is demonstrated to achieve compliance with the consent conditions and the objectives of this Plan, with adjustments where the previous recorded vibrations dictate.
6. Repeat steps 3 to 5 when blasting moves to a new area within the mine, or in areas where difficulties have already been experienced.
7. In instances where compliance has proven to be difficult to achieve, the design shall be interrogated further to include detailed analyses based on the available data from previous blasting specific to, or near, that location.

All blasts are designed by Production Engineers and are reviewed and approved by a Senior Technical Services staff member. This review includes checks on the maximum instantaneous charge, timing and sequencing, and considers the results of previous firings in the same area.

OGNZL has also modified Envirohub (Section 7.2) to enable blast vibration history to be reviewed by level and location to inform subsequent blast designs. This process will continue throughout the life of projects.

The updated statistical analyses and revisions to the design relationship referred to in the steps above shall be undertaken by Heilig & Partners.

6.2.3 Blasting Protocols

<u>Underground Development and Cut & Fill Blasts</u>

- Generally, for development there are no more than 8 holes on any one delay.
- Typically, a charge weight per hole of no more than about 5kg will be used unless previous blasts have indicated a higher-than acceptable vibration. Where elevated vibration is experienced, the blast design will be reassessed as outlined above in s6.2.2.

<u>Underground Development – Tunnelling</u>

For WNP development (tunnelling) blasting pyrotechnic delays will be used for all of the charged holes in the development face and then a single Orica Ikon electronic starter detonator for each blast to initiate the pyrotechnic delays.

Underground Slot Blasts

- Slots will be blasted in lifts, with each lift being generally no more than around 5 metres, unless ground conditions or safety dictate otherwise.
- An MIC of around 18kg will be used in each lift.

Underground Production Blasts

- For production blasts other than in WUG, as far as practicable blasts with a predicted PPV of greater than 2 mm/s are to be fired between 1.30 – 2.30pm. Production blasts with a predicted PPV of less than 2 mm/s may be fired during the morning (7.00am - 8.00am) and evening (7.00pm – 8.00pm) blast windows.
- WUG production blasts will be designed to generate vibrations of no more than 15mm/s at the ground surface directly above each blast. Firing times will be driven by operational requirements.
- The MIC is selected based on the procedures outlined above in s6.2.2 to achieve an acceptably low level of vibration while maximising the efficiency of the blast. For about one third of the production blasts in the mid to upper levels of the Martha orebody, a charge weight of less than 20kg per delay will be required, with a further one third of production blasts able to be fired with 20-30kg per delay. These reduced charge weights may be achieved by decking. At the bottom of the mine, the remaining productions blasts can be mined with a single column of explosives and an MIC of around 30kg per delay. Fewer restrictions apply to the MIC selected in WUG, which provides for production blasting at the higher permitted vibration levels while still maintaining compliance with the prescribed vibration limit.
- OGNZL uses IKON electronic detonators, recognising the need to control vibration magnitude and duration. These can be programmed for between 1 millisecond out to 15,000 milliseconds (note that the conditions of consent for underground production blasting other than at WUG limit the maximum delay to 8050 milliseconds). Production blasting at WNP will use IKON electronic detonators exclusively.
- The above routine protocols have come about after extensive modelling and trial blasting; there is a check process for each stope blast design. If there is a need to increase the size of patterns above and beyond standard practice, blast plans are sent to Heilig and Partners Pty Ltd for review.

Underground Maintenance/Safety Blasts (Martha)

- Because the limit for these blasts is 1 mm/s, these are necessarily small charge blasts, likely to be no more than a few holes, and in most cases decoupled from the host rock. These blasts include breaking over-sized rocks, trimming / slashing of backs, walls and floors, firing of mis-fired explosives and removal of bridged stopes

Open Pit and Borrow Area Blasts

- Blasting of the open pits will be designed around benches varying between 3 to 10 metres blasthole depths, with the blasting the environmentally sensitive areas adopting the smaller blasthole depths. As a guide, the blasting configuration for the various blasthole depths with ½ metre of sub-drill, an 89 mm diameter blasthole, a 2.3 metre uncharged collar height and loaded with bulk explosive is considered the base condition. The uncharged collar length of 2.3 metres is proposed to control any ejection of material from around the blasthole.
- The larger 10 metre benches are only expected to be used for the Borrow pits. Both Martha and Gladstone open pits will be primarily designed with 5 metres benches.
- Due to the time that has passed since the last open pit blast, to confirm the modelled vibration levels from the blasting, a small trial blast of around 10 holes will be completed prior to the restart of blasting to calculate the vibration/distance and explosive quantity relationship for each

open pit. The trail will involve monitoring vibration levels at 5 to 10 locations around the blast area.

Irrespective of blast type, OGNZL has procedures that utilise the blast design for management of the blasting process; from marking out the blast pattern, for drilling through to charging, firing, and managing misfires.

6.3 Air-blast Overpressure

Overpressure from blasting refers to the momentary levels of pressure above atmospheric pressure. It is measured with no frequency weighting (dBL), cf. noise, which is weighted to account for human audibility (dB A-weighted).

The most observed effect of elevated overpressure levels is the associated rattling that it may cause to some parts of a dwelling, such as ill-fitting windows, loose timber panelling and so on. In this manner, the effect is often confused with that of elevated vibration.

At low levels of overpressure like those generated by well controlled blasting, the effect is not detrimental to people, is incapable of damaging any property, and furthermore, unlikely to cause rattling and other side effects mistaken for increased vibration levels.

Other than during initial portal and decline blasting, overpressure is very unlikely to be an issue with underground mining. Managing this short-term effect is addressed below in section 6.3.2.

Compliance with an overpressure level of 128 dBL has previously been a condition of blasting for the Martha open pit. Given the low levels of overpressure that have been recorded and the demonstrated compliance with the limit, regular monitoring for compliance is not routinely undertaken but rather assessed in the uncommon instance of overpressure related complaints, or where infrequent blasts that could generate elevated overpressure levels are planned, such as pre-split blasting. However, for GOP and the borrow areas as well, the maximum overpressure will be measured for all blasts at a minimum of one monitoring station, in accordance with c29-d. Note: the maximum limit of overpressure in the WNP has been set at 120 dBL, which is aligned with section 8.3.2.3 2(b) of the Hauraki District Plan.

6.3.1 Martha Pit, GOP and Borrow Area Overpressure Management

Through appropriate blasting practices and blast design guidelines that vary the scale of blasting according to the distance to the nearest sensitive receiver, the levels of overpressure can be controlled to acceptable and compliant values. For example, for surface blasting, the uncharged collar length of 2.6 metres in blastholes will aid limiting air overpressure levels and control any ejection of material from around the blasthole. With the separation distance between surface blasting and the nearest receivers and the blasting controls to minimise vibration, overpressure levels for surface blasting have been assessed as low by the overpressure modelling.

Overpressure is not expected to be a major issue associated with blasting within the Martha pit provided care continues to be applied to the design, loading and firing of all blast events.

Overpressure modelling assessed overpressure levels from blasting in the upper area of the GOP where the pit geometry is not as beneficial in shielding and reducing overpressure levels as will occur at the deeper areas of the pit. In these circumstances, the minimum separation distance between the blast and the properties is around 300 metres, and with an explosive weight of 16 kilograms, the expected overpressure levels will be less than 115dBL. Similar magnitudes of effect are expected from blasting in the borrow areas.

6.3.2 Tunnel Overpressure Management

WNP will develop three portals for underground access (the Willows Tunnel, the WUG Access Tunnel, and a new MUG portal to re-establish access when GOP progresses). Blasting during the initial development phase for each of these has the potential to generate overpressure that requires careful management.

Experience from the Favona portal blasting has shown that the greatest effect on overpressure levels is the distance between the blasting face and the portal. At chainages very near to the portal and for properties very near to the portal (<200 metres), almost irrespective of the design and the additional measures implemented for controlling overpressure, compliance with 120dBL is only expected to be achieved through strategic placement of the portal, adequate separation distance to the sensitive receivers, effective shielding of properties through topographical barriers, potential barricades in the decline, and well implemented blast designs and practices.

Preliminary modelling was based upon an overpressure level of 138dBL at a location 30 metres in front of the portal with an attenuation of 6BL for every doubling of distance. This is consistent with the measurements taken during blasting of the initial section from the Favona portal face when it was constructed. Based on this experience, the separation distance between the initial blasting at each of the proposed portals and the nearest residence is sufficient for the overpressure to attenuate to levels less than 120dBL.

Compared with the two portals near the Baxter Road SFA, overpressure from blasting at the Willows Portal will be less of an issue as the nearest residence is over 800m away and shielded by topography and the orientation of the portal.

Overpressure levels will be monitored at the nearest occupied residence to the tunnel portal as well as the closest property located in front of the tunnel portal. The two locations may be represented by the same property. The measured overpressure levels will be assessed against the compliance criterion and where it is shown that the values are repeatably compliant and the levels are displaying a decreasing trend, a proposal to cease overpressure monitoring shall be submitted to the HDC. The measured overpressure results shall be submitted aspart of the proposal.

If the measured overpressure levels approach or exceed the compliance limits, mitigation measures will be implemented to control the overpressure values. The mitigation could include minor changes to the blast design where the reductio in overpressure level is not greater than a few dB. Any instances where the more significant reductions in overpressure levels are required, one or more physical deflection methods may be implemented and include:

- Portal shields, large steel plate deflectors, are useful for nearby receptors, but may have limited use for more distant residents.
- Tunnel blockages (such as concrete blocks or trucks parks across the decline), with effectiveness depending on the blockage's mass and the proportion of the tunnel blocked.
- Water sprays (unproven, but there is evidence of success in European civil construction).

6.4 Blast Fumes

All nitrate-based blasting explosives produce large volumes of gas in very short time frames. The action of these gases facilitates the rock breakage process, and they therefore remain an integral component of an effective blasting program. Under ideal detonation conditions, the gases produced are nitrogen, carbon dioxide and water (vapour), all of which are colourless gases. Under non-ideal detonation conditions, undesirable gases are also produced and includes the oxides of nitrogen (NO and NO_2) and carbon monoxide. NO_2 is a red coloured gas and it is the observation of this gas after a blast which is

commonly described as “post-blast fume”. Such incidents are generally only applicable to the open pit blasts.

6.4.1 Fume Management

While there are multiple causes that can contribute to non-ideal detonation of nitrate-based blasting explosive, bulk explosives are formulated and manufactured to minimise post-blast fume when used in accordance with the technical data sheet recommendations. Controls, decisions and practices at the time of blast hole charging can have an impact on the potential for post-blast fumes.

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 are conditions that have a higher risk of producing post-blast fumes. These factors are considered in the blast design and scheduling process.

As part of the OGNZL Blast Safety Management System, several control measures for addressing post-blast fumes are assessed. These techniques include conservative blast patterns, effective stemming, and utilising explosives that produce relatively low emissions. The same successfully applied procedures for Martha open pit will continue to be implemented for the GOP and borrow area blasting. Because of the very low likelihood of a post-blast fume event occurring when blasting at these latter sites, the recommendation is to continue with the existing Management Plan practices.

6.5 Fly-Rock

Fly-rock refers to the movement of rock beyond a small working area around the blast pattern, commonly of the order of 20 to 50 metres. This outcome is only a consideration for open pit blasting.

Like ground vibration and air overpressure, fly-rock can also be controlled, as demonstrated by the few and isolated instances of fly-rock that have occurred from the many thousands of blasts that have occurred at the Martha open pit.

6.5.1 Fly-Rock Management

The blasting method used will minimise the risk of fly-rock; the primary controls being the paddock blasting practice, the use of electronic detonators, and quality stemming. In addition, the restrictive vibration limits OGNZL operates under constrains the blast hole charge weights, and experience over the many years of mining has demonstrated that fly-rock is unusual.

The paddock blasting method generally practiced at Martha, and to be used at GOP and the borrow areas, means that each shot is fired against broken rock and there is no vertical face from which fly-rock is liable to ejected. With electronic detonators, at-risk holes (those overloaded or with short stemming) are identified and fired at the end of the shot by which time most of the explosive has been destroyed leaving only the detonator and booster to fire.

Another existing mitigation practice includes videoing each shot. If any precursors are observed (e.g. stemming ejection or face bursts) additional controls such as increasing the uncharged collar depth or modifying confinement can be introduced for future blasts.

Blast mats are available, to be laid on top of the blast, if there is a further demonstrated need to manage fly-rock.

Prior to any blasting programme beginning, a specific risk assessment (involving technical and practical expertise) will be required to determine appropriate practices to manage the various risks of blasting.

Fly-rock will be one of those risks that will be required to be managed. Reporting of this risk assessment may be through either redrafting the Blasting and Vibration Management Plan or, more likely, a specific risk assessment workshop (the findings of which will be appended to the Management Plan). Potential risk control measures may include, if the risk assessment deems them necessary, the monitoring of blasts using video cameras and the rating of collar and free-face venting for each blast fired.

The initial blasts for each tunnel will necessarily include the movement of the blasted rock to facilitate breakage of the rock mass and achieving advancement of the tunnel. It is proposed that these initial blasts will incorporate an increased collar length to limit the velocity of the movement of the blasted rock. In addition, blast mats may be placed over the face, or containers or other barriers placed in front of the face, to limit the travel of any fly-rock.

7 MONITORING

7.1 Structural Condition Surveys

For structural surveys, OGNZL utilises BRANZ as an independent, suitably qualified and experienced engineering firm. They have been undertaking surveys at Waihi for many years and understand the requirements relating to visual inspections and video records.

For the Martha underground project, c55 required BRANZ to undertake structural condition surveys of residential properties over the Rex ore body prior to any blasting in relation to Rex. OGNZL offered the survey to all properties above the Rex ore body. At least five representative properties were surveyed, along with two ‘control’ properties away from the potential vibration effects from mining.

Also, as a consent requirement for the Martha underground, c33(l) required an engineering survey into the structural integrity of the Cornish Pumphouse prior to blasting within a 250m radius (horizontal or vertical) of the pumphouse. Particular emphasis of the survey is to be on changes that are likely to be caused by blast induced vibrations. The survey will be repeated every five years, unless agreed otherwise by HDC

For the WNP, c50 requires similar structural condition surveys to be undertaken (if agreed by the property owner) for five representative properties within each area, prior to any blasting under the consent. The objective is to confirm the current structural condition of the surveyed houses against which any future complaints of property damage resulting from the blasting can be compared. The specific houses to be considered for this will be determined once the WUG Access Tunnel alignment is finalised.

7.2 Envirohub

The Envirohub vibration monitoring system (VMS), previously called Blasthub, has been utilised as the blast vibration monitoring system since 1 January 2005 (HDC approval reference 64.601.001 dated 8/3/05). The system provides real-time, web-based monitoring that is accessible to both HDC and OGNZL and includes automatic email notification of blast events that trigger two or more monitors.

Results from blast monitoring are automatically loaded onto Envirohub from the vibration monitoring network (Figure 2), along with manual loading of details of the blast design and plan. A schematic of the VMS is shown in Figure 1.

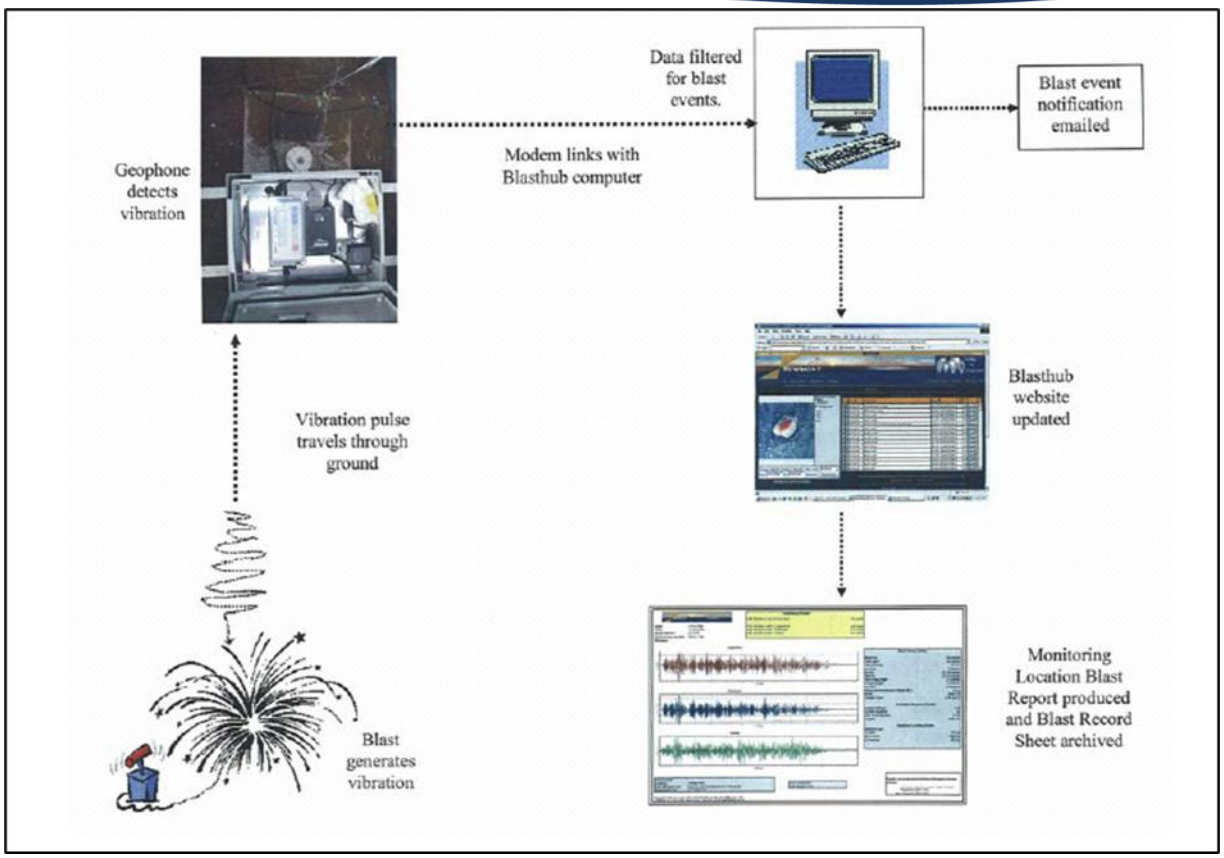


Figure 1 – Schematic of Envirohub Vibration Monitoring System

Heilig and Partners Pty Ltd compares the corresponding plans/results and provides an external review, developing recommendations when necessary for on-going blasting plans and procedures to ensure compliance (with a safety margin).

