APPENDIX F

Noise Assessment
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PROJECT MARTHA

WAIHI

ASSESSMENT OF NOISE EFFECTS

Report No 17086/2

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CONTENTS

1 INTRODUCTION

Project Martha will extend the existing Martha Mine by developing the Martha Phase 4 pit (MP4) as shown on Figure 1, only a very minor part of which lies outside the existing permit areas (Figure 2). The MP4 pit crest requires the realignment of Bulltown and Cambridge Roads and a noise bund will be constructed to assist with noise mitigation to the north of the pit. Project Martha also includes the Martha Underground Mine, which is a new project and therefore requires a new land use consent, but as underground mining generates no noise other than the associated portals and shafts within MP4 only these aspects are relevant to this report.

This report assesses the noise effects associated with the surface elements of Project Martha, including:

- mining and mining operations on the Martha pit's north wall including blast hole drilling, excavation and hauling to the stockpiles on the crusher ROM;
- proposed noise bund above the north wall;
- house relocations and demolition;
- Bulltown Road realignment;
- construction and operation of a vent shaft and portals on the south wall of the pit;
- crushing underground and open pit mining material at the portals within Martha Pit for use underground;
- hauling waste rock from the cutback to an in-pit stockpile to be used as underground backfill;
- all activities in the Surface Facilities Area (SFA) including crushing and transfer onto the main conveyor belt;
- maintenance of machinery within the maintenance shed (24 hours), dust control (24 hours) and transporting explosives;
- surface activities relating to the Martha Underground being haulage of material in and out, construction and operation of the ventilation shaft and one fresh air/one return air portal;
- continued operation of the Trio and Correnso Vent Shafts; and the MDDP portal.

- operation of the Cement Aggregate Fill (CAF) plant near the Favona portal,
- mobile crusher;
- rock hammer in the base of the pit; and
- rehabilitation works, including construction of the pit lake filling pipeline corridor and the lake outlet tunnel, and construction of the limestone addition plant adjacent to the pit lake.

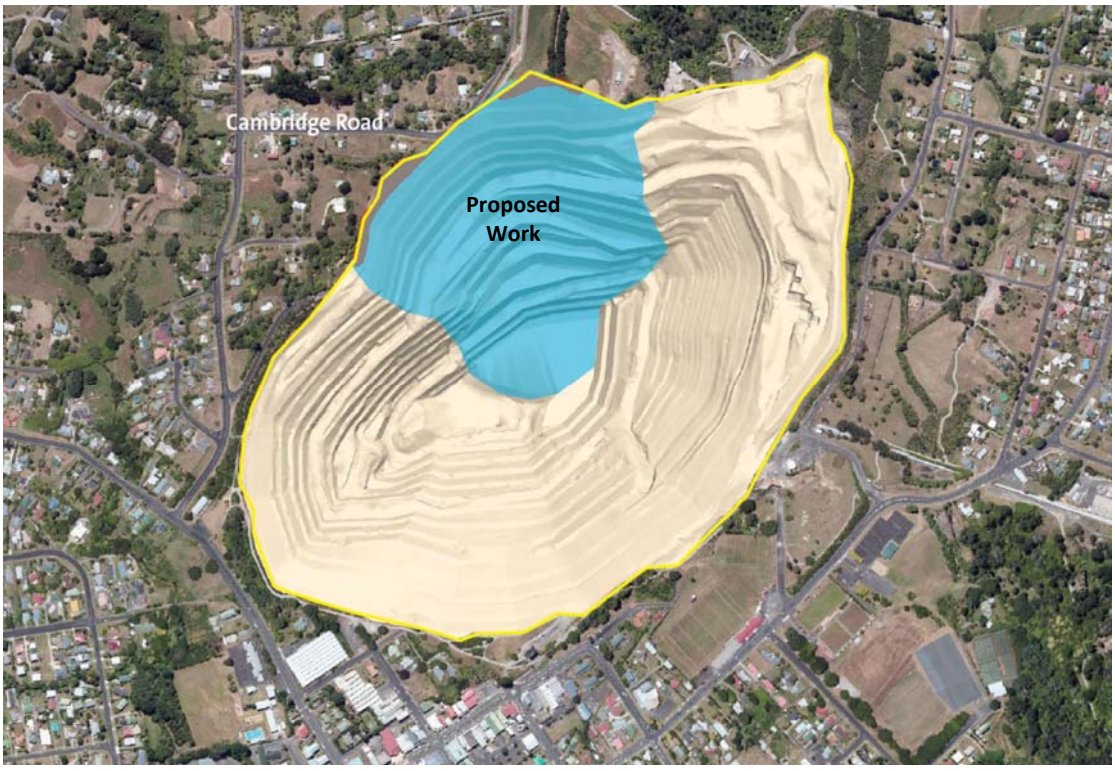

Figure 1. Area of Proposed Works

The proposed mining will rely partly on the use of existing consented facilities and infrastructure including:

- The Processing Plant, including the Water Treatment Plant;
- Access drives and shafts associated with the existing underground mines;
- The crusher and conveyor from the Martha pit to the rock and tailings storage area;
- Existing stockpiles within the Processing Plant and polishing pond stockpiles,

- The existing rock and tailings storage facilities.

For MP4 there will be construction noise effects associated with the relocation and demolition of houses, construction of the proposed noise bund, realignment of Bulltown and Cambridge Roads and rehabilitation work including construction of the lake outlet tunnel, the limestone addition plant for the pit lake and the pit lake filling pipeline corridor. Operational noise effects will occur from any noise generating activity associated with mining and mining operations.

Accordingly, this report considers both the construction noise effects of the proposals and the operational noise effects of the proposed mining-related activities. Each of the proposed activities has been evaluated and the method to be adopted to control noise to within a reasonable level has been assessed. As part of this process, appropriate noise limits have been recommended for both construction and operational activities. The proposed operational noise limits are intended to provide a similar level of amenity protection as is provided by the existing noise conditions. At the same time it is proposed to simplify the existing noise limits as discussed in the following section.

2 DESIGN CRITERIA

As shown on Figure 2 the Martha Mine is located in the Martha Mineral Zone in the Hauraki District Plan. All but a small area of the proposed open pit mining activities associated with Project Martha will be located within that zone, as are the proposed ventilation and access shafts and portals associated with the Martha Underground Mine. Those aspects of the pit mining activities located outside of the Martha Mineral Zone will be located in the Residential and Low Density Residential Zones.

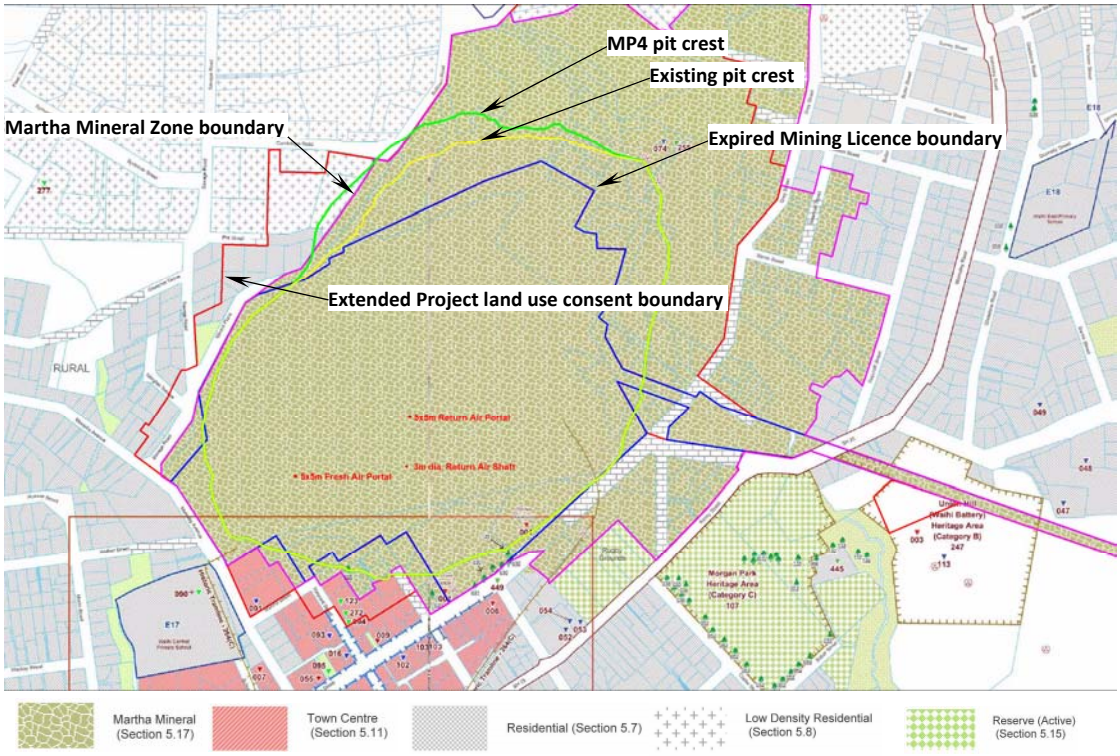

Figure 2. Site Zoning

Historically there has been a 50dB and 55dB noise control boundary used to control noise from mining in the Martha Pit. This is set out in the Hauraki District Council Land Use Consent and Conditions for the Extended Martha Mine Project No 87/98-105 (the EMMA consent), which established these noise control boundaries[1] around

[1] A noise control boundary is a spatial representation showing the extent of permitted noise around the mine

the mine. In relation to operational noise, condition 3.8(b)(i) of the Land Use Consent[2] includes the following:

> i) Activities Within Area B
>
> The noise level (L_{Aeq}) at any point outside the 55dB and 50dB control boundaries shown in Plan 2 (copy attached in Appendix E) [Figure 3 in this report] arising from mining and related activities when measured within or close to the boundary of any residentially zoned site or the notional boundary of any occupied dwelling in the Rural Zone not owned by the Company or not subject to an agreement with the Company or related Company shall not exceed the limits specified below:

		55dB Control Boundary	50dB Control Boundary
Monday – Friday	0700-2100	55dB	50dB
Saturday	0700-1200	55dB	50dB
All other times		40dB	40dB

> In the event that a property is sold and ceases to be subject to an agreement between the consent holder (or related Company) and the purchaser, or in the event that there is no longer an agreement between the consent holder (or related Company) and the landowner, the location for the measurement of noise shall revert to being within or close to the boundary of that residentially zoned site or the notional boundary of the occupied rural site.

[2] HDC is currently processing an application to change from the previous L_{10} to its L_{Aeq} noise measure.

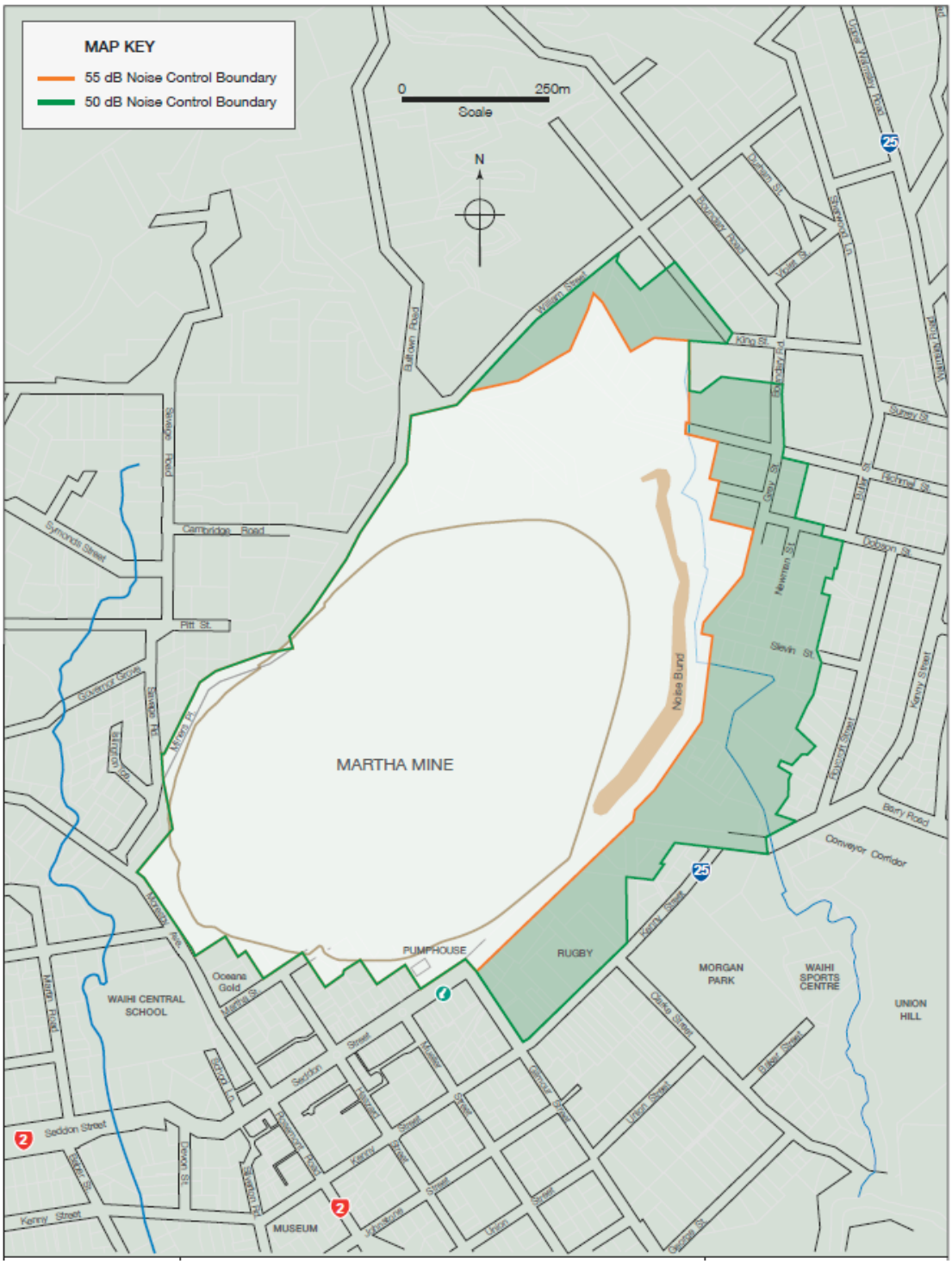

Figure 3. Noise Control Boundaries

There is no noise standard for the Martha Mineral Zone in section 8.3.1.3 of the Hauraki District Plan. However, Rule 5.17.4.1 of the Martha Mineral Zone states that any activity that complies with the requirements of Mining Licence 32 2388 is a permitted activity subject to conditions in the Hauraki District Plan. The Conditions of

Mining Licence 32-2388 (incorporating Favona, Trio Variations – and 2017 Variation) set the following noise requirements.