Results are accessible for review on an internet website (http://oceanagold.envirohub.com). Access to the website is controlled by the OGNZL Superintendant – Environment, with permission for review provided to HDC staff and OGNZL users.

7.3 Monitoring Locations

The locations of the vibration monitors installed around Waihi and the mining-related activity are shown in Figure 2 to Figure 4 and listed in Table 2. Each vibration monitor has four recording channels. An external geophone (transducer) monitors vibration in three directions (Transverse, Vertical & Longitudinal particle velocities). Ground vibrations generated by a blast are detected by the geophone generating a variable voltage trace. From this data a Peak Particle Velocity (PPV) is generated.

The fixed monitors have pre-set recording period and vibration trigger levels (see

Table 1). After recording an event a monitor will automatically dial the Envirohub computer to download the data. In addition, each monitor has a “dial home” schedule for administrative checks. Downloaded data is filtered by Heilig & Partners Pty. Ltd. to classify blast events from erroneous events (activities such as vehicular, livestock, seismic, etc.). Blast Location Monitoring Reports (summarising results & displaying vibration traces) are generated and incorporated into the Envirohub database.

While all other monitoring installations are permanent, for monitoring the development of the WUG Access Tunnel (linking the WUG to the existing Processing Plant) roving monitors will be deployed when the developing tunnels are near any private residences.

For the Willows Access, monitoring locations will be positioned around the tunnel alignment to best provide data that can be used to establish the vibration relationship for the development blasting. This data will be analysed and used to further refine the blasting, including that planned for the WUG access tunnels. The vibration monitors will be relocated as the blasting progresses to ensure the most appropriate data is recorded. Each blast will be monitored at several locations during this data evaluation period. Once sufficient vibration data has been recorded, blast monitoring is proposed not to continue unless further data for analyses is required.

As discussed further in s7.6, roving monitor results are to be entered into Envirohub to ensure a full record is kept of all compliance monitoring.

Figure 2 – Fixed Vibration Monitors for Martha Pit and Underground and for GOP

Figure 3 – Fixed Vibration Monitors for GOP and Borrow Pits

Figure 4 – Monitoring Locations for the WUG Access Tunnel

Table 2 – VMS Monitor Locations and Configurations

Name	Location	Monitor Co-ordinates (Old Mt. Eden)			Recording Period	Threshold[1]	Operating Schedule[2]	Applicable Consents[3]
		X	Y	RL				
Main North	47 Gladstone	396544.2	643492.1	1121.4	18 seconds	0.75mm/s	Continuous	Cor, SUPA
Main Central	29 Gladstone	396497	643283.4	1119.4	18 seconds	0.75mm/s	Continuous	Cor, SUPA
Main South	16 Gladstone	396545.8	643094.1	1117.9	18 seconds	0.75mm/s	Continuous	Cor, SUPA
Secondary East	23 Mataura Rd	396781.2	643388.8	1120.4	18 seconds	0.75mm/s	06:30 – 20:30	Cor, SUPA
Secondary SE	60 Barry Rd	396739.8	643022.5	1117.4	18 seconds	0.75mm/s	06:30 – 20:30	Cor, SUPA
Secondary SW	28 Roycroft St	396251.0	643049.2	1113.5	18 seconds	0.75mm/s	Continuous	SUPA, PM
Secondary West	22 Slevin St	396246.0	643262.5	1115.5	18 seconds	0.75mm/s	Continuous	SUPA, PM
Central School	Central School	395075.1	642730.8	1116.9	18 seconds	0.75mm/s	Continuous	PM
Pensioner Flats	Pens Flats	395674.2	642704.1	1115.1	18 seconds	0.75mm/s	Continuous	PM
Waihi CBD	47 Seddon St	395309.7	642592.0	1116.1	18 seconds	0.75mm/s	Continuous	PM
Pitt Street	Pitt St	395185.4	643301.1	1125.6	18 seconds	0.75mm/s	Continuous	PM
Grey Street	Grey St	396091.6	643365.7	1117.3	18 seconds	0.75mm/s	Continuous	PM
Islington Tce	Islington Tce	395006.3	643023.3	1125.6	18 seconds	0.75mm/s	Continuous	PM
Bulltown Road	Bulltown Rd	395440.3	643576.9	1148.2	18 seconds	0.75mm/s	Continuous	PM
Rex North	Kenny St	395711.3	642684.4	1111.3	18 seconds	0.75mm/s	Continuous	PM
Rex East	Kenny St	395889.7	642697.0	1109.7	18 seconds	0.75mm/s	Continuous	PM
Rex South	Gilmour St	395769.5	642585.8	1107.8	18 seconds	0.75mm/s	Continuous	PM
Rex West	Mueller St	395586.3	642539.8	1111.4	18 seconds	0.75mm/s	Continuous	PM
Scout Hall	Baker St	396219.5	642542.7	1118.5	18 seconds	0.75mm/s	Continuous	WNP
Moore St	Moore St	396840.2	642909.2	1116.5	18 seconds	0.75mm/s	Continuous	WNP

[2] *The threshold and operating schedule may need to be varied (with HDC written approval) if extraneous vibration readings cause the monitors to fill and go into 'idle'.*
[3] *Applicable consents: Slevin (SUPA), Project Martha (PM), Waihi North Project (WNP)*

Name	Location	Monitor Co-ordinates (Old Mt. Eden)			Recording Period	Threshold[1]	Operating Schedule[2]	Applicable Consents[3]
		X	Y	RL				
Boyd Rd	Boyd Rd	397165.6	643053.8	1119.6	18 seconds	0.75mm/s	Continuous	WNP
Clarke St	Clarke St	396624.9	642315.0	1094.9	18 seconds	0.75mm/s	Continuous	WNP
Borrow Pits 1-3	Refer to Figure 3	tba[4]	tba	tba	18 seconds	0.75mm/s	Continuous	WNP
GOP 1-2	Refer to Figure 3	tba	tba	tba	18 seconds	0.75mm/s	Continuous	WNP
Willows Access Tunnel	Roving	na	na	na				WNP
Wharekirauponga Access Tunnel	5 locations as per Fig. 4	tba	tba	tba				WNP

[4] Blasting is not scheduled to start within the borrow pits or GOP for several years. The locations of the monitors will be confirmed prior to the first blast within the mine.

7.4 Compliance Determination

7.4.1 Overview

Land use consent conditions from some elements of mining (Slevin c8(c-d), and Martha Underground c33(d-e)) require that blast vibration compliance be assessed separately for development and production blasts against permissible maximum and average levels of vibration. For Slevin, a blast will be classed as either development or production on the basis of whether the maximum instantaneous explosive weight (MIC) is less than or greater than 7 kilograms respectively. For Martha Underground, the definition is based on activity; a development blast being a blast used to create or enlarge a tunnel for mine construction/access, a production blast is 'not a development blast' (except blasts for maintenance/safety purposes).

Calculating the average level of vibration for development and production blasting where required by consent will occur within the Envirohub program and the results displayed on a compliance page within Envirohub where data specifically relating to the compliance statistics will be shown. The statistics page will show for each of the approved monitoring locations[5] the average level of vibration for both development and production based upon the six-month rolling period (or for the first 100 blast events, whichever occurs later). The data will be displayed for each of the individual monitoring sites. The page will also display trend graphs for each monitoring site showing the variation in the average level of vibration with time.

Envirohub assigns vibration value for all production and development blasts, including blasts that are initiated simultaneously within a single blast event. The assigning of a specific blast to a recorded vibration will be based on the blast with the minimum scaled distance from each monitor.

Vibration levels for each blast will be assigned (where that blast has the minimum scaled distance) or back calculated using the K value for that blast/monitoring configuration. Only the single highest value for each blast type within a blast event will be used for calculating the average and 95% compliance statistics.

7.4.2 Scaled Distance

As described in s6.2.2 (blast design), the convention for estimating the magnitude of vibration is expressed by the following equation (Equation 1);

$$PPV = K \times \left(\frac{d}{\sqrt{w}}\right)^{\beta}$$

where:

PPV = peak particle velocity (vector sum), expressed in mm/s;

K = an attenuation constant;

d = the distance between the blast and the monitor, expressed in m;

w = the MIC, in kilograms;

β = a constant, which for Waihi has been determined as -1.49; and

$d/\sqrt{w}$ = the scaled distance term

[5] Plus any additional sites that may be identified through the roving monitoring and agreed in writing by HDC.

The scaled distance is therefore a term that encompasses the distance between the blast and the monitoring location divided by the square root of the MIC.

7.4.3 Assigning Blasts to Monitored Vibration Results

When multiple blasts are fired within a single blast event, the maximum vibration recorded at each monitor will be assumed to have been generated by the individual blast with the minimum scaled distance value, irrespective of the type of blast (development or production).

Once assigned to a recorded vibration level, the K value for the blast generating the maximum vibration is the only unknown but can be readily calculated by manipulating the above equation thus (Equation 2);

$$K = \frac{PPV}{\left(\frac{d}{\sqrt{w}}\right)^{\beta}}$$

The same approach is applied to blast events that contain only a single blast.

7.4.4 95% Compliance

Compliance with the 95th percentile limit (Slevin c8(c-e), Martha c33(d-e), and WNP cc32-35) shall be based on the highest recorded vibration for each blast event measured at any monitor, i.e. after each blast event, a single vibration reading will be added to the historical readings, with that reading being the highest level obtained from the entire monitoring array. Separate records will be maintained for development blast events, production blast events and open pit blast events (excl WNP, see s7.5 for WUG monitoring), where the blast type is assigned on a monitor-by-monitor basis according to the blast with the minimum scaled distance from each monitor. Envirohub will also classify the blast events into Correnso, Martha, or WNP based on the assigned monitors within each projects' network, enabling corresponding reporting of compliance.

The reported percentile level for each type of blast event will be derived over a rolling period of 6 months. For the first 100 blast events within new mining elements, e.g. the WUG Access Tunnel and Gladstone pit, no more than 5 may exceed 5mm/s. Given the long term without any blasting in the Martha pit, the same limits for the first 100 blasts apply. Thereafter, compliance will be reported as a percentage.

The primary OGNZL response required for higher level blasts is the requirement for investigating and reporting individual blast events that exceed the 5mm/s level (Correnso c22(c-d), Slevin c14(c-d), MDDP c18(c-d), Martha c50-51 and WNP cc32, 33 and 35) or 6mm/s (Trio c9). For WUG, the trigger value for investigation and reporting is 15mm/s (WNP c34).

7.4.5 Averaging Procedure

The algorithm (agreed between HDC and OGNZL) for calculating the average vibration value will be coded into Envirohub and unable to be altered without the agreement of HDC and OGNZL. The algorithm will calculate the average level of vibration according to the following definitions:

a) A blast event may comprise only development blasts or production blasts, or a combination of both types, initiated simultaneously;
b) Each blast within a blast event will be classed as either development or production depending on its relevant criteria (refer blast type definitions (s4);
c) For calculation of average PPV levels, independent average levels will be calculated for development and production blasts;

d) For calculation of average PPV levels, independent average levels will be calculated at each permanent vibration monitor;

e) After each blast event, and at each permanent monitor location, a single PPV level will be added to either the development or production database to update the average PPV value, and the only exception to this will be when a blast event contains both development and production blast types, in which case a single PPV will be added to each of the development and production blast databases. The second level will be calculated using the same K value derived from the dominant blast type which was estimated to have produced the measured PPV, based on the blast type with the minimum scaled distance to the monitor. The level assigned to each blast-type database will represent the highest vibration level recorded from all of the blasts of that type fired in that event. The following examples are provided for clarity:

   i. Where a blast event contains multiple development blasts, and no production blast, Envirohub will identify the blast with the minimum scaled distance, and the PPV for the entire event will be assigned to that particular development blast. The development blast vibration database, and the average PPV for development blasting will be automatically updated by the addition of one new value, being the PPV as measured at that monitor location.

   ii. Where a blast event contains multiple production blasts, and no development blast, Envirohub will identify the blast with the minimum scaled distance, and the PPV for the entire event will be assigned to that particular production blast. The production blast vibration database and the average PPV for production blasting will be automatically updated by the addition of one new value, being the PPV as measured at that monitor location.

   iii. Where a blast contains a mix of both production and development blasts, Envirohub will identify the blast with the minimum scaled distance and determine whether it is a production or development blast by reference to supporting documentation. The procedure described in a) or b) above will then be followed for that blast type. In addition, Envirohub will calculate the appropriate K value for that blast and apply that K value to estimate the highest PPV for the other blast type with the minimum scaled distance (considering only the blasts of the second blast type). The single estimated PPV for the second blast type will also be added to the vibration database for that blast type.

f) Where a permanent monitor fails to trigger, that monitor will be assigned a PPV equal to two thirds of the threshold trigger level, which will nominally be set to 0.75 mm/s. The assumed PPV will be assigned to the blast type with the minimum scaled distance, and, if necessary, a PPV will be back-calculated for the other blast type using the method described above. The trigger threshold level at each monitor will be set as low as possible to avoid bias in assumed PPV levels but will also be set so as to avoid excessive spurious triggering and possible loss of critical blast event data.

g) For completeness, for those blast events consisting of only a single type, the K value will also be calculated using Equation 2;

h) For each blast event type, the average level of vibration will be calculated by summing the measured, calculated or inferred level of vibration for each event type initiated over the previous six-month period and dividing by the number of blast events of that type that occurred within the same period;

i) The average values will be recalculated each day for each monitoring location and for each blast type and the values appended to the trend graphs. Envirohub will also be able to classify the averages based on which project (Correnso/Slevin/MDDP or Martha) the blasts and monitors are assigned to.

For each blast within every event, the blast, K value, distance and MIC will be recorded within Envirohub. The tabulated data will be available for export to permit any further analyses as and when required.

7.5 WUG

7.5.1 Overview

Vibration limits on blasting in WUG is proposed to avoid potential effects on Archey's frogs and that will be protective of historical features and recreation values in the area above the mine. Monitoring the level of vibration at WUG is complicated by accessibility and operability within the heavily vegetated terrain above the orebodies and an alternative monitoring approach will be undertaken.

Monitoring the vibration from the WUG blasting activities will include measuring vibration at selected proxy locations within the underground mine and adjusting the level to reflect the value that would have been measured at the surface. This will use the same equipment and assessment software that has been successfully used previously for blast monitoring, including the predictive models used for the Amenity Effect Programme (AEP) calculations (s11.1). Vibration levels will be monitored from sensors securely mounted in cuddies off the upper levels of the underground mine development. Using algorithms consistent with those currently used for the AEP calculations, the level of vibration at representative locations on the surface will be extrapolated from the measured underground results.

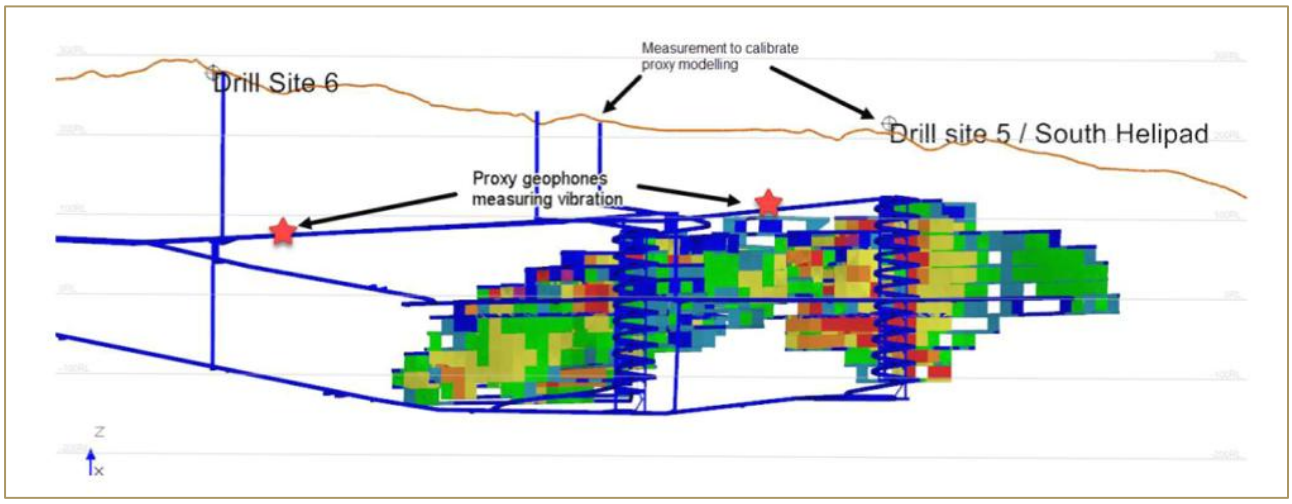


Figure 5 – Proposed monitoring locations within underground network

7.5.2 Assessing Compliance

A blast event may comprise of multiple blasts, including development blasts or production blasts, or a combination of both types, initiated simultaneously.