Condition 21 states:

(a) *All activities provided for by the Mining Licence taking place on any site within the Mining Licence area shall not exceed the following limits when measured at or within the boundary of any residentially zoned site or the notional boundary of any occupied dwelling in the Rural Zone and measured over the periods specified below:*

Monday-Friday	*0700 - 2100*	*55dB L_{Aeq}*
Saturday	*0700 - 1200*	*55dB L_{Aeq}*
All other times		*40dB L_{Aeq}*
2100 - 0700 (the following day)		*70dB L_{AFmax}*

All noise shall be measured within or close to the boundary of any residentially zoned site or the notional boundary of any occupied rural dwelling site not owned by the licence holder or related Company or not subject to an agreement with the licence holder or related Company.

In the event that a property is sold and ceases to be subject to an agreement between the licence holder (or related Company) and the purchaser, or in the event that there is no longer an agreement between the licence holder (or related Company) and the landowner, the location for the measurement of noise shall revert to being on or close to the boundary of that residentially zoned site or the notional boundary of the occupied rural site.

(b) *Deleted*

(c) *Deleted*

(d) *Noise shall be measured in accordance with the provisions of New Zealand Standard NZS 6801:2008 Acoustics - Measurement of Environmental Sound and assessed in accordance with the provisions of NZS 6802:2008 Acoustics - Environmental Noise.*

(e) *Noise Management Plan*

The licence holder shall prepare a Noise Management Plan. This Management Plan shall be submitted to and approved by Hauraki District Council. The objective of this plan is to detail the methods to be used to comply with conditions 21 and 30.

Condition 9 Construction noise during construction period in the above document is set at:

With the exception of Waihi Central School where the construction noise limit shall be 55dB L_{Aeq} at any point within the boundary of the school, all construction activities provided for by the Mining Licence taking place within the Mining Licence area shall not exceed the following limits:

Monday - Friday	*Saturdays*	*L_{Aeq}*	*L_{AFmax}*
0630-0730		*60*	*70*
0730-1800	*0730-1800*	*75*	*90*
1800-2000		*70*	*85*

At all other times, including Sundays and Public Holidays, the noise level shall not exceed 40dB L_{Aeq}.

In summary, the current consents and the Hauraki District Plan set:

- an operational noise limit of 55dB L_{Aeq} between 0700 and 2100 Monday to Friday plus 0700 to 1200 on Saturdays for all existing mining activities taking place within the Mining Licence area;

- an operational noise limit of 50dB L_{Aeq} between 0700 and 2100 Monday to Friday plus 0700 to 1200 on Saturdays for all existing mining activities within Area B, with the EMMA consent imposing a 55dB L_{Aeq} limit at a noise control boundary for a sector around the eastern half of the Martha pit;

- for all other times (including night time) a noise limit of 40dB L_{Aeq} and

- construction noise limits for a strictly defined set of construction activities.

The Project Martha proposal is to update the location of the current Noise Control Boundaries shown in Figure 3 to reflect the minimum practicable noise that mining can operate to around the Martha Pit.

Where the operational noise exposure from mining is above 50dB, but does not exceed 55dB, this effect will be limited to a nominal six month period at any given receiver, after which mining activities will have moved and the noise exposure reduced to no more than 50dB. The District Plan expectation in a residential and low density residential zone is 50dB L_{Aeq} between 0700 and 2200, so there will potentially be up to a 5dB increase for a small number of residents.

While there will be three residents (Figure 8, Sites 7, 10 and 11), exposed to occasional periods of noise above the District Plan's 50dB L_{Aeq} level, this needs to be considered against the following:

- The relatively short duration of exposure – mining is transient and levels will only be above 50dB for a short period before mining moves across the north wall;
- Any increased noise levels will be limited to daytime hours, which is a maximum of 0700 – 2100. These hours are less than the daytime hours of 0700 – 2200 adopted in the District Plan;
- In most instances the level of noise at the boundary of any dwellings will remain close to 50dB (i.e. 51 - 53 dB). While such increases in noise will be measurable, they are unlikely to be discernible to residents;
- Similar noise levels have been previously experienced in these areas as a result of mining activity in the Martha pit; and
- The greater construction noise effects that would be associated with creating additional noise screening so as to achieve 50dB would in comparison cause a greater loss of amenity.

As such, it is considered that any short duration increases in noise levels will not unduly impact on the amenity experienced by the dwellings located between the 50dB and 55dB noise contours proposed by Project Martha, and that reasonable amenity will be maintained.

The construction of a higher bund to provide better screening and hence even lower noise levels would face considerable construction challenges, and also would involve a longer period of construction activity at higher noise levels than would be experienced from the mining noise (e.g. the construction noise standard allows up to 75dB for works that take less than 20 weeks to complete at any one location). The construction of the screening would also need to be undertaken closer to the neighbours than any mining activity.

The shafts and portals associated with the Martha Underground Mine are located within the Martha Mineral Zone. While their use is not a permitted activity under that rule, any noise from the shafts and portals will be controlled to within the requirements of the permitted activity Rule 5.17.4.1P1 of the Hauraki District Plan.

Much of the construction of these shafts and portals will be undertaken from inside the underground mine, so other than the breakthrough there will not be any noticeable construction noise. Breakthrough may be completed using a rock hammer, which, when considering the depth of the work in the pit, will comply with the operational noise limits for any mining activity with a good factor of safety.

For the operational phase, vent fans would be designed to meet 40dB L_{Aeq} with a factor of safety by either the selection of a quiet fan or if this is impractical, including a silencer on the fan. Any associated mining activity (e.g. light vehicle access; stockpiling near the portal) would also comply with the 40dB L_{Aeq} limit if undertaken outside the open pit work hours. The hours of work for open pit mining, conveying, and operations within the waste and tailings area (other than maintenance work) are 0700-2100 Monday to Friday and 0700-1200 Saturday, although work is permitted between 1900 and 2100 hours Monday to Friday if the operations are of an urgent nature and necessary for the effective carrying out of mining operations.

It is noted that some limited exploration drilling, maintenance work and the use of water carts for dust control may occur (and has in the past) at lower levels within the pit at night time. These various activities have been, and will continue to be, managed to ensure that noise effects comply with a noise limit of 40dB $L_{Aeq,}$ which also reflects the night time noise limits in the EMMA consent and Rule 5.17.4.1 P1 of the Hauraki District Plan.

3 PROPOSED WORK

At current mining and processing rates the existing consented mineral resource will be exhausted at the end of 2019. Further mineral resources have been identified and a proposal, MP4, will extend the life of the open pit mine by improving stability around the area of the north wall that was subject to the recent rock fall and to enable access to ore in the floor of the pit currently buried under the rock fall debris. The MP4 mining will follow a top down sequence.

Construction activities include:

- All road realignment work at Bulltown Road/Savage Road;
- All work associated with the Project Martha noise bund/walls/fencing;
- Construction of the lake outlet tunnel;
- House relocation and demolition
- Construction of the limestone addition plant for the pit lake; and
- Construction associated with the pit lake filling pipeline corridor,
- Rehabilitation activities.