At each proxy monitoring location, all blasts within the blast event will have a vibration level assigned to enable the calculation of the vibration level at the existing ground level immediately above the blast location.

The measured vibration level at the proxy location will be assigned to the blast with the minimum scaled distance ($d/\sqrt{w}$). Based upon the measured vibration level, distance and explosive weight used in that blast, the blast event K value will be determined. The calculated level of vibration for the other blasts within the blast event (i.e. the development or production blast that were not responsible for the peak

level of vibration) will be determined according to the associated blast parameters including the derived K value.

Based upon the distance between each blast and the proxy location, the level of vibration at the ground surface immediately above the blast will be determined from the following equation:

$$PPV = PPV_{recorded} \cdot \left(\frac{d2}{d1}\right)^{-1.49}$$

where:

d1 = vector distance from the blast to the proxy vibration monitor; and
d2 = vector (vertical) distance from the blast site to the ground surface.

The assigned blast to a measured level of vibration could vary for different proxy monitoring locations depending upon the proximity of the blast to the monitor and the MIC of the blast.

The resulting PPV for each blast in an event will be compared against a value of 15mm/s to check compliance.

If proxy monitor is not triggered by a blast event, the vibration level for individual blasts at either the proxy monitoring location, or the specified surface locations, will be calculated based upon the explosive weight and a pre-determined K value derived from historical data. The modelling parameters will be selected to ensure the calculated vibration levels are not greater than the threshold value for the monitor.

7.5.3 Monitoring System Calibration

At regular intervals (defined as either annually or when the area of mining relocates to another area within the mine) several blasts will be monitored on the surface to confirm the accuracy of the predictive algorithm and the reliability of the predicted vibration levels.

Calibration monitoring will require the establishment of surface monitoring location sites. The proposed verification site locations are shown in Figure 6, noting that not all locations need be monitored simultaneously for the verification purposes. But as a minimum, monitoring at two locations within reasonable proximity to the underground blast sites will be undertaken.

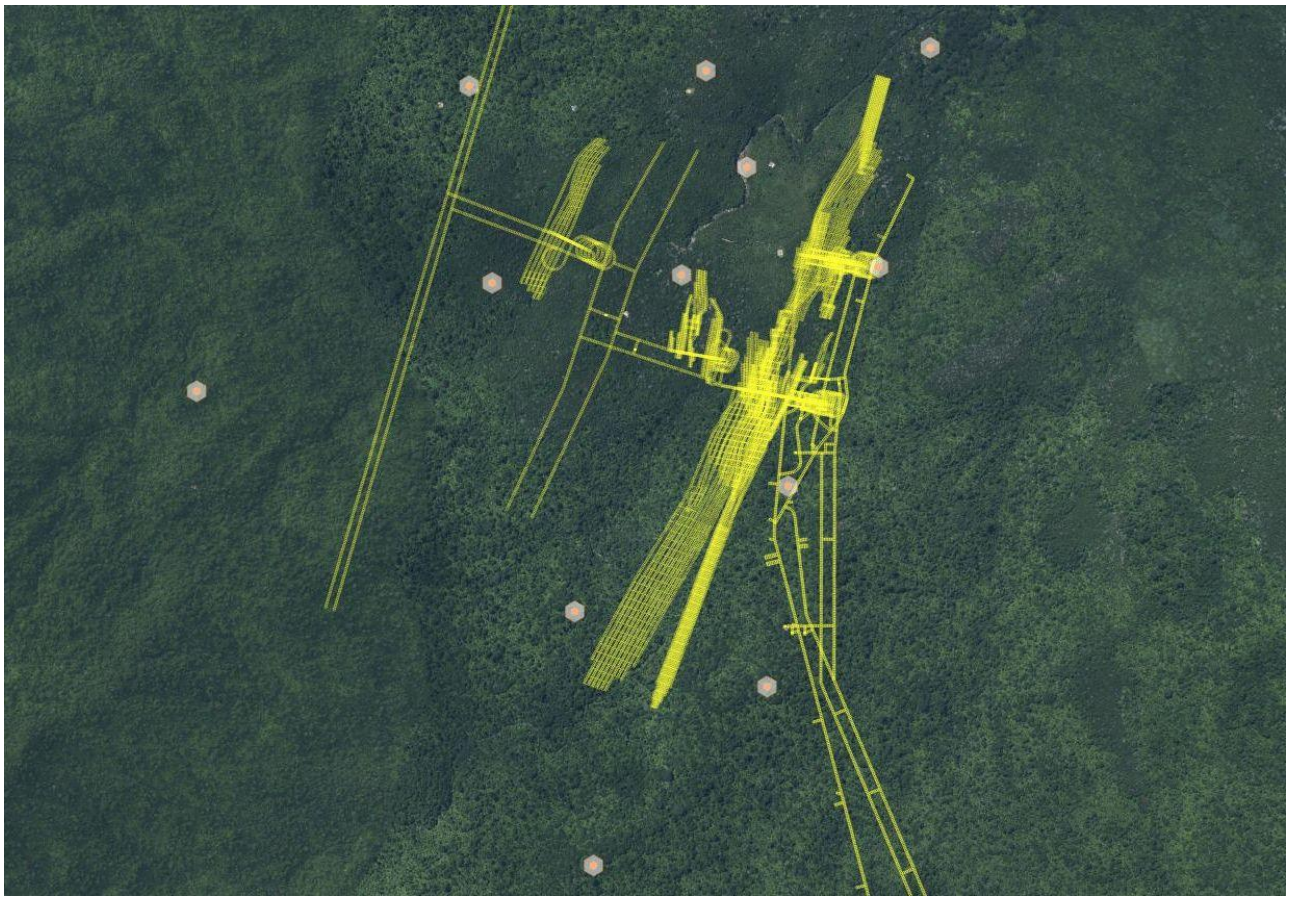


Figure 6 – Proposed Vibration Verification Sites

The sites shown in Figure 6 have been selected to cover the currently expected extent of the mine. The sites shown have been located to reasonably represent the current extent on the mine while being adjacent to existing tracks for ease of access.

One of the proposed sites includes the concrete foundations of the swing bridge on the Wharekirauponga walking track just north of the central spiral decline. As the other sites are established, to ensure good coupling between the ground and the sensor(s) the installation of suitably-sized concrete blocks firmly set into the ground in accordance with the requirements of AS2187.2:2006 Explosives Use and Storage, Section J will be required. When undertaking calibration, each sensor will be firmly mounted (bolted) onto one of the selected blocks.

Should the calibration monitoring indicate any discrepancy that suggests the algorithm should be adjusted, these revised modelling parameters will be incorporated into the predictive model.

7.5.4 Monitoring System Amendments

Should the extents of the orebody be redefined necessitating changes to the blasting locations, the representative assessment locations can be adjusted accordingly or supplemented with additional monitoring locations.

7.6 Roving Monitor

Under the conditions of consents OGNZL must hold at least one spare vibration monitoring unit for use as a roving monitor. A roving monitor can be quickly installed (and removed with little impact) at an agreed location to evaluate vibrations at locations not immediately covered by permanent installations.

The objectives for the roving monitor(s) are;

1. To assess and confirm compliance with the consent vibration and duration limits.
2. The check for anomalous vibration behaviour.
3. To address residents' concerns about vibration effects and to assist in understanding what they are experiencing.
4. To provide additional detail on blast design and behaviour (often when deployed near blasts).
5. To identify a new or additional fixed monitoring location (see Martha c47(a(vii)) and WNP c40).

To achieve objectives 1 to 3, the roving monitor(s) will be deployed in response to a series of complaints from a single residence or area, and/or when requested by a resident. A roving monitor need not be deployed in response to a single complaint, nor when complaints are received following a single blast event that generates a relatively high level of vibration. A roving monitor will only be deployed where its installation is approved by the resident.

Internal monitoring to improve knowledge on blast behaviour and design (objective 4) occurs on an "as required" basis, typically at the request of mining engineering personnel.

7.6.1 Roving Monitor Procedure

The Field Monitoring of Blast Vibration Standard Operating Procedure (WAI-200-PRO-008) outlines the field procedures for undertaking roving monitoring. Achieving the objectives (1-3) of roving monitoring requires a unit to be set at a site of interest for a period to time sufficient to enable vibration results at that site to be compared with results from the permanent vibration monitors and the expected levels of vibration (based on the relevant scale-distance equation and the separation between the site and the locations of the blasts). Recognising the limited number of roving monitors and the time required to obtain sufficient data, responding to complaints and monitoring requests may have to be scheduled.

Typically, a roving monitor programme at a property would follow the following sequence until resolved:

1. OGNZL will undertake monitoring upon receipt of a series of complaints from a resident, when the resident requests monitoring, and when a roving monitor is available. Initially, monitoring will be undertaken with the geophone on spikes, in natural ground where practical, and at a specific location on the property agreed to between the resident and monitoring personnel. After monitoring for typically 2 weeks or 20 blast events (whichever completes first), the data will be analysed (including a comparison with compliance monitors) and reported in the quarterly report to HDC with a recommendation.

   Normal configuration settings for residential monitoring are to set the units in 'histogram mode' rather than one of the 'waveform' modes which have higher monitor memory demand. This means that not only can smaller vibrations be determined; the units can be left for longer durations before they reach capacity (this means less disruption to the residents).
2. If warranted (in discussion with HDC), OGNZL will subsequently continue monitoring (this time, with the geophone on a concrete block) for a further 4 weeks or 50 events (whichever completes first). The data will be analysed (utilising a protocol agreed between Blastechnology and Heilig & Partners, June 2018) and reported to HDC, along with a recommendation.

3. If the subsequent data indicates sufficiently anomalous data to question the existing compliance network, a range of mitigation and redress measures will be considered in consultation with HDC:
    - Relocation of a nearby compliance monitor to a location more representative of the vicinity.
    - An additional compliance monitor.
    - Either of the above may require additional roving monitoring to determine an even more representative or acceptable location; the site of the initial monitoring may be improved upon, a permanent monitor may be unacceptable to the resident, or practical considerations (e.g. traffic interference) may require a more pragmatic location.
    - OGNZL may negotiate with the resident to reach a written agreement whereby vibration effects are not to be taken into account for monitoring and compliance purposes (Slevin c8, Martha c30(b), WNP c31)
    - OGNZL may negotiate to purchase the property, which would render the compliance standards not applicable as a company-owned property (Slevin c8, Martha c30(a) WNP c31)
    - In addition to this, the AEP program (Section 10.1) has the capability to adjust AEP assessments (from an agreed start date) for the affected property to more accurately reflect the anomalous vibrations determined for the property.
4. All roving blast-monitoring data in response to residents' complaints will be reported to HDC for their consideration as part of the monitoring programme above, along with being held on OGNZL's computer network. Roving data will continue to be included in the three-monthly summary reports submitted to HDC, with private data redacted (copies are available on their website: http://www.hauraki-dc.govt.nz/).

7.6.2 WUG Access Tunnel Monitoring

Monitoring the WUG Access Tunnel development will entail a similar procedure to the established roving monitoring procedure above, regarding placing and moving the monitors. However, as this monitoring is undertaken for compliance assessment, the set-up and reporting processes need to reflect this different function.

Preliminary monitoring sites are shown in Figure 4. The monitor geophones will be set up on concrete blocks unless agreement to do so cannot be obtained from the property owner.

The monitors will be programmed in waveform mode and, because of the potential increase in data, configured to 'call-back' their data to Envirohub. An advantage of this process is that the data can be promptly assessed following any blasts in the event of any elevated vibration readings.

7.6.3 Monitoring within Structures

Monitoring within structures for compliance is generally discouraged. There are large variations within a structure depending on its construction and foundations (some structures dull vibrations while others amplify the transmission) and consent compliance is based upon the level of ground vibration, not structure vibration. This is verified in the conditions of the consents which specify that fixed (compliance) monitoring locations must not be on or inside a building or structure (and that roving monitoring in such locations is not deemed to be compliance monitoring).

7.6.4 Geophones

Figure 2 to Figure 4 shows the locations of the compliance vibration monitors (geophones) associated with the projects. These locations were established by agreement with the HDC and are documented

in the consents. Should the monitor locations become redundant or non-representative of their surrounding area, relocation will be consulted with HDC and any new locations confirmed in writing.

Geophones are bolted to a concrete block set in the ground at each site. Other than when used for calibrating the WUG vibration algorithm, the equipment needs to be secured by a protective housing to discourage vandalism.

Within the protective housing is an “Instantel MiniMate Plus” (or equivalent) seismograph and a cellular modem. Each monitoring station calls the Envirohub computer after being triggered, and at predetermined schedules to conduct administrative checks.

7.7 Overpressure Monitoring

Overpressure monitoring must be incorporated at any blast monitoring device located on private property (c42-5A). For the establishment of access portals and underground tunnels within Areas 2, 3, and 5, a temporary overpressure monitor must be sited at or near a representative residence, for the first 50m of tunnel development from all new access portals (c42-12). The nearest residents to the Willows Access Tunnel are approximately 1km away on Highland Rd. Given the vibration levels will be less than the trigger threshold, it will not be possible to measure an overpressure waveform at this distance. The monitor however will be configured to record the peak level of overpressure for each 30 second period. The recorded histogram will be interrogated at the time of the blast identified by other monitors nearer to the blast and the overpressure value identified. OGNZL propose to undertake overpressure monitoring at two appropriate locations for the first 30 blasts, to assess compliance with the overpressure limit of 120 dBL (c28d). The data collected will inform the overpressure monitoring program for the Wharekirauponga Access Tunnel portal. This will be documented in a future revision of this plan for certification by HDC prior to commencing blasting.

7.8 Geophone & Microphone (Sound) Calibration

The seismographs, geophones and microphones undergo annual calibration by an independently certified company. The preferred supplier is Saros Group Pty. Ltd., contact:

3/11 Parkview St, Milton, Queensland, 4064, Australia.
Tel: 00 61 7 3367 3400,
Web: www.saros.com.au.

Calibration certificates are kept electronically on the Envirohub database (accessible via the internet), with additional copies in the OGNZL Environmental Department database.

Calibration certificates required for geophones and microphones (currently included with geophone certificate) contain the following information:

- Report number
- Make & Model of instrument
- Monitor serial number
- Geophone serial number
- Microphone serial number (if present)
- Calibration date
- Method reference in accordance with ISO/IEC 17025 (1999) & management ISO 9002:1994 accredited
- Test equipment references

- Compliance with relevant standard (Australian national standards of measurements)
- Endorsement certification or logo by accrediting organisation
- Signature of person performing calibration and date of service.

8 MITIGATION

Whenever production blasting is initiated in a new area, the first blasts are designed conservatively and take into consideration the geographical location, geological factors of the ground and the vibration results from nearby production areas. Based on the results of the initial blasts, charging parameters may be altered for subsequent blasts to increase efficiencies whilst still maintaining vibration compliance.

Most the factors that affect vibration management are completed well ahead of OGNZL obtaining the detailed vibration relationship data required to finalise a blast design. Those aspects of mine design that influence blast design (e.g. sub-level spacing) are typically fixed years before blasting occurs in each area of the mine. Also, key aspects of a blast design (blasthole diameter, burden and spacing) are completed weeks if not months ahead of blasting occurring within a given stope, and the pattern drilled to that design typically weeks ahead of a blast occurring.

Therefore, if an elevated and unexpected vibration result occurs, the only remaining aspect of the design that can usually be modified to reduce vibration is the charge weight, and in the case of the tunnel blasting, the length of advance. Selection of the appropriate charge weight therefore becomes the fundamental mitigation action.

The following pro-active management regime has been developed. Adhering to the mitigation procedure will minimise the chances of individual (or average) vibration results above consent limits and minimise vibration effects on residents.

8.1 Mitigation Actions

The objective of mitigation is to minimise significant impacts on residents and ensure processes are in place to avoid a breach of consent.

8.1.1 Open Pit Mines and Borrow Areas

The consent limit for vibration from blasting in the open pits (Martha and Gladstone pits and the three borrow areas in the Waste Disposal Area) stipulates 95% of blasts no greater than 5mm/s. For any blasts resulting in vibration levels greater than 5mm/s at any compliance monitor, OGNZL will review the blast design and implementation. This review, and any subsequent mitigation measures, will be reported to HDC within five working days of the blast. This correspondence gives effect to the requirements of consent conditions.

8.1.2 Underground Mines

The primary mitigation for significant impact on residents is compliance with the 95% and average limits (where applicable) specified in consent conditions. While there is no single blast maximum limit (both limits are based on a ‘trend’ of blasts), vibrations larger than 5mm/s are recognised as having a potentially significant detrimental effect on both the 95% and average limits.