Day time operational activities include:

- All Phase 4 cutback work and associated activities (with the exception of the construction activities referred to above) including blast hole and probe hole drilling, bulldozing, excavation and hauling to the stockpiles on the crusher ROM, use of the water cart, service vehicles, explosives trucks and ancillary vehicles etc;
- Hauling overburden from the Phase 4 cutback to an in pit stockpile to be used as underground backfill;
- Installation of pumps within the base of the pit to remove perched water;
- All operational activities in the surface facilities area including crushing and transfer onto the main conveyor belt, (i.e. until that point where it is covered by District Plan Rule 5.17.4.1 P1), a dozer and digger on the stockpile;
- Transportation of explosives from where they are stored to the Phase 4 cutback and to the underground portals;

- Surface activities at depth within the open pit relating to Martha Underground and Rex including haulage of material in and out of the portals with the underground haul trucks, to and from the in-pit stockpiles (note these will be 24 hour activities);

- A mobile crusher located adjacent to the MDDP portal on the RL1010 South Haul Road;

- Loading of the in pit underground stockpiles into the open pit haul trucks and trucking the material to the crusher ROM;

- A rock hammer or rock crusher within the pit or in the SFA;

- The construction and ongoing operation of the ventilation shaft, the return air portal and the fresh air portal in the open pit;

- The continued operation of the Correnso and Trio Vent Shafts;

- The CAF plant close to the Favona portal; and

- Stockpiling and rehandling of material at the processing plant near the portal and also hauling to and from and stockpiling/rehandling at the polishing pond stockpile.

The noise modelling includes the conveyor noise but the conveyor is not within the scope of the Project Martha consents as the conveyor noise is covered by the ML and is therefore included within the permitted activity rule in the District Plan.

Night time work includes:

- Maintenance activities;

- Dust control;

- Underground mining activities as explained above, including hauling of material in and out of the open pit at depth to and from the in pit stockpiles, and hauling material in and out of the Favona portal to and from stockpiles located at the Processing Plant and also to and from the polishing pond stockpile;

- Vent shaft and portal operation; and

- CAF plant operation.

The initial work will require the relocation and demolition of houses, realignment of Bulltown and Cambridge Roads, as set out in the TDG Project Martha Transportation

Assessment, and the construction of a noise control bund as shown in Figure 4 to reduce noise levels. The relocations/demolition of houses, construction of the road realignment, the noise control bund and proposed barrier on top of the earth bund will cause temporary construction noise effects.

Figure 4. Proposed Noise Control Bund

Once Bulltown Road and Cambridge Road have been realigned, a noise control screen as shown on Figure 4 will be constructed using a combination of an earth bund with a noise barrier on top of the bund. The barrier section of the screening would be constructed with a solid material having a surface density of at least 10kg/m^2.

The height of the proposed barrier was determined following advice to OGNZL from Hegley Acoustics recommending a barrier of about 3m in height above the natural ground level extending from about Pitt Street in the south to the highest point of natural ground above the pit wall in the north. For most of its length OGNZL proposes to construct the bund using soil from adjacent to the MP4 crest, subject to

the spatial constraints imposed by the pit crest, which defines the inner toe of the bund, and private and Council properties that define the bund's outer extent.

The greatest spatial constraint occurs where the realigned Cambridge/Bulltown Roads come closest to the pit crest, limiting the height of an earth bund to no more than about 1.5m. For this section, a length of around 140m, OGNZL proposes to construct a 2m high, close-boarded timber fence a minimum of 20mm thick to provide the necessary screen height and acoustic performance (including surface density of at least 10kg/m^2). As part of its obligation to minimise noise, OGNZL also proposes extending that fence to the south along the remaining length of the noise bund. It is this arrangement that was assumed for the modelling of noise effects associated with mining of the upper north wall.

Material from the mine would be used to construct the bund with equipment such as an excavator, bulldozer and compactor as used during the recent work undertaken to construct the noise bund prior to the interim remedial work undertaken above the north wall in late 2016/early 2017. An excavator loading an articulated dump truck to transport material from the mine to the bund would also be used. Constructing the barrier on top of the bund will require an excavator and drill to prepare the ground for posts to support the barrier. As the construction of the bund would be the noisiest activity, and is best seen as a construction as opposed to operational noise, this activity has been assessed against the construction noise limits.

Once the noise control bund is constructed mining operations will commence behind the bund and the operational noise limits will be applicable. This mining operation work will be undertaken using a bulldozer, two excavators, two rock drills initially then increasing to four drills once the mining is 15m to 20m below the rim of the pit. These drills are used to enable charges to be placed for blasting. Until the depth of mining is well advanced, when larger machinery will and can be used, articulated dump trucks would be used to transport the mined material to the crusher where there will also be a loader to manage the excavated material.

4 EXISTING ENVIRONMENT

The existing noise environment is dependent on the effects of any activity that may be occurring in the mine, the proximity to roads, and general environmental noise. There has been minimal work in the pit in the last few years, so the community in the Bulltown Road area has not had much recent experience with the consented environmental baseline for noise. The existing environment in relation to mining is represented by the activities authorised by a resource consent (i.e. EMMA consent) and permitted activities (i.e. the incorporation of the mining licence into a permitted activity rule).

The Hauraki District Plan adopts a daytime noise level of 50dB L_{Aeq} in the Residential and Low Density Residential Zones for a permitted activity, L_{Aeq} being the preferred noise descriptor in the District Plan, replacing the previous L_{10} descriptor.

In an application for Mining Licence 23 2388 the Planning Tribunal (now Environment Court) reported[3] "… *we find that the average day-time L_{10} values range from 40 to 55dBA in residential areas of Waihi which are not affected by traffic noise. The levels remain relatively steady from before 7.00am to after 6.00pm (and 9.00pm if traffic noise is not excluded), and there is no significant difference at weekends*".

Recent field surveys indicate similar noise levels are still experienced around the perimeter of the mine including in the Bulltown Road area.

When the open pit was first developed in the 1980's the noise design criteria for the pit operations was 55dB L_{10}, and in 1999 through the EMMA consent was changed to 50dBA L_{10}. Prior to the expiry of the Mining Licence in mid-2017, when those noise limits were transferred to a permitted activity rule within the Martha Mineral Zone, and following a variation to the EMMA consent, the operation's limits now adopt the same L_{Aeq} noise descriptor as the District Plan. The existing noise environment for areas around the pit is defined generally as 50dB, with some areas around the northern perimeter being 55dB, and is generally 55dB elsewhere (the conveyor, processing plant and tailings storage facilities area).

[3] Report and Recommendation of the Planning Tribunal, Paragraph 8.5.1 Decision No. A48/87

For Project Martha where a variation to the existing environment is proposed, in making an assessment on the effect such change has on nearby residents and the District Plan's objective of protecting amenity, it is important to understand that an increase or decrease in noise level of 3dB is considered to be just noticeable and a change of 10dB is a doubling, or halving, of the perceived noise.

5 PREDICTED NOISE LEVELS

Noise from the various stages of bund construction and mining has been predicted using the Brüel & Kjær Predictor program version 11.10. This is a powerful environmental noise calculation software package that uses a digital terrain model with a 2m ground resolution, plus any purpose built noise bunds, and each of the noise sources modelled at their various locations on the ground. Calculations are undertaken in accordance with the requirements of ISO 9613-1/2 Acoustics – Attenuation of Sound during Propagation Outdoors. Slightly enhanced propagation conditions have been adopted in accordance with the requirements of clause 7.1.2 of NZS6801:2008 Acoustics - Measurement of Environmental Sound with a ground attenuation factor of 0.7 for farmland and a grid size to calculate the noise contours varying between 15 – 40m. No screening effects of buildings have been included in the calculations.