Post-blast mitigation measures are based on the same ‘monitor and response’ process as used at OGNZL’s other underground operations as outlined above in s6.2. However, in recognition of the

blasting activities that occur near or below the residential area of Waihi, and the introduction of an average limit, the following safeguards and responses to blast results have been developed:

Individual Blasts

For any blasts (excluding Trio and WUG) resulting in vibration levels greater than 5mm/s at any compliance monitor, OGNZL will review the blast design and implementation. This review, and any subsequent mitigation measures, will be reported to HDC within five days of the blast.

For Trio, the same process will be followed for any blast events that generate a vibration of greater than 6mm/s.

For WUG, the same process will be followed for any blast events that generate a vibration of greater than 15mm/s at the ground surface above the mine.

Average Vibration

The application of average blast levels relates to the protection of amenity for Waihi residents. The requirement to monitor and comply with average limits applies to those underground mine elements under or near the residential areas of Waihi (e.g. Martha, Rex, Correnso). Average vibration limits do not apply at Favona, Trio and the WUG access tunnels and mine.

Separate from investigating individual high PPV blasts, OGNZL will also establish an arbitrary level for the average vibration, which when reached triggers an investigation to ensure that the relevant consent limit is not reached. These arbitrary levels are proposed as 1.9mm/s for development blasts (with a compliance limit of 2mm/s) and 2.9mm/s for production blasts (compliance limit 3mm/s).

Because the average vibration is determined separately for each monitor, in addition to the mitigation options (Slevin c14(c), Martha c50), OGNZL may also be able to relocate primary blasting activities to another area to give relief to the affected compliance monitor (and therefore to the residents in that area).

9 ROLES AND RESPONSIBILITIES

ROLE	RESPONSIBILITY
General Manager	• Review of the BVMP • Provide appropriate management and financial support for the implementation of this plan • Reporting high-level blast results to HDC
Superintendent - Environment	• Monitoring and reporting of blast vibration results • Review of the BVMP • Informing the General Manager and Manager – Mining (UG) of any high-level vibration results • Staff environmental awareness and training
Manager - Mining (Underground)	• Designing blasts to meet required vibration standards

ROLE	RESPONSIBILITY
	• Investigating high-level vibration results and implementing mitigation strategies • Provision of blast information data in a timely manner
Senior Environmental Advisor - Operations	• Maintaining the vibration monitoring network • Ensuring blast information data is entered into Envirohub correctly and in a timely manner
All applicable personnel	• Be aware of, and comply with, the procedures contained within or referred to in the BVMP

10 REPORTING

Records of all vibration monitoring (including roving monitoring) shall be maintained and made available to HDC on request. In the event of a high level blast or non-compliance with a consent condition, OGNZL will prepare a specific report to HDC. This report will contain the details of the event, along with the outcome of an investigation and mitigation measures to avoid a recurrence.

OGNZL provides a summary report to the Council for each calendar quarter of all blasting and vibration for the Waihi operations (for practical purposes, HDC has approved calendar quarter reporting, rather than the consent dates specified). This report provides information on blasting undertaken, explosive use, vibration and overpressure levels recorded, compliance and exceedance data, complaints received, and roving monitoring undertaken.

The Company Liaison Officer provides Council with six-monthly reports documenting any complaints (including those relating to vibration) and mitigation action taken.

11 COMMUNITY LIAISON

In accordance with conditions of its mining licence, resource consents and land use consents, OGNZL maintains the position of Company Liaison Officer (CLO) to liaise between the consent holder, the community, and the Council. *(While not required by a condition of consent, OGNZL also employs a Community Engagement Officer to increase its community engagement support.)* The CLO has sufficient delegated power to be able to deal immediately with complaints received and is required to investigate those complaints as soon as possible after receipt.

The contact free-phone number for the CLO is notified in local newspapers as a footnote in every community update (normally fortnightly). The current CLO and contact details are:

Donna Fisher 0800 WAIHIGOLD (0800 924 444)

In addition to liaison staff, a range of communication and engagement strategies are used for different stakeholder groups as appropriate. These include:

- ‘Open door’ policy for members of the public to meet with External Affairs team members at our Moresby Ave Admin Office.
- A monthly “Update” column in the Waihi Leader, providing information on current mining activities and items of interest.
- Monthly publication of the “Mining Matters” newsletter distributed to 900 households in Waihi.

- Press releases in local newspapers in response to media requests or project milestones such as the commencement of blasting.
- The actively managed website, http://www.waihigold.co.nz/, providing information on mining activities (e.g. blasting notification and results as itemised in section 5) and including the “Update”.
- Public notice boards erected at Martha viewing areas to provide project information.
- Letter drops within the community when information about specific issues needs to be circulated.
- House visits to residents seeking further information.
- The use of various forums and groups to gain feedback and provide information (e.g. Waihi Community Forum and Iwi Advisory Group)
- In addition, regular public meetings will be held to present information and receive feedback on past and proposed mining activities, and monitoring results.

11.1 Amenity Effect Programme

The consent limits that have been set for mining operations are designed to, and do, avoid nuisance effects for most of the Waihi community for most of the time. OGNZL complies with these limits but some people living close to its operations consider they experience some reduction in amenity due to increased levels of noise, vibration and possibly dust. Thus, while the Waihi community broadly shares the economic and social benefits of OGNZL’s mining operations, a relatively small proportion of the town’s population considers it bears some disadvantages from the operations.

In addition to on-going community liaison and complaints management, OGNZL has developed the Amenity Effect Programme (AEP) and has been implementing this as part of its on-going liaison and consultation programme with the local community. The programme was instigated in 2008 (with payments backdated to 2007), and aims to:

- Acknowledge that some people consider their amenity is affected by blast vibration, dust or noise effects;
- Provide an incentive for owners/occupiers to maintain the property ownership/occupation status quo to the maximum extent practicable;
- Provide an incentive for OGNZL to strive to minimise operational effects on the local community; and
- Ensure cost-effectiveness for OGNZL and enable or enhance existing and future land access.

To determine the assessed vibration at a residence for a blast, the AEP program utilises known ‘data-points’ (the locations of the blast, the residence, and adjacent compliance monitors) in three dimensions (easting, northing and relative elevation), along with the vibration results for the adjacent compliance monitors. A regression algorithm utilises the vibration data from the compliance monitors and the monitors’ distance from the blast, and calculates an assessed vibration for each residence based on the residence’s distance from the blast and their relative proximity to the adjacent compliance monitors. This calculation is undertaken for each property for each blast; when there are several blasts within one event, the largest assessed vibration is utilised in the AEP determination for that event.

More recent consents have made this previously voluntary programme a condition requirement (Slevin c9(b), Martha c35, WNP c34). The property owners or occupiers within the areas affected by operations will be offered payments based on the assessed vibration received at the property. This is determined by utilising the known or assessed vibrations from the compliance monitoring network and making scaled-distance calculations for each individual property.

Payment rates and calculations have been established for the existing (voluntary) AEP through detailed investigations and negotiation. The consents have formalised the payment regime and methodology (Slevin c9(c-i), Martha Underground c36-42, WNP c35-41) for properties subject to the operations. Payments are calculated on a six-monthly basis (January-June, July-December) and made within two months or as soon as practicable thereafter.

Calculating the specific payments to each property is done via a web-based program that utilises the Envirohub database. Those owners/occupiers within the program requesting the information can be provided with a username and password to access the data for their property. The programme does not apply to unoccupied houses or undeveloped property.

12 COMPLAINT RESPONSE

The OGNZL Standard Operating Procedure WAI-800-PRO-007 Managing Public Complaints (refer to SharePoint) will be used for any complaints received from the community.

13 TRAINING

All management, staff and contractors who work on site take part in induction training before commencing work on the project. In addition to the site health and safety training, the induction aims at raising general awareness of individual responsibilities for managing and reporting environmental and community effects. Reporting procedures and accountabilities to departmental managers and environmental staff are outlined, and all inductees are provided with a site contact list.

Responsibility for staff environmental awareness and training rests with the – Superintendent - Environment or delegated representative. Environmental personnel undertake vibration monitoring and maintain monitoring infrastructure, with training, support and guidance provided by John Heilig of Heilig & Partners Pty Ltd.

14 RECORDS AND DOCUMENTATION

Records and documents related to Vibration are saved in the network drive G: Environmental folder. Vibration monitoring data is saved on the Envirohub database.

15 AUDIT AND REVIEW

As this is a plan to manage an identified Environmental Material Risk, OGNZL internal standards require it to be reviewed every year as a minimum, and/or in any of the following circumstances:

- Following any event or investigation that impacts on this BVMP
- Any relevant amendments to the site risk register
- Any relevant amendments to legislation

Any material modification will be submitted to HDC for review and not implemented until certified. If additional mitigation actions are required to reduce vibration effects, the agreed actions will be implemented by OGNZL as soon as practicable.

One such modification is documented in Section 3.4. There is no scheduled restart date for the Martha Pit operation and any likely blasting in the open pit is not foreseen for up to two years. While this management includes sections relating to the management of open pit blasting, OGNZL will review and if necessary, submit a revised management plan, if required, at least one month prior to the first pit blast.

16 REFERENCES

Grindlay, G.D., November 2012. Evidence of Glen Grindlay – Golden Link Project including Correnso Underground Mine.

Heilig & Partners Pty Ltd, June 2012: Review of the potential vibration effects of drilling and blasting activities in the Golden Link Project Area.

Heilig, J.H., November 2012. Evidence of John Heilig – Golden Link Project including Correnso Underground Mine.

Tonkin & Taylor, June 2012. Golden Link Project including the Correnso Underground: Application to HDC for resource consent and AEE.

Heilig & Partners Pty Ltd and Lane Associates Ltd, July 2016. Assessment of vibration from the SUPA Project.

Heilig & Partners Pty Ltd, 05 February 2017. Exploration drive blasting assessment. Letter report to OceanaGold NZ Ltd.

Blastechnology and Heilig & Partners Pty Ltd, June 2018. Recommendations in Relation to Roving Vibration Monitor Data at Waihi. Report to HDC and OceanaGold NZ Ltd.

Heilig & Partners Pty Ltd, June 2018. Project Martha Consent Application, Appendix G, Vibration Assessment and Envelopes. Report to OceanaGold NZ Ltd.

Heilig & Partners Pty Ltd, February 2025. Waihi North Project - Blasting and Vibration Assessment. Report to OceanaGold NZ Ltd.

APPENDIX A – VIBRATION CONDITIONS HDC LAND USE CONSENT LUSE-202.2016.544.001 (Slevin)

Blasting and Vibration

7. Ground Vibration

   All blast events shall comply with the vibration levels, numbers of events and durations specified in Condition 8.

8. Impulsive Vibration from Blasting

   The activity shall comply with the following standard as measured at the boundary of any Residentially or low density residentially zoned site or the notional boundary of any occupied rural dwelling not owned by the consent holder (or related company) or not subject to an agreement with the consent holder (or related company).

   In the event that a property is sold and is not subject to an agreement between the consent holder (or related company) and the purchaser or related company, or in the event that there is no longer an agreement between the consent holder and the landowner, the measurement of vibration shall revert to being on or close to the boundary of that residentially or low-density residentially zoned site or the notional boundary of the occupied rural dwelling.

   a. There shall be no more than three blast events per day, from Monday to Saturday and between 0700 and 2000 (excluding any blasts for maintenance/safety purposes).
   b. No blasting shall be undertaken at night (2000 to 0700 the following day), on Sundays or on public holidays (excluding any blasts for maintenance/safety purposes).
   c. The peak particle velocity (vector sum) shall be no more than:
      i) For development blasts;
      - 5mm/s for 95% of the monitored events.
      - 2mm/s on average.

      ii) For production blasts;
      - 5mm/s for 95% of the monitored events.
      - 3mm/s on average.

      iii) For maintenance/safety blasts:
      - 1.0mm/s for all blast events

   d. Compliance with the 95% and average limits shall be measured over a six-month rolling period.
   e. Compliance with the 95-percentile limit shall be determined separately for development blast events and for production blast events, and based on the highest recorded vibration for each blast event measured at any monitor, where the blast type is assigned on a monitor-by-monitor basis according to the blast with the minimum scaled distance from each monitor.
   f. Compliance with the average limit shall be determined separately for each blast monitor based on the total number of blast events in the six-month rolling period.
   g. For all blast events, including those involving a combination of production and development blasts (95% compliance);
      i) Production blasts shall have a total duration of not more than 9 seconds;
      ii) Development blasts shall have a total duration of not more than 12 seconds;
      iii) A combination of production and development blasts shall have a duration of not more than 12 seconds.

iv) Maintenance/safety blasts shall have a total duration of not more than 2 seconds, other than for maintenance to retain tunnels, shafts and accessways in SUPA.

h. No blast event shall have a duration of more than 18 seconds.

i. Duration is to be calculated as the time from the nominal firing time of the first charge to the nominal firing time of the last charge.

j. A 'Blast Event' is defined as:

An individual or number of linked individual blasts of no more than the total duration periods specified above

k. A 'Development Blast' is defined as:

Any blast with a maximum instantaneous charge weight per hole of no more than 7 kilograms of explosive.

l. A 'Production Blast' is defined as:

Any blast in which a single hole contains a maximum instantaneous charge weight of more than 7 kilograms of explosive.' Slot blasts are deemed to be Production Blasts for the purpose of this definition.

m. A ‘Maintenance/Safety Blast’ is defined as:

Blasts for maintenance/safety purposes include breaking over-sized rocks, trimming/slashing of backs, walls and floors, firing of mis-fired explosives and removal of bridged stopes.

Advice Note:
There shall be no more than three development/production blast events per day from within all of the underground mines operated by the consent holder combined in the area covered by Mining Permit 41808. within CEPPA, SUPA and the Martha Drill Drive Project “MDDP” combined. For condition 8c the averages and 95 percentiles will be calculated for vibration from blasting within SUPA, CEPPA and MDDP combined.

9. Minimisation and Mitigation of Blasting Impacts

a. In addition to complying with the requirements of Condition 8, the consent holder shall minimise, to the extent practicable, the impacts of blasting vibrations for the Community. The measures to be applied in this regard shall be set out in the Vibration Management Plan (Condition 11) and will include details of how the following requirements will be achieved to the greatest extent practicable:

i. Restrict the duration of blast events to the minimum consistent with safe and efficient mining operations;

ii. Fire the production blasts within the 1 pm meal break;

iii. Fire the three defined daily blast windows at shift changes and meal breaks;

iv. Implement timely blast notification procedures;

v. Report blast vibration results in a timely manner.

b. While blasting is occurring as provided for by this consent, the consent holder shall also continue to implement the Amenity Effect Programme (AEP) in respect of vibration as set out below provided that owners and/or tenants who have entered into a separate arrangement with the consent holder and/or have otherwise agreed not to receive the AEP will not be eligible to receive AEP payments under this condition.

c. The consent holder shall use the recorded data from the vibration compliance monitoring network to estimate the vibration received at occupied residences from

blasting within the Slevin Underground Mine, and shall make payments to the occupiers of those residences in accordance with the table and criteria below:

Table: AEP Payment Schedule

Vibration Magnitude (mm/s)	Payment per Blast Event ($)
≥1.5	18.68
≥3.5	55.92
≥5	186.75
≥6	371.69

d. The stated payment rates are those existing at 1 January 2018. The rates will be adjusted for the start of each calendar year by the Consumer Price Index (CPI) published by Statistics New Zealand and made publicly available on the consent holder's website.

e. An occupied residence shall be eligible to receive AEP payments if it receives 2 or more blast events generating vibration of 1.5mm/s or greater in any month.

f. The AEP does not apply to any unoccupied houses or undeveloped residential property.

g. Occupiers of eligible residences shall receive a minimum payment of $250 per six monthly period.

h. Payments to occupiers of eligible residences shall be calculated six-monthly, and payment made within two months or as soon as practicable thereafter.

i. Should AEP payments become taxable, the consent holder shall not be liable for any taxes associated with the payments. Nor shall the consent holder be liable for any future changes to national superannuation or other benefits as a result of an eligible occupier receiving the AEP payments required under this consent.

Advice Note:
For the purposes of determining AEP payments the AEP payments will be based on the recorded vibration data from both CEPPA, SUPA and the Martha Underground Mine combined.

10. Where blast events provided under this consent occur simultaneously with blast events at other Underground Mines Mines operated by the consent holder and set out in Condition 2 above, or the Martha Mine, the consent holder shall ensure that such blast events comply with the maximum ground vibration level limits specified in Condition 8 of this consent.

11. Vibration Management Plan

The consent holder shall prepare a Vibration Management Plan for written approval by the Council. The objective of the Plan is to provide detail on how compliance with vibration consent Conditions 7 to 14 and 42 will be achieved for the duration of this consent. This Plan shall be submitted to the Council at least 2 weeks prior to the exercise of this consent and the consent shall not be exercised until the Vibration Management Plan has been approved by the Council. The Vibration Management Plan may be reviewed and amended from time to time, subject to the certification of the Council but not in a manner inconsistent with these conditions. If certification is not provided within 30 working days of Council's receipt of the Vibration Management Plan blasting authorised by this consent may commence.