For both construction and operational phases each relevant assessment has been based on the noisiest phase of the work. That is the noise bund constructed with equipment operating at a position closest to the dwellings and mining based on the 'top down' approach, which is all equipment at the top of the work area. For the majority of the time the noise levels will be lower than predicted. The predicted operational noise levels are the levels from the mining activities; they do not include any cumulative effects from the existing noise environment in accordance with the requirements of NZS6802:2008 *Acoustics – Environmental Noise*.

Construction – Noise Bund

The highest noise levels would be experienced during the construction of the noise control bund when there is no screening to the neighbours. The assessment has considered three of the locations most exposed to dwellings during the bund construction.

Figure 5 shows the noise contours when undertaking the construction works at the eastern end of the noise control bund. Figure 6 shows constructing the centre section of the bund and Figure 7 shows constructing the western end of the bund.

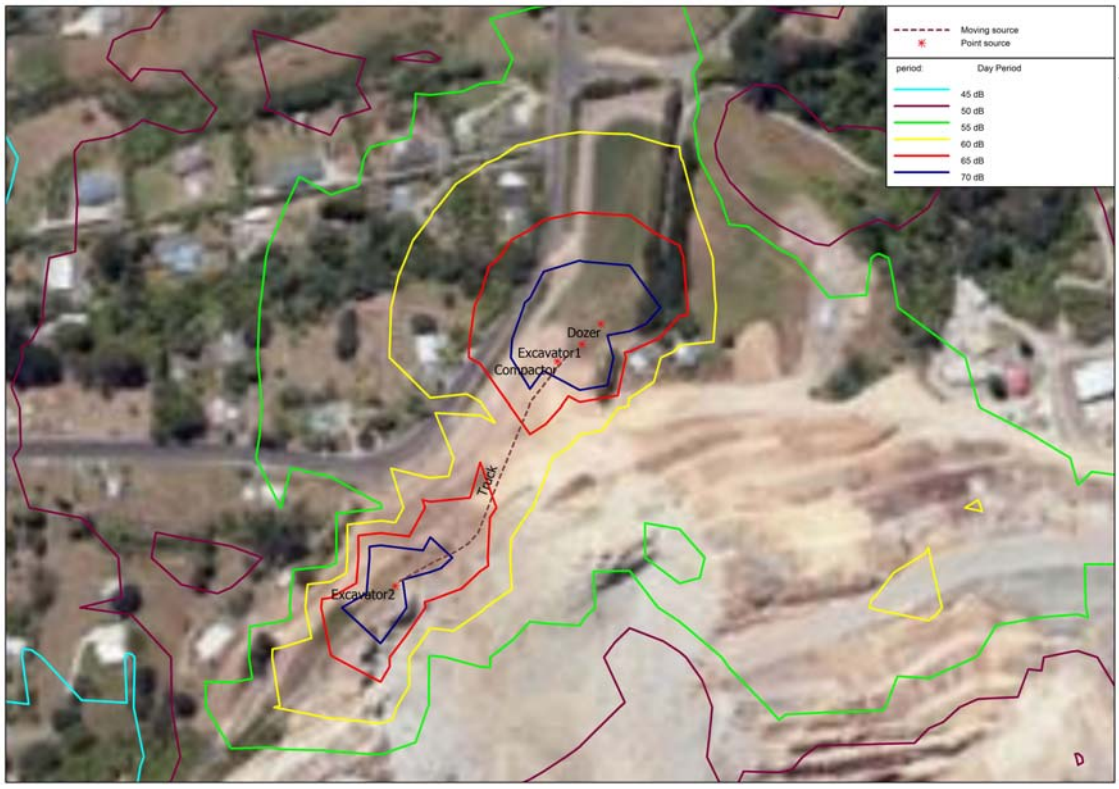

Figure 5. Constructing the Eastern End of the Bund, dB L_{Aeq}

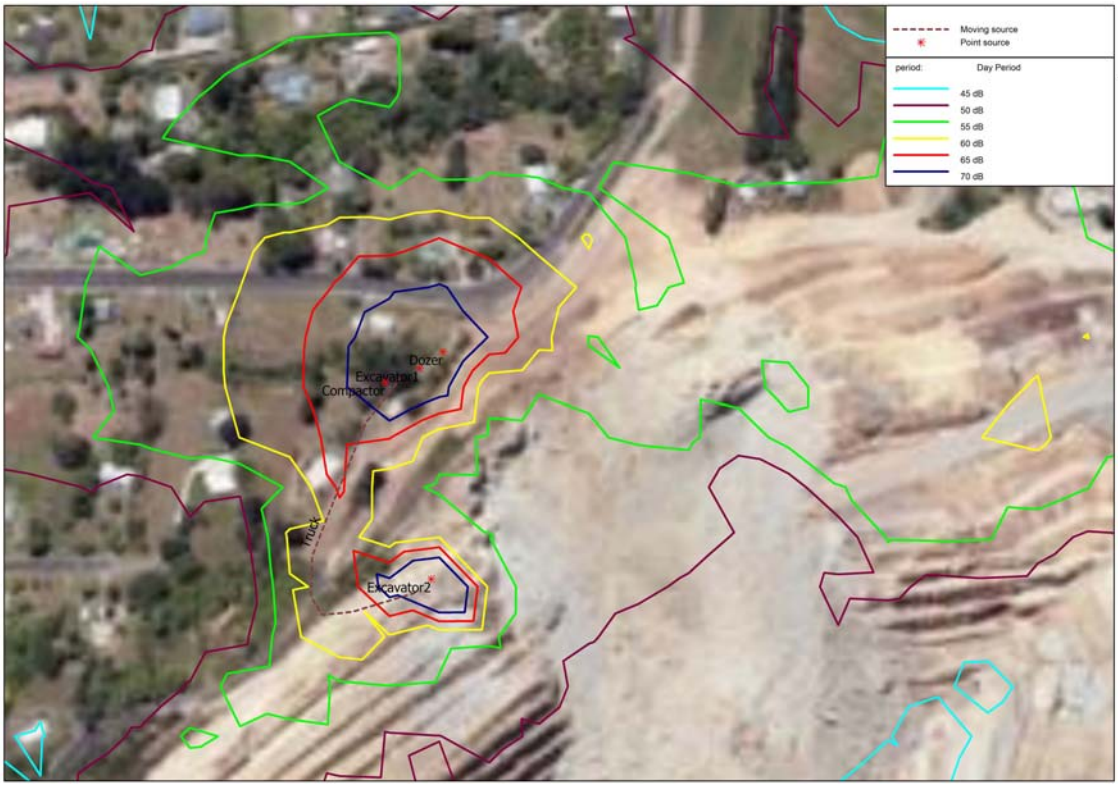

Figure 6. Constructing the Centre of the Bund, dB L_{Aeq}

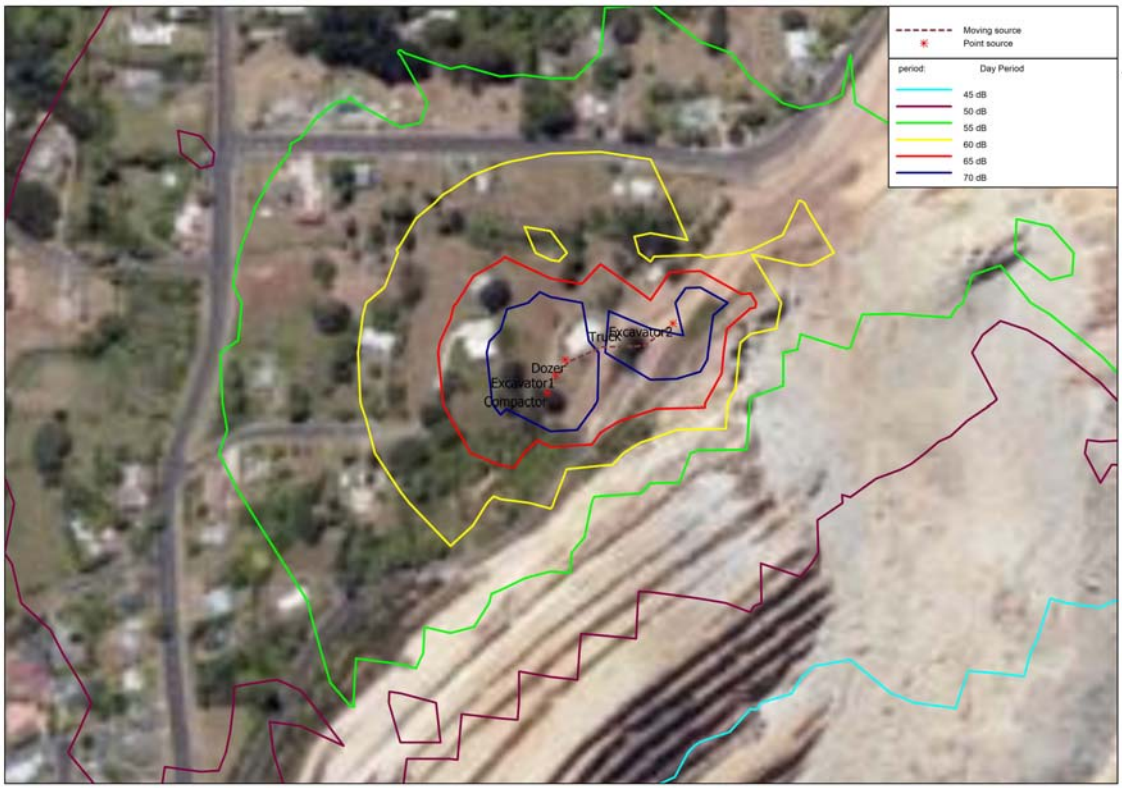

Figure 7. Constructing the Western End of the Noise Bund, dB L_{Aeq}

In addition to the prediction of noise contours, construction noise levels have been calculated at 1m from the façade of the dwellings shown in Figure 8 and the results listed in Table 1. From the Table 1 results, the property predicted to receive one of the highest levels of construction noise is dwelling 7. At the time of reporting the owner of this property and OGNZL were negotiating its sale.

Figure 8. Noise Prediction Points for Martha Phase 4

Site*	Eastern End of Bund (Figure 5)	Centre of Bund (Figure 6)	Western End of Bund (Figure 7)
1	51	55	51
2	53	56	51
3	56	54	51
4	59	53	49
5	60	49	50
6	67	51	52
7	66	56	55
8	50	55	55
9	49	55	55
10	50	52	70
11	45	45	58
12	43	44	52
13	43	44	52

* See Figure 8 for the location of the dwellings

Table 1. Predicted Construction Noise, dB L_{Aeq}

As shown in Table 1 construction noise will comply with the design limit of 75dB L_{Aeq} at all residential locations. It is noted that the predicted levels are for the worst case construction scenarios. For the majority of the time the noise levels will be noticeably lower than given in Table 1. Construction noise will only be at the higher levels for 2 – 3 weeks (weather dependent) and will be restricted to the core construction hours of 0730 - 1800 Monday to Saturday.

Construction - Bulltown Road Realignment

As part of the MP4 work it will be necessary to realign Bulltown Road and Cambridge Road. The general location of the realignment is shown on Figure 9.

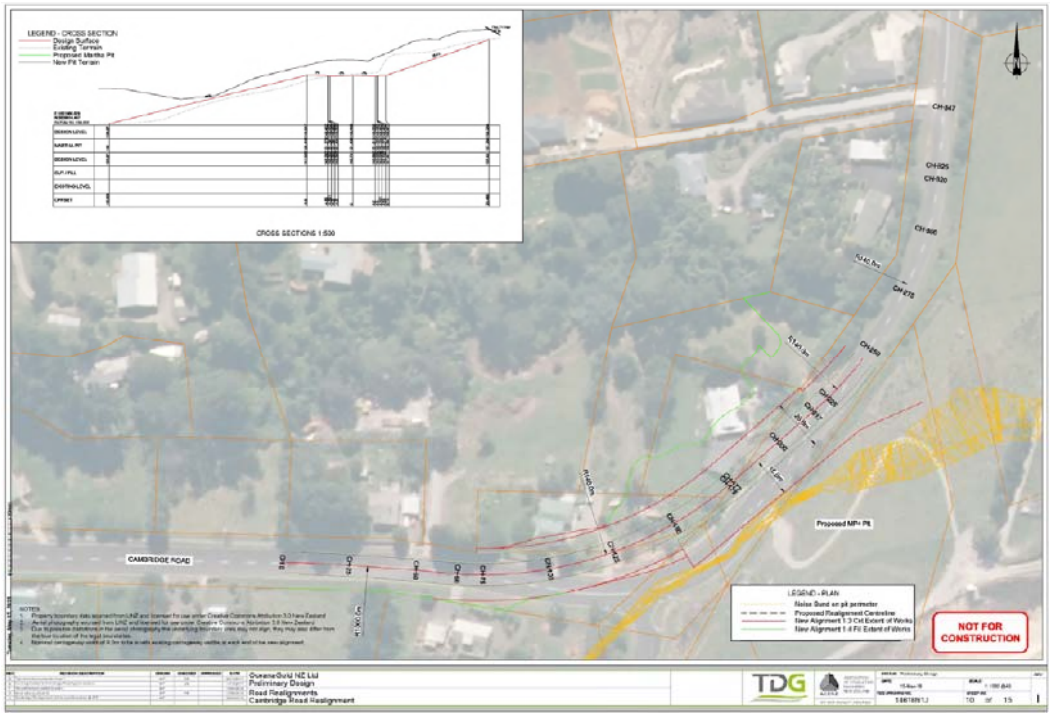

Figure 9. Bulltown Road Realignment

The noise effects of the road realignment will be from the construction of the new section of the road and the traffic noise once the road has been realigned. It has been assumed the typical construction equipment to realign the road will include a Komatsu D53P bulldozer (L_{WA} 105dB), Cat 320D excavator (L_{WA} 106dB), Volvo L120 loader (L_{WA} 102dB), Cat 16M grader (L_{WA} 102dB), Bomag BW121D compactor (L_{WA} 100dB) and trucks (L_{WA} 102dB). Not all of this equipment will operate at the same time.

Based on this equipment operating, the unmitigated noise measured at 1m from the most exposed dwelling façade (Site 7, Figure 8) will be up to 77dB L_{Aeq} when assuming line of sight between the equipment operating on the road realignment and the receiver position. Assuming the residents are home during the daytime when the construction work will be undertaken it will be necessary to construct a solid 1.8m high barrier located between the construction works and the dwelling to control all construction noise to an upper limit of 75dB L_{Aeq}. When taking into account the duration of this work, the construction noise will be typical of any minor road construction, within the requirements of NZS 6803:1999 and at a level considered reasonable for construction work. The next closest resident (Site 6, Figure 8) is well clear of the proposed realignment so the received noise will be 66dB L_{Aeq} assuming no purpose built screening in place. This is well within the limit for construction noise.