The Plan shall specifically include the following:

a. Measures to be adopted to meet the conditions of this consent to ensure that blast vibrations for both development and production blasts are minimised to the greatest extent practicable, including;

i. Description of the blast design criteria and blast design review procedures. All blasts shall be designed to a 95% level of confidence to achieve the vibration levels specified in Condition 8 and the requirements of Condition 9a).

ii. The numbers, times (generally around shift changeovers), duration of blast events, and in general terms the coordination of development and production blasts into one blast event and steps to minimise the duration of blast events.

iii. Procedures to be adopted where vibration levels approach the maximum permitted levels and mitigation actions to be implemented in the event of an exceedance of the limits stated in Condition 8.

iv. The methods and procedures to be adopted to enable the separate recording and reporting of development and slot / production blasting.

v. The methods and procedures to be adopted in deploying the roving monitor(s), data usage from theroving monitors, procedures for converting a roving monitor location to a fixed monitoring location, and identifying circumstances where vibration monitoring within structures shall be considered. Any monitoring undertaken in these circumstances by roving monitors or within structures is deemed notto be compliance monitoring.

vi. The methods and procedures for identifying and addressing anomalous vibration results recorded at any monitored site, including sites monitored with roving monitors.

b. Further detail on the Amenity Effect Programme as required under Condition 9b).

c. The location of fixed monitoring locations to be established in accordance with Condition 12d).

d. Records to be kept, including blast design data.

Advice note:
The Vibration Management Plan may be prepared in conjunction with the Vibration Management Plans prepared in accordance with the consent requirements applying to other mines in the Waihi area.

12. Blasting and Vibration Monitoring

a. The consent holder shall monitor impulsive vibration from all blast events associated with the mining provided for under this consent.

b. The monitoring system shall be automated to allow for the prompt analysis of each blast event.

c. Suitably trained personnel shall conduct any monitoring required under this consent, including the installation of roving monitors. Equipment used for monitoring, equipment calibration and vibration measurement procedures shall comply with the current Australian Standard AS2187.2 (or equivalent international standards) and equipment manufacturers' recommendations.

d. Unless otherwise required or confirmed in writing by the Council, the fixed monitoring locations for the Slevin Underground Mine shall be those shown in Figure 2. These monitoring locations pertain to the Slevin ore body and will need to be reviewed if the operations move to new areas.

e. The fixed monitoring locations shall not be on or inside a building or structure.

f. Pursuant to condition 12(d), data received from a roving monitor may identify a new or additional permanent monitoring location.

g. A roving monitor shall be deployed to record vibrations in locations where complaints regarding vibration have been made in accordance with a procedure specified in the approved Vibration Management Plan required under Condition 11.

h. A complete record of each blast event shall be maintained. The record shall include:

i. Types of measurement instrument used.
ii. Time and duration of blast event.
iii. Locations of blasts.
iv. Locations of monitoring positions.
v. Distances from the blasts to the monitoring position and nearest residence.
vi. Measured vibration levels.
vii. Total amount of explosive used.
viii. Delay sequence of the blast event.
ix. Maximum instantaneous charge.
x. Volume of rock blasted.
xi. Complaints (including the nature of effects, for example rattling window, was the complainant awoken) and whether the vibration mitigation action process has been undertaken (Condition 14 c))
xii. Design criteria not covered in items (i) to (xi) above.

Advice note:
While this condition relates only to the monitoring of blast vibration associated with the mining activities provided for under this consent, similar conditions apply to all of the consent holder's other mining operations and require the consent holder to monitor blast vibrations from all of its mining activities.

13. Property Damage

a) Upon receipt of a complaint of property damage suspected by the property owner to be caused from activities authorised by this consent, an appropriately qualified staff member of the consent holder shall investigate and respond to the complaint within five business days or as soon thereafter as practicable unless the matter is considered urgent.

If the property owner does not agree with advice from the consent holder's representative the consent holder may, or if the cause of the damage is unclear the consent holder shall, engage an appropriately qualified independent third party to investigate and report to both the property owner and consent holder. The consent holder shall request that report to be available in 30 days unless considered urgent by the independent third party in which case the report shall be made available as soon as practicable. If the property owner does not agree with the advice and the consent holder does not engage a third party then the resident may contact the Council, and if the Council determines, after investigation, that a third party investigation is warranted then the consent holder shall commission and meet the reasonable costs of that investigation.

If the advice of the independent third party or the consent holder's representative determines that the cause of the damage is attributable to activities authorised by this consent then the consent holder will remedy the damage at its cost as soon as practicable in accordance with any recommendation made by the third party and to the reasonable satisfaction of the property owner.

If any dispute arises in accordance with this clause condition, then the consent holder will offer to the resident the opportunity to enter binding matter shall be referred to arbitration in accordance with the provisions of the Arbitration Act 1996. An arbitrator shall be appointed by the President of the Institute of Professional Engineers in New Zealand. The arbitrator shall give their determination within 30 working days of their appointment, unless the consent holder and the property owner agree that time shall

be extended. In all other respects, the provisions of the Arbitration Act 1996 shall apply. If the property owner chooses not to participate in the binding arbitration, then the consent holder's obligations under this condition are at an end.

14. Management and Reporting

a. Throughout the period of mining provided for under this consent, at the start of each calendar month the consent holder shall prepare a two-dimensional plan showing the existing mining and the proposed areas of mining activities during that month. The plan shall be loaded onto a page of the consent holder's website. A downloadable pdf version of the plan shall be available from the web page and hard copies shall be available for collection from the Waihi Information Centre and the Hauraki District Council Waihi Service Centre, and on request.

   The consent holder shall use its best endeavours to restrict its blasting to the work areas defined on the plan recognising that operational constraints prevail and may lead to deviations from the plan during the course of the month.

b. No blasting operations shall be carried out without the written approval of the Mine Manager. Before blasting commences, the Mine Manager shall ensure that the operations will not cause danger, damage or undue discomfort to any person nor danger and damage to property.

c. In the event that blast monitoring shows that the vibration standards have been exceeded, the consent holder shall implement mitigation actions to ensure compliance. Possible mitigation actions include but are not limited to:

   i. Limiting the rate of excavation advance.
   ii. Reducing the blast hole diameter.
   iii. Reducing the weight of explosive in the blast hole.
   iv. Using alternative explosive types.
   v. Using electronic delays to adjust sequencing.
   vi. Decking.
   vii. Changing the blast pattern.
   viii. Drilling and blasting in two passes.
   ix. Changing the method of mining.

d. The consent holder shall provide a report to Council for each blast event where the measured vibration exceeds applicable peak particle velocity specified in Condition 8. The report shall be submitted within five (5) days after the blast event and include the records listed in Condition 12 h) above and mitigation actions taken to limit subsequent blast vibrations to the maximum limits or less as generally outlined in Condition 14 c).

e. The consent holder shall establish a page on its website that will show the recorded vibration magnitude for the last ten blast events for each of the compliance monitoring required under Condition 12.The results of the most recent blast event will:

f. be posted on the consent holder's web page as soon as practicable after the occurrence of that blast event; and

g. remain provisional until they are verified

h. The consent holder shall provide a summary report to Council at three (3) monthly intervals after the first exercise of this consent as provided for by condition 4. The report shall include the following:

   i. Confirmation of actions taken during the previous reporting period.

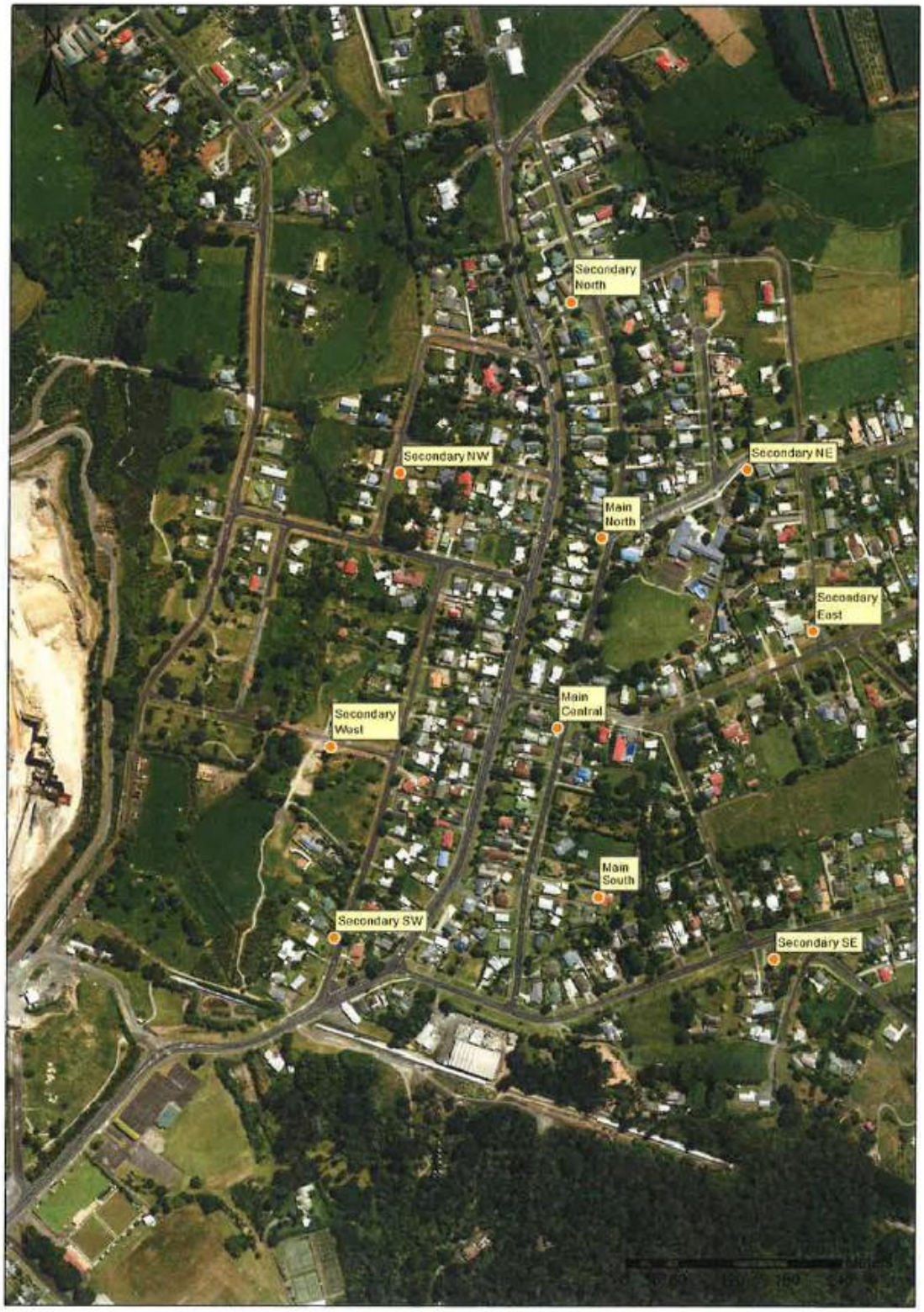
ii. All vibration related complaints received during the current reporting period and mitigation actions taken by the consent holder.

iii. Results of vibration monitoring separately for underground development and production blasts.

iv. All roving monitor data results recorded during the quarter.

i. Monitoring records, reports and complaint schedules shall be stored securely and maintained in a systematic manner for 12 months after completion of all blasting at the underground mine. Records shall be available for perusal by Council and its representatives on request.

Figure 2: Location of Vibration Monitoring Sites



APPENDIX B – VIBRATION CONDITIONS - VARIATION TO MINING LICENCE 32-2388

General and particular work programmes

1. The work to be undertaken pursuant to this licence shall be limited to the following:

b. Mining

Open pit and minor underground mining and exploratory work, using explosives and mechanical excavating, truck handling of material within the pit area and that portion of the rest of the licence area that lies to the west of Junction Road, conveyor belt handling to a chemical processing plant, beneficiation and ore treatment including waste and tailings disposal within the licence area.

d. Monitoring

The regular monitoring of pit slopes, tailings retaining structures, ground movement, noise, blasting, vibration, air quality and rehabilitation programmes together with the necessary rectification work as required.

7B Company Liaison Officer

(a) The licensee shall appoint a person ("the Company Liaison Officer"), subject to the approval of the Minister to liaise between the licensee, the community, and the Minister as set below. The Company Liaison Officer shall have sufficient delegated power to be able to deal immediately with complaints received and shall be required to investigate those complaints as soon as possible after receipt.

(b) The name of the Company Liaison Officer together with the contact phone numbers for that person shall be publicly notified in local newspapers by the licensee prior to the commencement of the extended project (at least one month prior, but not more than two months prior to the commencement of construction activities) and at least once a year thereafter.

(c) The Company Liaison Officer shall be appointed prior to the commencement of the extended project and this position shall be filled at all times during the construction activities as defined in Condition 3.

Council Liaison Officer

(d) The licensee shall provide all the reasonable costs associated with the appointment and support of a Council Liaison Officer, to be employed by and be responsible to the Minister during the construction activities as defined in Condition 3.

(Note: The following is for information purposes only and does not form part of the condition.

The Council Liaison Officer may either be a new appointment or may be an existing employee.

Whether or not the appointee is an existing employee, the Council Liaison Officer's role shall be independent and objective and designed to promote effective gathering

of information of effects upon the community from the mining activity; and, in the light of such information, to promote effective liaison with the Company Liaison Officer so that the effects identified may be remedied or mitigated.)

The functions and responsibilities of the Council Liaison Officer shall be as follows:

(i) Liaise between the Company Liaison Officer, members of the community, the Waihi Liaison Forum (or its equivalent), and the Minister;

(ii) Report to the Minister on an "as events happen" basis, and weekly on complaints received, actions undertaken by the licensee and the complainant in respect to complaints, and on any other relevant actions and activities occurring during the week;

(iii) Ensure that the Company Liaison Officer is providing information to residents in the area around the mine and tailings facilities of the activities that are programmed to be undertaken in the coming week (especially land clearance, construction and blasting), activities that were carried out in the previous week and any other material that will inform the residents of what is programmed to happen in the coming weeks;

(iv) Facilitate the appointment of a mediator, venue, time etc agreeable to both parties, to undertake the mediation of disputes or concerns between the licensee and members of the community. Except in those situations where both parties are in agreement, the Council Liaison Officer's function is not to act as a mediator. The role of mediation is a specialist one that needs to be undertaken by persons experienced and trained in this area.

(e) The Company Liaison Officer shall, during construction activities, report weekly to the Council Liaison Officer on all complaints received in the prior week and the action taken to investigate those complaints. In addition, the Company Liaison Officer shall investigate and report on any other matters as directed by the Council Liaison Officer concerning or arising out of construction activities. (See periods of construction activities as defined in condition 3.)

(f) The Company Liaison Officer shall give residents who are likely to be affected and the Council Liaison Officer reasonable (minimum one week's) prior notice of construction activities, indicating likely timing and duration.

(g) Following completion of initial construction activities, and prior to the commencement of other construction activities (ie during operations stage), the Company Liaison Officer shall report six monthly to the Minister on the following:

(i) All complaints received during the previous six-month period, action taken by the licensee and the resolutions, if any;

(ii) Other matters of concern raised by the community;

(iii) Any mediation entered into by the licensee and others with respect to operational matters and the outcome (unless the parties have agreed to keep such confidential).

7C Complaints procedure and mediation

Note: the following is for information purposes only and does not form part of the condition.

- Complainants will be expected to contact the Company Liaison Officer in the first instance (refer condition 7B(a)).

- During construction activities, if a complainant is dissatisfied with the response by the Company Liaison Officer, they shall contact the Council Liaison Officer with the details of the complaint and the Company Liaison Officer's response. Outside the construction activities, complainants shall contact any officer of the Minister.

The licensee shall comply with the following complaints procedure and mediation process:

(a) The Company Liaison Officer shall meet with the complainant and the Council Liaison Officer to discuss the complaint and ways in which the issue can be resolved.

(b) If the parties cannot agree on a resolution, the matter shall be put to mediation.

(Note: The following is for information purposes only and does not form part of the condition:

(i) Refer condition 7B(d)(iv) above.

(ii) Unless the parties agree the outcome of mediation shall not be binding.)

Blasting and vibration

20.

(a) All blasting procedures shall be carried out so as to ensure the safety of persons in the mine and/or the immediate vicinity of the mine site. The licensee shall notify WorkSafe New Zealand of the blasting procedures to be employed and of any changes thereto and the blasting procedures shall be approved by WorkSafe New Zealand. The blasting procedures shall address the following specific items; regular blasting times, warning and all clear signals, control of fly-rock, vibration and air blast monitoring and such other matters as Worksafe New Zealand may direct.

(b) No blasting operations shall be carried out without the written approval of the Mine Manager, who shall first satisfy himself that the blasting operations will not cause either danger, damage or undue discomfort to any person or danger to property.

(c) A blasting programme shall be publicly notified in newspapers circulating in the area prior to any blasting taking place and at regular intervals not exceeding six (6) months thereafter. Changes to the blasting programme will be notified in newspapers circulating in the area at least three (3) days prior to implementation.

The Company Liaison Officer shall ensure that the blasting programme and changes to the blasting programme are provided to all residents in the immediate area surrounding the mine who in the opinion of the Company Liaison Officer (after

consultation with the Council Liaison Officer) are likely to experience the effects of blasting and vibration. The same respective notification time periods shall apply.

d) Vibration levels measured in the ground closest to any affected residence excluding those properties owned by the licence holder or related Company or subject to an agreement with the licence holder or related Company shall be 95% compliant with a maximum level for ground vibration of 5 mm/s and shall not exceed a Vmax of 10 mm/s (both expressed as vector sum of velocity components). The 95% compliance limit is defined as the level not to be exceeded for 95% of blasts over the preceding twelve month period. Blasting is permitted within the following hours;

Open Pit Operations

Monday-Friday	1000-1500
Saturday	1000-1200

(e) Details of all blasts shall be recorded as set out in condition 29.

(f) The peak overall sound pressure level due to air blasts shall not exceed 128dB linear (unweighted), measured at any affected residence excluding those properties owned by the licence holder or related Company, or subject to an agreement with the licence holder or related Company.

(h) Except where specifically provided in condition 20(f) all blasting operations and measurements in relation to operations shall be carried out in accordance with AS2187.2:2006 The Use of Explosives.

(i) Vibration Management Plan

The licence holder shall prepare a Vibration Management Plan. The objective of this plan is to detail the methods to be used to comply with conditions 20 and 29.

Blasting

29.

(a) The licensee shall monitor every blast event in terms of blast location, charge weight per delay, number of holes, initiation timing and measured vibration. Where equipment malfunctions or is not available for recording (e.g. during maintenance), this shall be noted and included in the monitoring report presented to the Minister. Where blasting is to be undertaken in the vicinity of the overpressure sensor, the licensee shall also monitor the overpressure level. The location of the fixed vibration and overpressure sensors shall be undertaken in consultation with the Minister, and changes to the location of these sensors and monitor shall be agreed with the Minister prior to their relocation. The licensee shall deploy a roving monitor to record blast vibrations in the location where complaints regarding vibration have been made. The results of the monitoring shall be provided to the Minister.

(b) The licensee shall, unless otherwise directed to do so by the Minister following consultation with the licensee, provide a quarterly summary report to the Minister on the blasting undertaken, and the vibration and overpressure levels recorded, as well as any complaints received.

(c) Monitoring in the ground at the base of the Cornish Pumphouse shall be undertaken when blasting is carried out within a 250 metre radius of the structure. The peak component vibration levels shall not exceed 25 mm/s

APPENDIX C – VIBRATION CONDITIONS HDC LAND USE CONSENT 97/98-105 (EMMA)

3.4 LIAISON OFFICERS

Company Liaison Officer

a) The consent holder shall appoint a person ("the Company Liaison Officer"), subject to the approval of the Hauraki District Council and the Waikato Regional Council to liaise between the consent holder, the community, the Hauraki District Council and the Waikato Regional Council as set out in this consent. The Company Liaison Officer shall have sufficient delegated power to be able to deal immediately with complaints received and shall be required to investigate those complaints as soon as possible after receipt.

b) The name of the Company Liaison Officer together with the contact phone numbers for that person shall be publicly notified in local newspapers by the consent holder prior to the exercising of this consent (at least one month prior, but not more than two months prior to the commencement of construction activities) and at least once a year thereafter.

c) The Company Liaison Officer shall be appointed prior to the exercising of this consent and this position shall be filled at all times during the construction activities as defined in Condition 3.3.

Council Liaison Officer

d) The consent holder shall provide all the reasonable costs associated with the appointment and support of a Council Liaison Officer, to be employed by and be responsible jointly to the Hauraki District Council and Waikato Regional Council during the construction activities as defined in Condition 3.3.

(Note: The following is for information purposes only and does not form part of the condition.

The Council Liaison Officer may either be a new appointment or may be an existing employee. Whether or not the appointee is an existing employee, the Council Liaison Officer's role shall be independent and objective and designed to promote effective gathering of information of effects upon the community from the mining activity; and, in the light of such information, to promote effective liaison with the Company Liaison Officer so that the effects identified may be remedied or mitigated.

The functions and responsibilities of the Council Liaison Officer shall be as follows:

i) liaise between the Company Liaison Officer, members of the community, the Waihi Liaison Forum (or its equivalent), Hauraki District Council and Waikato Regional Council;

ii) report to the Hauraki District Council and Waikato Regional Council on an "as events happen" basis, and weekly on complaints received, actions undertaken by the consent holder and the complainant in respect to complaints, and on any other relevant actions and activities occurring during the week;

iii) ensure that the Company Liaison Officer is providing information to residents in the area around the mine and tailings facilities of the activities that are programmed to be undertaken in the coming week (especially land clearance, construction and blasting), activities that were carried out in the previous week and any other material that will inform the residents of what is programmed to happen in the coming weeks;

iv) facilitate the appointment of a mediator, venue, time etc agreeable to both parties, to undertake the mediation of disputes or concerns between the consent holder and members of the community. Except in those situations where both parties are in agreement, the Council Liaison Officer's function is not to act as a mediator. The role of mediation is a specialist one that needs to be undertaken by persons experienced and trained in this area).

e) The Company Liaison Officer shall, during construction activities, report weekly to the Council Liaison Officer on all complaints received in the prior week and the action taken to investigate those complaints. In addition, the Company Liaison Officer shall investigate and report on any other matters as directed by the Council Liaison Officer concerning or arising out of construction activities. (See periods of construction activities as defined in condition 3.3)

f) The Company Liaison Officer shall give residents who are likely to be affected and the Council Liaison Officer reasonable (minimum one week's) prior notice of construction activities, indicating likely timing and duration.

g) Following completion of initial construction activities, and prior to the commencement of other construction activities (ie during operations stage), the Company Liaison Officer shall report six monthly to the Hauraki District Council and the Waikato Regional Council on the following:

(i) All complaints received during the previous six month period, action taken by the consent holder and the resolutions, if any;

(ii) Other matters of concern raised by the community;

(iii) Any mediation entered into by the consent holder and others with respect to operational matters and the outcome (unless the parties have agreed to keep such confidential).

3.5 COMPLAINTS PROCEDURE AND MEDIATION

(Note: The following is for information purposes only and does not form part of the condition:

i) Complainants will be expected to contact the Company Liaison Officer in the first instance (refer to Condition 3.4 a)).

ii) During the construction activities, if the complainant is dissatisfied with the response by the Company Liaison Officer, they shall contact the Council Liaison Officer with details of the complaint and the Company Liaison Officer's response. Outside the construction activities, complainants shall contact the Manager Planning and Environmental Services or any other Officer of Council.)

The consent holder shall comply with the following complaints procedure and mediation process:

a) The Company Liaison Officer shall meet with the complainant and the Council Liaison Officer, to discuss the complaint and ways in which the issue can be resolved.

b) If the parties cannot agree on a resolution, the matter shall be put to mediation.

(Note: The following is for information purposes only and does not form part of the condition:

i. Refer to Condition 3.4 d), Note iv)

ii. Unless the parties agree, the outcome of the mediation shall not be binding.)

3.10 BLASTING AND VIBRATION

(a) All blasting procedures shall be carried out so as to ensure the safety of persons in the mine and/or in the immediate vicinity of the mine site. The consent holder shall notify the Health and Safety Inspector (Mining Act) of the blasting procedures to be employed and of any changes thereto and the blasting procedures shall be approved by the Health and Safety Inspector (Mining Act). The blasting procedures shall address the following specific items: regular blasting times, warning and all clear signals, control of fly-rock, vibration and air blast monitoring and such other matters as the Inspector may direct.

(b) No blasting operations shall be carried out without the written approval of the Mine Manager, who shall first satisfy himself that the blasting operations will not cause either danger, damage or undue discomfort to any person or danger to property.

(c) A blasting programme shall be publicly notified in newspapers circulating in the area prior to any blasting taking place and at regular intervals not exceeding six (6) months thereafter.

Changes to the blasting programme shall be notified in newspapers circulating in the area at least three (3) days prior to implementation.

The Company Liaison Officer shall also ensure that the blasting programme and changes to the blasting programme are provided to all residents in the immediate area surrounding the mine who in the opinion of the Company Liaison Officer (after consultation with the Council Liaison Officer) are likely to experience the effects of blasting and vibration. The same respective notification time periods shall apply.

(d) Blasting shall be restricted to within the following hours:

Monday - Friday	1000-1500
Saturday	1000-1200

(e) Details of all blasts shall be recorded.

(f) The peak overall sound pressure level due to the air blasts:

i) at any residence within the boundary of the Extended Martha Mine Area as shown on Planning Maps K1 - K5 of the Operative Hauraki District Plan not owned by the Waihi Gold Company; or

ii) at any residence outside the boundary of the Extended Martha Mine Area as shown on Planning Maps K1 - K5 of the Operative Hauraki District Plan except for those residences owned by the Waihi Gold Company in the area shown on the map attached in Appendix F;

shall not exceed 128 dB linear (unweighted).

(g) During initial construction (as defined in Condition 3.3), but excluding:

- upgrade of conveyor system (not including the creation of the conveyor slot), but including use of laydown areas
- construction of pipeline from the Water Treatment Plant to the Ohinemuri River;
- road construction and upgrading associated with the Extended Project;
- construction of a new Scout Hall and a new Radio Club facility,

and for a period of 12 months after initial construction activities cease, vibration levels measured in the ground closest to:

i) any residence within the boundary of the Extended Martha Mine Area as shown on Planning Maps K1 - K5 of the Operative Hauraki District Plan not owned by the Waihi Gold Company; or

ii) any residence outside the boundary of the Extended Martha Mine Area as shown on Planning Maps K1 - K5 of the Operative Hauraki District Plan, except for those residences owned by the Waihi Gold Company in the area shown on the map attached in Appendix F:

shall not exceed 10 mm/s peak particle velocity measured in the frequency range between 3 Hz and 12 Hz, thereafter NZS 4403:1976 Codes of Practice for the Storage, Handling and Use of Explosives shall apply.

(h) After the 12 month period specified in Condition 3.10 (g) has expired, and at all times for those initial construction activities excluded under Condition 3.10 (g) above, vibration levels measured in the ground closest to:

i) any residence within the boundary of the Extended Martha Mine Area as shown on Planning Maps K1 - K5 of the Operative Hauraki District Plan not owned by the Waihi Gold Company; or

ii) any residence outside the boundary of the Extended Martha Mine Area as shown on Planning Maps K1 - K5 of the Operative Hauraki District Plan except for those residences owned by the Waihi Gold Company in the area shown on the map attached in Appendix F:

shall comply with the provisions of Rule 9.4.3 of the Operative Hauraki District Plan.

(i) Except where specifically provided in Condition 3.8(g) all blasting operations and measurements in relation to such operations shall be carried out in accordance with NZS 4403:1976 Code of Practice for the Storage, Handling and Use of Explosives .

3.11 MONITORING AND REPORTING ON BLASTING AND VIBRATION

(a) The consent holder shall monitor every blast event over 1 mm/sec in terms of blast location, charge weight per delay, number of holes, initiation timing and measured vibration. Where equipment malfunctions or is not available for recording (eg during maintenance), this shall be noted and included in the monitoring report presented to Council. Where blasting is to be undertaken in the vicinity of the overpressure sensor, the consent holder shall also monitor the overpressure level. The location of the fixed vibration and overpressure sensors shall be undertaken in consultation with Council, and changes to the location of these sensors and monitor shall be agreed with Council prior to their relocation. The consent holder shall deploy a roving monitor to record blast vibrations in the location where complaints regarding vibration have been made. The results of the monitoring shall be provided to Council.

(b) The consent holder shall, unless otherwise directed to do so by the Council following consultation with the consent holder, provide a summary report to the Council at the end of each February, May, August and November on the blasting undertaken, and the vibration and overpressure levels recorded, as well as any complaints received.

(c) Monitoring in the ground at the base of the Cornish Pumphouse shall be undertaken when blasting is carried out within a 250 metre radius of the structure. The peak component vibration levels shall not exceed 25 mm/s at frequencies in the range 20 to 30 Hz within the 250 metre radius. A report addressing changes to the building's structural integrity (with particular emphasis on changes that are likely to be caused by blast-induced vibrations within 250 metres) shall be supplied to Council on the anniversary of the date of commencement of this consent. The report shall be prepared by a registered engineer experienced in such work.

APPENDIX D – VIBRATION CONDITIONS HDC LAND USE CONSENT LUC 202.2018.857.001 (Project Martha)

BLASTING AND VIBRATION

Impulsive Vibration from Blasting

28 Ground Vibration

All blast events shall comply with the vibration levels, number of events and durations specified in Conditions 29 to 33.

29 Impulsive Vibration from Blasting

All blast events shall comply with the limits and standards set out below as measured at the boundary of any residential, low density residential or town centre zoned site that is lawfully used for residential purposes, or the notional boundary of any occupied rural dwelling.

30 The standards in Condition 33 shall 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 Council) whereby vibration effects on the property caused by activities authorised under this consent are not to be taken into account for monitoring and compliance purposes.

31 Underground Blasting

There shall be no more than three blast events per day, from Monday to Saturday and between 0700 and 2000 (excluding any blasts for maintenance / safety purposes).

No blasting shall be undertaken between 2000 and 0700 the following day (excluding any blasts for maintenance / safety purposes).

Blasts for maintenance / safety purposes can occur at any time and shall not exceed a maximum peak particle velocity of 1.00mm/s.

32 Pit Blasting

Blasting is permitted between the hours of 1000 – 1500 Monday to Friday and 1000 – 1200 Saturday.

No blasting in the Pit shall occur concurrently with underground blasts other than for safety reasons.

The maximum overpressure is 128 dBL for any blast.

33 All Blasting

a. No blasting shall be undertaken on Sundays or on public holidays (excluding any underground blasts for maintenance / safety purposes).

b. The peak particle velocity (vector sum) shall be no more than:

(i) For development blasts;

- 5mm/s for 95% of the monitored events
- 2mm/s on average.

(ii) For production blasts;

- 5mm/s for 95% of the monitored events
- 3mm/s on average.

(iii) For Martha Pit blasts;

- 5mm/s for 95% of the monitored events

(iv) For maintenance/safety blasts;

- 1.0mm/s for all blast events

c. Compliance with the 95% and average limits shall be measured over a six-month rolling period.

d. Compliance with the 95% limit shall be determined separately for development blast events and for production blast events, and based on the highest recorded vibration for each blast event measured at any monitor, where the blast type is assigned on a monitor-by-monitor basis according to the blast with the minimum scaled distance from each monitor.

e. Compliance with the average limit shall be determined separately for each blast monitor based on the total number of blast events in the six-month rolling period.

f. For all underground blast events, including those involving a combination of production and development blasts (95% compliance);

(i) Production blasts shall have a total duration of not more than 9 seconds;

(ii) Development blasts shall have a total duration of not more than 12 seconds;

(iii) A combination of production and development blasts shall have a duration of not more than 12 seconds;

(iv) Maintenance/safety blasts shall have a total duration of not more than 2 seconds, other than for maintenance to retain tunnels, shafts and accessways in Correnso and SUPA.

g. No underground blast event shall have a duration of more than 18 seconds.

h. Duration is to be calculated as the time from the nominal firing time of the first charge to the nominal firing time of the last charge.

i. A 'Blast Event' is defined as:

'An individual or number of linked individual blasts of not more than the total duration periods specified above.'

j. A 'Development Blast' is defined as:

'Any blast that is used in the creation or enlargement of a tunnel for the purposes of mine construction or access.'

k. A 'Production Blast' is defined as:

'Any blast that is not a development blast (excluding any blast for maintenance / safety purposes)'.

k_1. A 'Maintenance / Safety Blast' is defined as:

'Blasts for maintenance / safety purposes includes breaking over-sized rocks, trimming / slashing of backs, walls and floors, firing of mis-fired explosives and removal of bridged stopes.'

l. Prior to the first blast within a radius of 250 m (horizontal or vertical) of the Pumphouse, and every 5 years thereafter unless otherwise agreed by Council, the consent holder shall engage a structural engineer to undertake a survey of and produce a report on the structural integrity of the Cornish Pumphouse with particular emphasis upon changes that are likely to have been caused by blast induced vibrations. Each such report shall be supplied to the Council within 30 working days of its completion. The consent holder shall make good any damage identified in the structural engineer's report referred to above.

Advice Note:
There should be no more than three development / production blast events per day from within all of the underground mines operated by the consent holder combined in the area covered by Mining Permit 41808.

Minimisation and Mitigation of Blasting Impacts

34 In addition to complying with the requirements of Condition 28, the consent holder shall minimise, to the extent practicable, the impacts of blasting vibrations on the community. The measures to be applied in this regard shall be set out in the Vibration Management Plan (Condition 46) and will include details of how the following requirements will be achieved where practicable:

a. Restrict the duration of blast events to the minimum consistent with safe and efficient mining operations;

b. Fire the underground production blasts within the 1330 meal break;

c. Fire the three defined daily underground blast windows at shift changes and meal breaks;

d. Implement timely blast notification procedures; and

e. Report blast event vibration results in a timely manner.

34A Prior to the commencement of blasting within the Martha Pit, the consent holder shall conduct a risk assessment, the objective of which is to minimise the risks associated with fly-rock having considered all relevant and material factors including but not limited to:

a. Proximity of blasting to the pit crest, property and areas with public access;

b. Blast design parameters such as stemming length, loading horizon, explosive quantity, explosive density, blast hole inclination, blast orientation and degree of ground fracturing;

c. Identification and treatment of any uncharged holes or voids;

d. Degree of ground saturation; and

e. Potential risk control measures.

The assessment shall be facilitated by a person suitably qualified or experienced in risk assessment. The risk control measures, and the methods and procedures for implementing them, shall be set out in the Vibration Management Plan required under Conditions 46 and 47.