Once the road realignment has been completed the traffic volumes and vehicle types are expected to be the same as that currently experienced. A perceptible noise change of 3dB would only occur if the distance between the existing and proposed road alignment halved. This is not the case and therefore as the realignment does not materially alter the distance to the remaining houses, traffic noise effects associated with the realignment will be less than minor.

Operational - Mining

Once any barrier is in place the highest noise levels will be at the start of the mining activities close to the bund where the plant is at its closest position to the neighbours and at the maximum height. As a result, it is this location where the maximum noise level will be experienced by any neighbour. The assessment has considered four locations to determine the mining noise effects.

When predicting noise from the mining it has been assumed in the assessment there are four drilling rigs to prepare the holes to place the charges for blasting (the number of drilling rigs will vary between two and four, with two expected to be used initially. To provide the worst case four rigs have been included in the noise assessment). In addition, it is conservatively assumed there will be an underground mine truck exiting the portal to stockpile mined material before returning underground, a portable

crusher in operation to crush the stockpiled material, a loader feeding the main crusher, the conveyor operating, and a bulldozer working on top of the stockpile to the north of the crusher at RLm1125 to 1130. It is unlikely all of this plant would operate at the same time although it has been included so providing a factor of safety with the noise assessment.

Figure 10 shows the noise effects when mining is taking place adjacent to the eastern end of the bund on the north wall cutback and at the top of the existing ground surface plus a bulldozer working on the stockpile and feeding the crusher.

Figure 11 shows the noise effects when mining nominally half way along the proposed bund on the north wall cutback and at the closest and highest position to the dwellings.

Figure 12 shows the noise effects when mining the north wall cutback toward the western end of the bund and at the closest and highest position to the dwellings.

Figure 13 shows the noise effects when mining the north wall cutback at the western end of the bund and at the closest and highest position to the dwellings.