35 While blasting is occurring as provided for by this consent, the consent holder shall also continue to implement the Amenity Effects Programme ("AEP") in respect of vibration as set out below, provided that owners and / or tenants who have entered into a separate arrangement with the consent holder and / or have otherwise agreed not to receive the AEP will not be eligible to receive AEP payments under this condition.

36 The consent holder shall use the recorded data from the vibration compliance monitoring network to estimate the vibration received at occupied residences from blasting associated with the Martha Pit and the Martha Underground Mine, and shall make payments to the occupiers of those residences in accordance with the table and criteria below:

Vibration Magnitude (mm/s)	Payment Per Blast Event ($)
≥ 1.5	18.68
≥ 3.5	55.92
≥ 5	186.75
≥ 6	371.69

37 The stated payment rates are those existing at 1 January 2018. The rates will be adjusted for the start of each calendar year by the Consumer Price Index (CPI) published by Statistics New Zealand and made publicly available on the consent holder's website.

38 An occupied residence (including properties lawfully used for residential purposes in the Town Centre Zone) shall be eligible to receive AEP payments if it receives two or more blast events generating vibration of 1.5 mm/s or greater in any month.

39 The AEP does not apply to any unoccupied houses or undeveloped residential property.

40 Occupiers of eligible residences shall receive a minimum payment of $250 per six-monthly period.

41 Payments to occupiers of eligible residences shall be calculated six-monthly, and payment made within two months or as soon as practicable thereafter.

42 Should AEP payments become taxable, the consent holder shall not be liable for any taxes associated with the payments. Nor shall the consent holder be liable for any future changes to national superannuation or other benefits as a result of an eligible occupier receiving the AEP payments in accordance with this consent.

43 Where blast events provided for under this consent occur simultaneously with blast events at other underground mines operated by the consent holder and set out in Condition 1A above, the consent holder shall ensure that such blast events comply with the maximum ground vibration level limits specified in Condition 33 of this consent.

44 For the initial 100 underground blast events of each type, no more than one exceedance of 5mm/s in every 20 consecutive blast events shall be deemed to be compliant with the 95 percent limit stated in Condition 33.

The assessment of compliance with the average limits stated in Condition 33 shall not apply until 100 underground blast events of each type have been fired.

Once 100 underground blast events of each type have been fired, compliance with both the 95 percent and average limits shall be separately assessed for each blast type as per Conditions 33(d) and (e) respectively.

Blasting and Vibration Monitoring

45 Blasting and vibration monitoring shall be managed as follows:

a. The consent holder shall monitor impulsive vibration from all blast events associated with the mining activities provided for under this consent;

b. The monitoring system shall be automated to allow for the prompt analysis of each blast event;

c. Suitably trained personnel shall conduct any monitoring required under this consent, including the installation of roving monitors. Equipment used for monitoring, equipment calibration and vibration measurement procedures shall comply with the current Australian Standard *AS2187.2* (or equivalent international standards) and equipment manufacturers' recommendations;

d. Unless otherwise required or confirmed in writing by the Council, the fixed monitoring locations for the Martha Pit, Martha Underground Mine and Rex Orebody shall be those shown in Appendix 3;

e. The fixed monitoring locations shall not be on, or inside, a building or structure;

f. Pursuant to Condition 45(d), data received from a roving monitor may identify a new or additional permanent monitoring location;

g. A roving monitor shall be deployed to record vibrations in locations where complaints regarding vibration have been made in accordance with a procedure specified in the Vibration Management Plan required under Conditions 46 and 47; and

h. A complete record of each blast event shall be maintained. The record shall include:

(i) Types of measurement instrument used;

(ii) Time and duration of blast event;

(iii) Locations of blasts;

(iv) Locations of monitoring positions;

(v) Distances from the blasts to the monitoring position and nearest residence;

(vi) Measured vibration levels;

(vii) Total amount of explosive used;

(viii) Delay sequence of the blast event;

(ix) Maximum instantaneous charge;

(x) Volume of rock blasted;

(xi) Complaints (including the nature of effects, for example rattling window, was the complainant awoken) and whether the vibration mitigation action process has been undertaken (Condition 50); and

(xii) Design criteria not covered in items (i) to (xi) above.

Advice Note:
While this condition relates only to the monitoring of blast vibration associated with the mining activities provided for under this consent, similar conditions apply to all of the consent holder's other mining operations and require the consent holder to monitor blast vibrations from all of its mining activities.

Vibration Management Plan

46 The consent holder shall prepare a Vibration Management Plan for certification by the Council. The objective of the Vibration Management Plan is to provide detail on how compliance with Conditions 28 to 54 will be achieved for the duration of this consent. The Vibration Management Plan shall be submitted to the Council at least 30 working days prior to the first blast event authorised by this consent. If certification is not provided within 30 working days of Council's receipt of the Vibration Management Plan blasting authorised by this consent may commence.

The Vibration Management Plan may be reviewed and amended from time to time, subject to the certification of the Council but not in a manner inconsistent with these conditions.

47 The Vibration Management Plan shall specifically include the following:

a. Measures to be adopted to meet the conditions of this consent to ensure that blast vibrations are minimised to the greatest extent practicable, including:

i) Description of the blast design criteria and blast design review procedures. All blasts shall be designed to a 95-percentile level of confidence to achieve the ground vibration level limits specified in Condition 33;
ii) The numbers, times (generally around shift changeovers), duration of blast events, and in general terms the coordination of blasts into one blast event and steps to minimise the duration of blast events;
iii) Procedures to be adopted where vibration levels approach the maximum limits and mitigation actions to be implemented in the event of an exceedance of the ground vibration level limits stated in Condition 33;
iv) The methods and procedures to be adopted to enable the separate recording and reporting of development and slot / production blasting;
v) The methods and procedures to be adopted for managing and monitoring of overpressure;
vi) The methods and procedures identified by the risk assessment required by Condition 34A to be adopted for managing fly-rock;
vii) The methods and procedures to be adopted in deploying the roving monitor(s), data usage from the roving monitors, procedures for converting a roving monitor location to a fixed monitoring location, and identifying circumstances where vibration monitoring within structures shall be considered. Any monitoring undertaken by roving monitors or within structures is deemed not to be compliance monitoring; and
viii) The methods and procedures for identifying and addressing anomalous vibration results recorded at any monitored site, including sites monitored with roving monitors.

b. The location of fixed monitoring locations to be established in accordance with Condition 45(d); and

c. Further detail on the Amenity Effects Programme as required under Condition 35;

d. The properties to be surveyed in accordance with Condition 55; and

e. Records to be kept, including blast design data.

Advice Note:
The Vibration Management Plan may be prepared in conjunction with the Vibration Management Plans prepared in accordance with the consent requirements applying to the consent holder's other mines in the Waihi area.

Management and Reporting

48 Throughout the period of mining the Rex Orebody as authorised under this consent, the consent holder shall prepare a two-dimensional plan at the start of each calendar month showing the existing mining and the proposed areas of mining activities during that month. The

plan shall be loaded onto a page of the consent holder's website. A downloadable pdf version of the plan shall be available from the website and hard copies shall also be available for collection from the Waihi Information Centre and the Council's Waihi Service Centre, and on request.

The consent holder shall use its best endeavours to restrict its blasting to the work areas defined on the plan recognising that operational constraints prevail and may lead to deviations from the plan during the course of the month.

49 No blasting operations shall be carried out without the written approval of the Mine Manager. Before blasting commences, the Mine Manager shall ensure that the operations will not cause danger, damage or undue discomfort to any person nor danger and damage to property.

50 In the event that blast monitoring shows that the vibration standards have been exceeded, the consent holder shall implement mitigation actions to ensure compliance. Possible mitigation actions include, but are not limited to:

a. Limiting the rate of excavation advance;

b. Reducing the blast hole diameter;

c. Reducing the weight of explosive in the blast hole;

d. Using alternative explosive types;

e. Using electronic delays to adjust sequencing;

f. Decking;

g. Changing the blast pattern;

h. Drilling and blasting in two passes; and

i. Changing the method of mining.

51 The consent holder shall provide a report to Council for each blast event where the measured vibration exceeds the applicable peak particle velocity specified in Condition 33. The report shall be submitted within five working days after the blast event and include the records listed in Condition 45(h) above and mitigation actions taken to limit subsequent blast vibrations to the maximum limits or less as generally outlined in Condition 50.

52 The consent holder shall, prior to the first development blast event pursuant to this consent, establish a page on its website that will show the recorded vibration magnitude for the last ten blast events for each of the compliance monitors required under Condition 45(d). The results of the most recent blast event will:

a. Be posted on the consent holder's webpage as soon as practicable after the occurrence of that blast event; and

b. Remain provisional until they are verified.

53 The consent holder shall provide a summary report to Council at three-monthly intervals after the first exercise of this consent. The report shall include the following:

a. Confirmation of actions (including all blasts for maintenance / safety purposes) taken during the previous reporting period;

b. All vibration related complaints received during the current reporting period and mitigation actions taken by the consent holder;

c. Results of vibration monitoring separately for underground maintenance/safety, development and production blasts, and for Martha Pit blasts; and

d. All roving monitor data results recorded during the quarter.

54 Monitoring records, reports and complaint schedules shall be stored securely and maintained in a systematic manner for 12 months after completion of all blasting at the underground mine. Records shall be available for perusal by Council and its representatives on request.

Property Damage

55. Before blasting associated with the Rex Orebody of the Martha Underground Mine commences, and provided the property owner consents, the consent holder shall:

a. Undertake a BRANZ survey for each building (excluding out buildings and garages) in accordance with the Project Martha Property Policy as on the consent holder's website as at 19 October 2018;

b. Complete a structural condition survey for at least five representative properties (excluding properties owned by the consent holder at that time). The representative properties are to be located in the vicinity of the vibration monitors required under Condition 45(d); and

c. In addition to these properties, structural condition surveys shall be carried out at 'control' properties removed from the influence of any potential vibration effects from mining.

The survey properties shall be identified in the Vibration Management Plan (Conditions 46 and 47).

The surveys shall be carried out by an independent structural engineer suitably qualified and experienced in domestic building design and construction. The survey reports shall include a visual inspection and video of all existing built surfaces and defects including concrete accessways.

APPENDIX E – VIBRATION CONDITIONS HDC LAND USE CONSENT LUC (Waihi North Project)

BLASTING AND VIBRATION

26	All blast events must comply with the limits and standards set out in Conditions 28 and 29 as measured at the boundary of any residential, low density residential or town centre zoned site that is lawfully used for residential purposes, any commercial site used for social congregation, or the notional boundary of any lawfully occupied rural dwelling.
27	The standards in Conditions 28 and 29 do not apply to any property or site that is: a. Owned by the Consent Holder or a related company; or b. Owned or occupied by a third party which is subject to either a registered covenant or a written agreement (a copy of which has been provided to the Hauraki District Council) whereby vibration effects on the property caused by activities authorised by this consent are not to be taken into account for monitoring and compliance purposes.
28	For all blasting within Areas 2, 3 and 5 associated with the establishment of access portals and underground tunnels: a. The peak particle velocity (vector sum) at the surface must be no more than: i. 5mm/s for 95% of blast events between the hours of 0700 and 2000, Monday to Saturday (excluding public holidays); and ii. 1mm/s for 95% of blast events at all other times; b. The duration of the underground development blasts must be limited to no more than 12 seconds; c. Peak particle velocity compliance with the 95% limit must be determined based on the highest recorded vibration for each blast event measured at any monitor installed in accordance with Condition 42(6) or 42(7); and d. The maximum overpressure must not be greater than 120 dBL for any blast at any overpressure monitoring site.
29	For all GOP Blasting within Area 5, and borrow pit blasting at the western borrow pit in Area 6, and the central and eastern borrow pits in Area 7: a. Blast events must only occur between the hours of 1000 and 1500, Monday to Friday and 1000-1200 Saturday (excluding public holidays) b. Peak particle velocity must be measured for all blasts and the peak particle velocity (vector sum) at any monitor point must be no more than 5mm/s for 95% of blast events. c. Peak particle velocity compliance with the 95% limit must be determined based on the highest recorded vibration for each blast event measured at any monitor installed in accordance with Condition 42(e); and d. The maximum overpressure must be measured for all blasts at a minimum of one monitoring station and must not be greater than 120 dBL for any blast.
30	1. For all blasting within Area 1 the peak particle velocity (vector sum) at the surface must be no more than 15 mm/s for 95% of blast events. 2. Compliance with this limit must be determined by: a. For development blasting (prior to the first stope blast), monitoring vibration at the surface

	above tunnelling activities within Area 2 to confirm that development blasting will not exceed the peak particle velocity (vector sum) limit set out in Condition 30.1 above at any location where subsequent tunnelling occurs in Area 1; b. For production blasting, monitoring vibration at three representative locations within the upper levels of the underground mine; and c. Using a predictive algorithm and the vibration recorded at the three underground locations to calculate vibration from production blasting at representative assessment locations on the surface. 3. The predictive algorithm for assessing compliance in this manner must continue to be included in any amended version of the BVMP referred to in Condition C5 of Schedule One.
31	1. When applying Conditions 28 and 29: a. The percentile calculations must be based upon all recorded vibration data. Where the level of vibration does not exceed the threshold level of vibration, the blast shall be assumed to generate 0.5mm/s peak particle velocity (vector sum) limit and be included in the calculation of the 95% statistics. b. For the first 100 blast events at each of: i. GOP; ii. Western Borrow Pit; iii. Central Borrow Pit; iv. Eastern Borrow Pit; v. Wharekirauponga Access Tunnel and Portal; and vi. Willows Access Tunnel and Portal; compliance with the 95% limit will be satisfied if no more than five of those first 100 events have a peak particle velocity (vector sum) that exceeds 5mm/s. 3. When applying Conditions 28 and 29 and 30: a. For the Gladstone Open Pit, unless 1(b) applies, compliance with the 95% limit must be measured over a rolling six-month period. b. For the other areas listed above in 1(b), compliance with the 95% limit must be measured over a rolling 100 blast events. 5. A 'Blast Event' is defined as an individual or number of linked individual blasts.
32	In addition to complying with the requirements of Conditions 28 – 30, the Consent Holder must minimise, to the extent practicable, the impacts of blasting vibrations on the community. The measures to be applied must continue to be set out in any amended version of the BVMP referred to in Condition C5 of Schedule One, and must include, as a minimum: a. Restricting the magnitude and duration of blast events to a minimum consistent with safe and efficient mining operations; b. Implementing timely blast notification procedures using a methodology appropriate for the receiving environment(s); and c. Reporting blast event vibration results to the community in a timely manner.

<table>
<tr><td>33</td><td>1. Prior to the commencement of blasting within GOP, the Western Borrow Area, the Central Borrow Area and the Eastern Borrow Area, the Consent Holder must conduct a risk assessment, the objective of which is to set out procedures that minimise the risks associated with flyrock and fume having considered all relevant and material factors including but not limited to:
a. Proximity of blasting to any pit crest, neighbouring property and areas with public access;
b. Blast design parameters such as stemming length, loading horizon, explosive quantity, explosive density, blast hole inclination, blast orientation and degree of ground fracturing;
c. Identification and treatment of any uncharged holes or voids;
d. Degree of ground saturation;
e. Potential risk control measures including but not limited to:
i. monitoring every blast using video cameras;
ii. rating of collar and free-face venting blast intensity in the Blast Report; and
iii. fume ratings in accordance with the AEISG rating guidelines; for
every blast fired in GOP and the borrow pits.
2. The risk assessment must be undertaken by a person suitably qualified or experienced in risk assessment. The risk control measures, and the methods and procedures for implementing them, must be set out in any amended version of the BVMP referred to in Condition C5 of Schedule One.</td></tr>
<tr><td>34</td><td>Until blasting has been completed, the Consent Holder must implement an Amenity Effect Programme in respect of vibration as set out in Conditions 35 – 41 below, provided that owners and / or tenants who have entered into a separate arrangement with the Consent Holder and / or have otherwise agreed not to receive the Amenity Effect Programme will not be eligible to receive Amenity Effect Programme payments under this condition.
Advice Note: The Amenity Effect Programme can be a continuation of the existing Amenity Effect Programme which has been conditioned on previous OGNZL consents in Waihi. The Amenity Effect Programme required by this consent can be implemented in conjunction with the existing Amenity Effect Programme implemented by the Consent Holder.</td></tr>
<tr><td>35</td><td>The Consent Holder must use the recorded data from the vibration compliance monitoring required by Conditions 28-30 to predict the vibration received from blasting at occupied residences, and must make payments to the occupiers of those residences in accordance with the table and criteria below:
<table><tr><td>Vibration Magnitude (mm/s)</td><td>Payment Per Blast Event ($)</td></tr><tr><td>1.5 – 3.5</td><td>23.89</td></tr><tr><td>≥ 3.5</td><td>71.52</td></tr><tr><td>≥ 5</td><td>238.86</td></tr><tr><td>≥ 6</td><td>475.02</td></tr></table></td></tr>
<tr><td>36</td><td>The rates in Condition 35 are those existing at 1 January 2024. The rates must be adjusted at the start of each calendar year by the Consumer Price Index (“CPI”) published by Statistics New Zealand and the adjusted rates must be made publicly available on the Consent Holder’s website.</td></tr>
<tr><td>37</td><td>Any permanently occupied residence (including properties lawfully used for residential purposes in the Town Centre Zone or Low Density Residential Zone) is eligible to receive Amenity Effect Programme payments if in any month it receives two or more blast events generating vibration of 1.5 mm/s or greater.</td></tr>
<tr><td>38A</td><td>For the purpose of Condition 37 a permanently occupied residence means a building that has been the normal place of residence for one or more persons for a period of at least 6 months prior to the blast events where residential living is a permitted activity, a lawful existing use under section 10 of the RMA, or is authorised by a resource consent.</td></tr>
<tr><td>38</td><td>The Amenity Effect Programme does not apply to any unoccupied houses or undeveloped residential property.</td></tr>
</table>

39	Occupiers of eligible residences must receive a minimum payment of $250 per six-monthly period.
40	Payments to occupiers of eligible residences must be calculated six-monthly, and payment made within two months of those calculations being made or as soon as practicable thereafter.
41	Should Amenity Effect Programme payments become taxable, the Consent Holder shall not be liable for any taxes associated with the payments. Nor shall the Consent Holder be liable for any future changes to national superannuation or other benefits as a result of an eligible occupier receiving the Amenity Effect Programme payments in accordance with this consent.
42	1. The Consent Holder must monitor impulsive vibration from all blast events at GOP, the Western Borrow Area, the Central Borrow Area and the Eastern Borrow Area, and all blast events associated with the development of the WUG, Wharekirauponga Access Tunnel and the Willows Access Tunnel; 2. The equipment used for monitoring, equipment calibration and vibration measurement procedures must comply with the current Australian Standard AS2187.2 (or equivalent international standards) and equipment manufacturers' recommendations; 3. The fixed monitoring system must be automated to allow for the prompt analysis of each blast event; 4. The monitoring must be conducted by suitably trained personnel, including the installation of roving monitors; 5. Unless otherwise required and confirmed in writing by the Hauraki District Council, the vibration monitoring for GOP blasting must include fixed monitoring at the sites shown in the figure annexed as Attachment 3 to this consent throughout the period of its development and mining operations; 5A Overpressure monitoring must be incorporated at any vibration monitoring device located on private property; 6. Unless otherwise required and confirmed in writing by the Hauraki District Council, the vibration monitoring for the Western Borrow Area, Central Borrow Area and Eastern Borrow Area blasting must include fixed monitoring at the sites shown in the figure annexed as Attachment 3 to this consent throughout the period of their development and mining operations; 7. Unless otherwise required and confirmed in writing by the Hauraki District Council, the vibration monitoring for the Wharekirauponga Access Tunnel blasting must include fixed or roving monitoring units at the sites shown in the figure annexed as Attachment 3 to this consent throughout the period of its development; 8. Unless otherwise required and confirmed in writing by the Hauraki District Council, the vibration monitoring for the Willows Access Tunnel blasting must include a roving monitor sited at or near a representative residence (to be determined by a suitably qualified and experienced expert engaged by the Consent Holder) throughout the period of its development; 9. Unless otherwise required and confirmed in writing by the Hauraki District Council, the vibration monitoring for the WUG must include: a. Monitoring vibration using geophones placed at three locations within the upper levels of the underground mine; b. Use of a predictive algorithm to predict the vibration levels at the surface using the monitoring data collected in accordance with (a); and c. Periodic monitoring undertaken at least at one of the indicative surface assessment locations shown in Attachment 3 to this consent sufficient to verify the accuracy of the predictive algorithm and reliability of the predicted vibration levels.

	10. Unless otherwise required and confirmed in writing by the Hauraki District Council, the overpressure monitoring for GOP blasting must include fixed monitoring at the sites shown in Attachment 3 to this consent; 11. Unless otherwise required and confirmed in writing by the Hauraki District Council, the overpressure monitoring for the Western Borrow Area, Central Borrow Area and Eastern Borrow Area blasting must include fixed monitoring at the sites shown in Attachment 3 to this consent; 12. Unless otherwise required and confirmed in writing by the Hauraki District Council, the overpressure monitoring for the establishment of access portals and underground tunnels within Areas 2, 3 and 5 must include a temporary monitor sited at or near a representative residence (to be determined by a suitably qualified and experienced expert engaged by the Consent Holder) for the first 50m of tunnel development from all new access portals; 13. The fixed monitoring locations must not be on, or inside, a building or structure; 14. Pursuant to 5, 6 and 7 above data received from a roving monitor may be used by the Consent Holder to identify a new or additional permanent monitoring location; 15. A roving monitor must be deployed to record vibrations in locations where complaints regarding vibration have been made in accordance with a procedure specified in the BVMP referred to in Condition C5 of Schedule One; and 16. A complete record of each blast event must be maintained which includes: a. Types of measurement instrument used; b. Time and duration of blast event; c. Locations of blasts; d. Locations of monitoring positions; e. Distances from the blasts to the monitoring position and nearest residence (except for blasting within Area 1); f. Measured vibration levels; g. Total amount of explosive used; h. Delay sequence of the blast event; i. Maximum instantaneous charge; j. Volume of rock blasted; k. Complaints (including the nature of effects, for example rattling window, was the complainant awoken) and whether the vibration mitigation action process has been undertaken; and l. Design criteria not covered in items 16.a to 16.k above.
43	1. The Consent Holder must prepare and submit a Blasting and Vibration Management Plan (BVMP) to the Hauraki District Council for written certification under Condition C5 of Schedule One. 2. The certified BVMP must be implemented by the Consent Holder and may be subsequently amended subject to any amendments that may be made under Conditions C7 – C8D of Schedule One.

44	The BVMP provided to the Hauraki District Council for written certification under Condition C5 of Schedule One and any amendment to the certified BVMP made under Conditions C7-C8D of Schedule One must ensure that the following objective is met: a. The impacts of blasting vibrations on the community in accordance with Condition 32, as well as ecological habitat values within Area 1, are minimised. Advice Note: The BVMP may be separate for each Area and/or cover multiple Areas combined. The BVMP may be combined with any similar management plans, including Vibration Management Plans, required under other resource consents held by the Consent Holder which authorise mining in the Waihi area, however the combined BVMP must clearly specify the contents that are applicable to the blasting activities authorised by this consent.
45	The BVMP provided to the Hauraki District Council for written certification under Condition C5 of Schedule One and any amendment to the certified BVMP under Conditions C7-C8D must include as a minimum: a. The measures to be adopted to ensure that the objective identified in Condition 44 is met, including, where relevant providing: i. A description of the blast design criteria and blast design review procedures required to achieve the ground vibration level limits specified in Conditions 28 – 30; ii. The numbers, times and duration of blast events, and in general terms the coordination of blasts and steps to minimise the duration of blast events; iii. Procedures to be adopted where vibration levels approach the maximum limits and mitigation actions to be implemented in the event of an exceedance of the ground vibration level limits stated in Conditions 28 – 30; iv. The methods and procedures to be adopted for managing and monitoring of overpressure, including detailed analysis of measured overpressure traces, to achieve and demonstrate compliance with the overpressure limits specified in Conditions 28 – 30, and to ensure that no perceptible overpressure is experienced at any location where the overpressure limits in those conditions apply between the hours of 2000 and 0700; v. The methods and procedures identified by the risk assessment required by Condition 33 which are to be adopted to manage flyrock; vi. The methods and procedures to be adopted in deploying the roving monitor(s), data usage from the roving monitors, procedures for converting a roving monitor location to a fixed monitoring location and identifying circumstances where vibration monitoring within structures must be considered; vii. The methods and procedures for managing vibration related complaints and responses to those complaints; viii. The methods and procedures for identifying and addressing anomalous vibration results recorded at any monitored site, including sites monitored with roving monitors; and ix The assessment by video analysis lasting for at least 30 seconds after the last blasthole in each of the GOP and the Eastern, Central or Eastern Borrow Pits has fired. b. The fixed monitoring locations to be established in accordance with Condition 42.5 to 42.7; c. The locations of the roving monitor to be established in accordance with Condition 42.7 and 42.8;

	d. The methods and procedures for differentiating between blast sources for vibration monitoring purposes immediately prior to the firing of the blast event for the various sites to allow for unambiguous classification of the source of the vibration event. e. Measures to be adopted to demonstrate compliance with Condition 28, including: i. The underground monitoring locations to be established in accordance with Condition 42 (9)(a); ii. The software and algorithm to be used to calculate surface vibration using the vibration recorded at those underground monitoring locations; iii. The location of the representative surface assessment locations where surface vibration will be calculated to assess compliance with Condition 30; and iv. The methodology for undertaking periodic surface monitoring in accordance with Condition 42 (9)(b) to calibrate the software and algorithm used for calculating surface vibration; f. The monitoring vibration threshold level for individual sites. This must be set at 0.75 mm/s unless elevated background vibration at a site means an alternative threshold is appropriate; g. Detail on the conditions which could cause post blast fumes at GOP, the Western Borrow Area, Central Borrow Area, or Eastern Borrow Area, and measures to monitor (including by way of a fume rating in accordance with AEISG guidelines), and if necessary, manage, post blast fume generation at GOP or any of the borrow areas; h. Further detail on the Amenity Effect Programme required under Condition 34; i. The properties to be surveyed in accordance with Condition 50; and j. Records to be kept, including blast design data.
46	1. At the start of each calendar month throughout the period of developing the Wharekirauponga Access Tunnel, the Consent Holder must prepare a two-dimensional plan showing the existing Access Tunnel and the proposed areas where blasting will occur and where the face of the Access Tunnel will progress during that month. 2. The plan must be loaded onto the Consent Holder's website and must also be available for collection in hard copy form from the Waihi Information Centre and Hauraki District Council's Waihi Service Centre. 3. No blasting operations in relation to development of the Wharekirauponga Access Tunnel may take place outside work areas defined on the plan.
47	In the event that blast monitoring shows that the vibration standards in Conditions 28 - 30 have been exceeded, the Consent Holder must: a. Implement mitigation actions to ensure compliance in accordance with the VMP; and b. Submit a report to the Hauraki District Council within one month of the exceedance event which includes: i. The records for the blast event collected in accordance with Condition 42 (12); and ii. The mitigation actions taken to ensure future compliance.
48	The Consent Holder must provide a Vibration Summary Report to the Hauraki District Council at three-monthly intervals. The report must include the following:

	a. Confirmation of blasting actions (including all blasts for maintenance / safety purposes) taken during the previous reporting period; b. All vibration related complaints received during the current reporting period and any mitigation actions taken by the Consent Holder; c. Results of vibration monitoring separately for: i. GOP; ii. The Wharekirauponga Access Tunnel; iii. The Willows Road Access Tunnel; iv. The WUG; v. The Western Borrow Area; vi. The Central Borrow Area; and vii. The Eastern Borrow Area. d. All roving monitor data results recorded during the quarter.
49	Monitoring records, reports and complaint schedules must be stored securely and maintained in a systematic manner for 12 months. Records must be provided to the Hauraki District Council on request.
50	Before undertaking any blasting within each Area of this consent, and provided the property owner consents, the Consent Holder must engage an independent structural engineer suitably qualified and experienced in domestic building design and construction (the Engineer) to undertake a structural condition survey for at least five representative properties (non-company owned) located in the vicinity of vibration monitors, and at 'control' properties removed from the influence of any potential vibration effects from mining . The Engineer must: a. Undertake a visual inspection and make video recordings of all existing built surfaces and defects including concrete accessways; and b. Identify, in written reports with accompanying photographs, any noted defects which were apparent at the time of the survey.
51	1. Upon receipt of a complaint of damage to a permanent dwelling or associated structures suspected by the property owner to be caused from activities authorised by this consent, an appropriately qualified representative of the Consent Holder must investigate and respond to the complaint as soon as is practicable, but no later than five working days later. 2. If the property owner does not agree with advice from the Consent Holder's representative, or if the cause of the damage is unclear, the Consent Holder must engage an appropriately qualified independent third party to investigate and report to both the property owner and Consent Holder within 30 working days unless considered urgent by the independent third party in which case the report must be made available as soon as practicable. If the property owner does not agree with the advice or the Consent Holder does not engage a third party then if the Hauraki District Council determines after investigation that a third-party investigation is warranted, the Consent Holder must commission and meet the reasonable costs of that investigation. 3. If the advice of the independent third party or the Consent Holder's representative determines that the cause of the damage is attributable to the activities authorised by this consent, then the Consent Holder must remedy the damage at its cost as soon as practicable in accordance with any recommendation by the Consent Holder's representative or by the third party and to the reasonable satisfaction of the property owner.

	4. If any dispute arises in respect of this condition the matter must be referred to arbitration in accordance with the provisions of the Arbitration Act 1996. An arbitrator shall be appointed by the President of the Institute of Professional Engineers in New Zealand. The arbitrator must be instructed to use their best endeavours to provide their determination within 30 working days of their appointment, unless the Consent Holder and the property owner agree that time can be extended. In all other respects, the provisions of the Arbitration Act 1996 shall apply. If the property owner chooses not to participate in the arbitration, the Consent Holder will have no further obligations under this condition.

APPENDIX F – OCEANAGOLD ENVIRONMENTAL PERFORMANCESTANDARDS

Table 1 includes OceanaGold's Environmental Performance Standards related to vibration and how they are complied with.

Table 1 - OGC Environmental Standards Requirements

Requirement	Compliance
Where noise, vibration and visual impacts are not assessed as Material Risks, the Business Unit shall document systems and processes that demonstrate how impacts from these aspects are managed at the Business Unit. (Site)	Vibration assessed as Material Risk
Baseline noise and visual impact conditions shall be characterised prior to the construction of new facilities and extensions to existing facilities. (Site)	Completed at the outset of new projects through the AEE process
Business units shall identify all affected external receivers that will be impacted by noise, vibration and intrusive visual impacts. Where applicable, noise, vibration and visual impact monitoring shall be undertaken to identify any adverse effects from the Business Unit. (Site)	Completed at the outset of new projects through the AEE process Monitoring processes outlined in section 6 of the BVMP
Equipment design and purchasing requirements shall consider the minimisation of noise and vibration levels. (Site)	Blast design considers minimisation of vibration level. Outlined in Section 5 of the BVMP.
Blasting activities shall comply with regulatory requirements and consider the potential impacts to the community. (Site)	Section 3 of the BVMP sets out host country requirements
In the absence of host country requirements and guidelines, peak overall sound pressure level due to air blasts shall not exceed 128 dB (unweighted) at any residential property not owned by Business Units. (Site)	Section 3 of the BVMP sets out host country requirements
Blasting shall be designed to prevent damage to structures unless they are owned by Business Units. (Site)	Vibration consent compliance limits designed to prevent damage to structures, Section 5 of the BVMP outlines necessary procedures.
Monitoring systems and programs shall be established to ensure Business Units activities operate in compliance, including a mechanism for assessing noise and vibration monitoring results against the relevant criteria. (Site)	Section 9 of the BVMP
In the absence of host country requirements or guidelines Australian Standard AS 2187.2-2006, Explosives – Storage and Use of Explosives (or equivalent) shall be applied. (Site)	Addressed within Hazardous Substances Use and Management Plan

APPENDIX G – VIBRATION RISK ASSESSMENT

Risk Description (What can happen)	Potential Cause(s) (How / why might it happen?)	Principal Hazard Impacts	Inherent Risk (Absent or failed controls/defences)				Critical Controls	Current Controls	Impacted Areas (Maximum reasonable consequence)							Residual/Current Risk (controls present and applied)			
			Consequence (Credible worst case)	Likelihood	Risk Level				Health and Safety	Environmental	Social	Financial	Reputation	Compliance	OceanaGold Standard	Consequence (Maximum reasonable case)	Likelihood	Risk Level	
Blast vibration non-compliance	Repeated high level blasts Poorly designed blasts Poor ground conditions Lack of mitigation following high level blasts	Delays to operation Prosecution Difficulties for future consenting	4	D	14	High	Blasts designed to predicted PPV <5 mm/s Investigations into vibration results >5mm/s	Blasts designed to predicted PPV <5 mm/s Investigations into vibration results >5mm/s			4	4	4	4	9.Environmental Noise and Vibration	2	D	5	Low
Blast vibration causes damage to structures or heritage items	Poorly designed blast Anomalous geology	Cost to repair/replace Damage to reputation Prosecution	3	D	9	Medium	Compliance limits designed by vibration technical specialist to prevent damage to structures Blast design to predicted PPV <5mm/s	Compliance limits designed by vibration technical specialist to prevent damage to structures Blast design to predicted PPV <5mm/s			4	4	4	4	9.Environmental Noise and Vibration	2	E	3	Low
High level blasts cause very high Amenity Effect Payment	Repeated high level blasts Poor ground conditions Lack of mitigation following high level blasts	Increased costs Damage to reputation	3	D	9	Medium	Compliance limits designed by vibration technical specialist to prevent damage to structures Blast design to predicted PPV <5mm/s	Compliance limits designed by vibration technical specialist to prevent damage to structures Blast design to predicted PPV <5mm/s Roving monitoring to investigate anomalous geology			3	3	3	3	9.Environmental Noise and Vibration	1	C	4	Low
Vibration from WUG impacts native frogs above WUG	High level blasts Unanticipated effects of vibration	Loss of biodiversity Reputational damage Process loss	2	D	5	Low	Compliance limits designed by vibration technical specialist to prevent impacts to native frogs Blast design to predicted PPV <15mm/s Pest control programme to address uncertainty in effect	Compliance limits designed by vibration technical specialist to prevent impacts to native frogs Blast design to predicted PPV <15mm/s Pest control programme to address uncertainty in effect		2			2	2	9.Environmental Noise and Vibration	1	E	1	Low