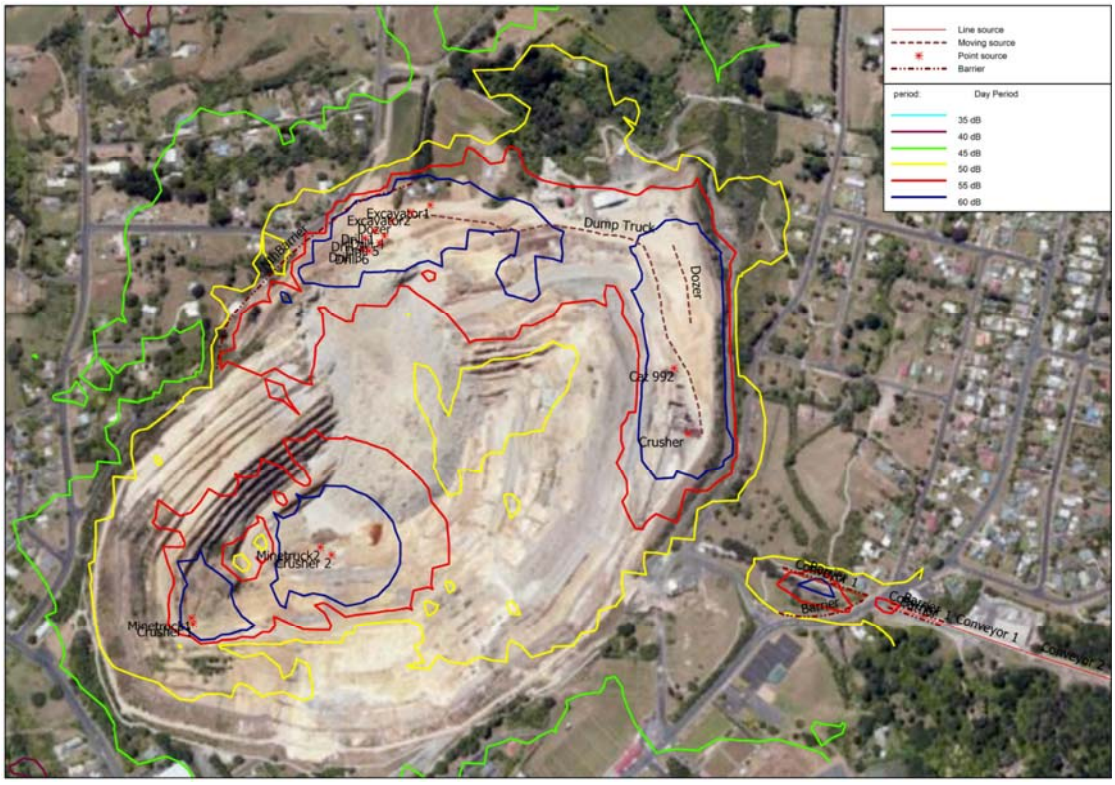

Figure 10. Mining Noise opposite the Eastern End of Bund, dB L_{Aeq}

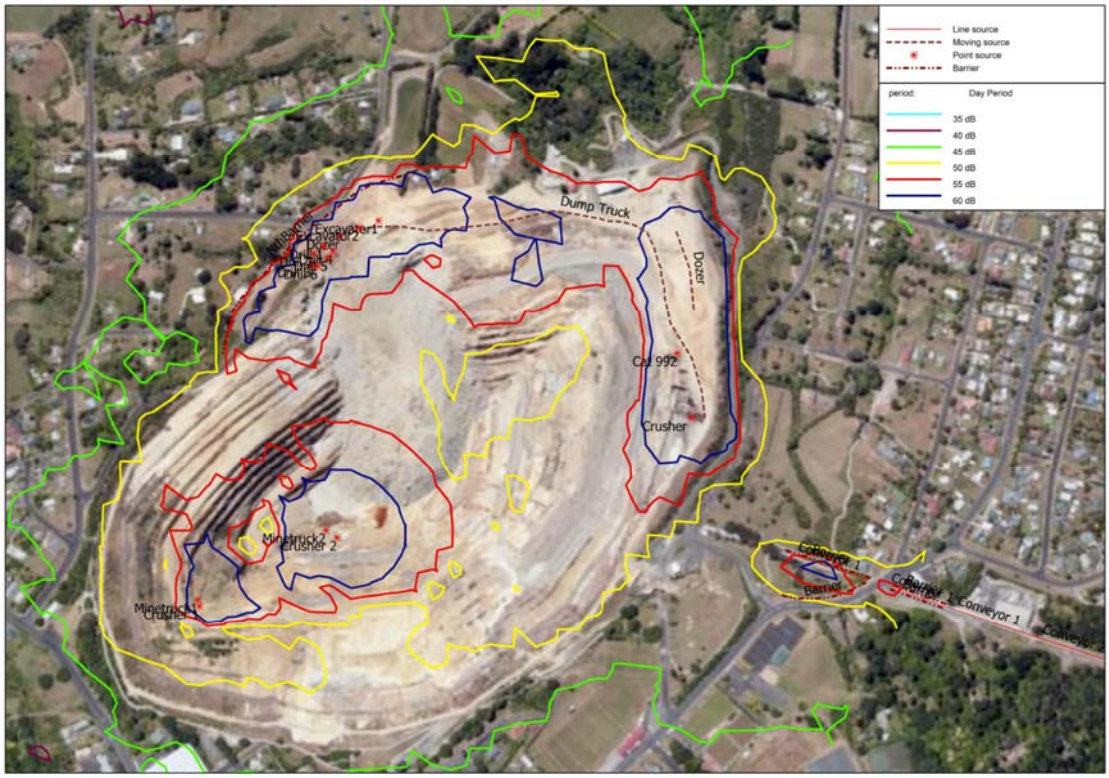

Figure 11. Mining Noise opposite the Centre of Bund, dB L_{Aeq}

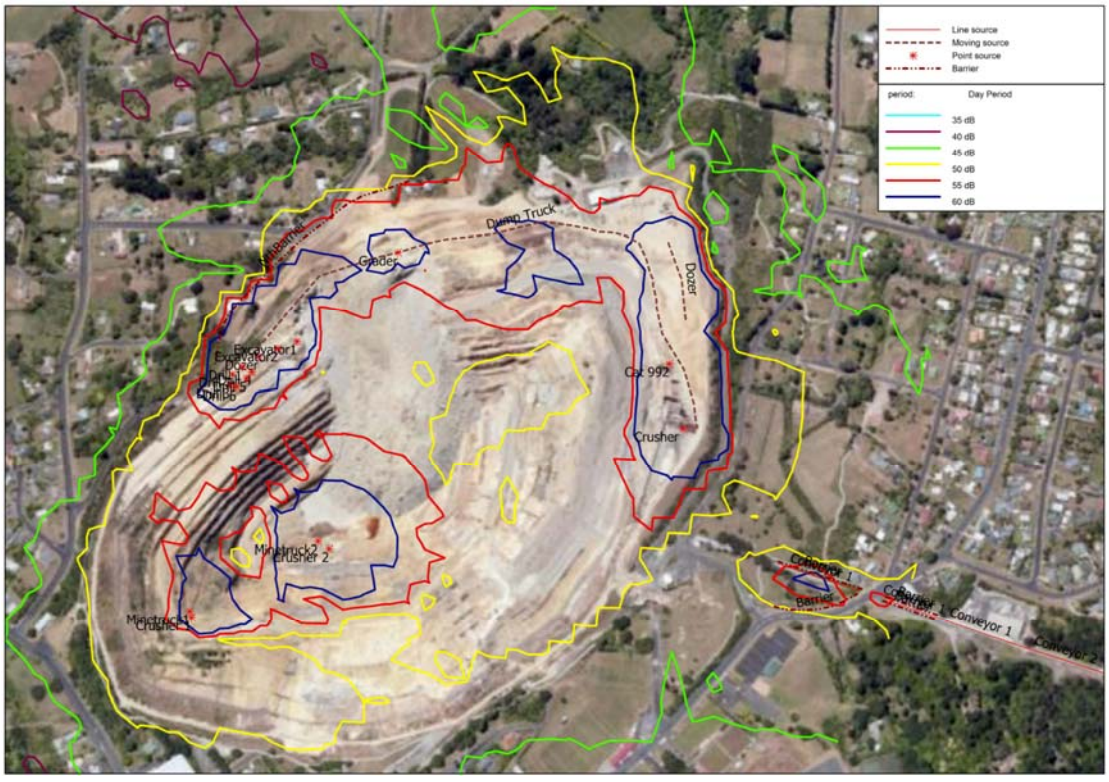

Figure 12. Mining Noise near the Western End of Bund, dB L_{Aeq}

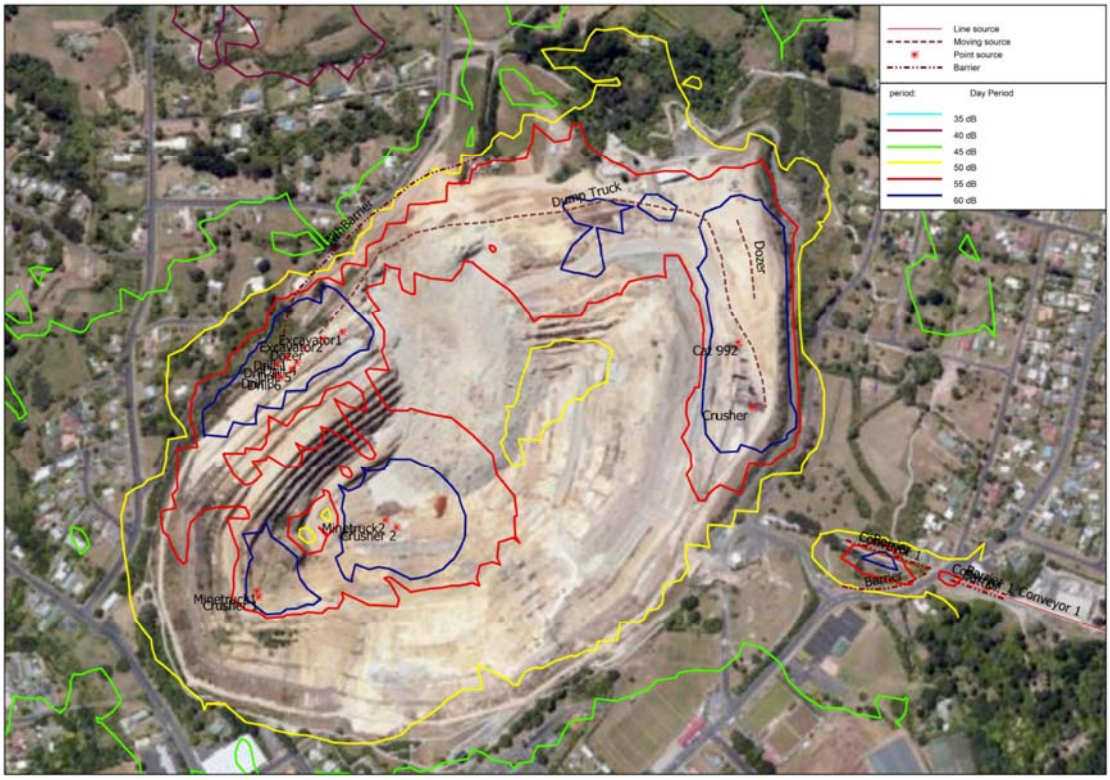

Figure 13. Mining Noise off the Western End of Bund, dB L_{Aeq}

Unlike construction noise, which is assessed within 1m of the building façade in accordance with the construction noise standard, mining noise levels have been predicted at the residential boundaries of the houses located close to the mining activities. Table 2 shows the predicted noise levels at the most exposed residential boundaries of the dwellings for the most exposed mining activity. The same locations used in the construction noise assessment have been used for the operational assessment.

Site*	Figure 10 East	Figure 11 Centre	Figure 12 Near West	Figure 13 Far West
1	45	44	43	43
2	47	46	43	42
3	44	45	44	42
4	46	43	46	43
5	46	47	46	44
6	48	48	46	45
7	53	53	51	47

8	46	46	45	44
9	45	45	45	45
10	46	47	47	51
11	44	45	46	52
12	44	44	44	50
13	44	44	44	50

* See Figure 8 for the location of the dwellings

Table 2. Predicted Mining Noise, dB L_{Aeq}

As shown in Table 2 mining behind the bund will ensure compliance with the proposed 55dB L_{Aeq} noise control boundary for operational noise. Site 7 will experience up to 53dB L_{Aeq}, Site 10 up to 51dB L_{Aeq} and Site 11 up to 52dB L_{Aeq}. It is noted that the above levels are for the worst case mining scenarios. For the majority of the time the noise levels will be noticeably lower than shown in Table 2, and mining noise is expected to be a minimum of 5dB L_{Aeq} lower than predicted within six months.

As set out above, the maximum level that will be experienced at any residential boundary of any property not owned by the company is 53dB L_{Aeq}. As an increase of 3dB is considered to be just noticeable and taking into account the existing noise environment, the small increase for the period when 53dB would be experienced is unlikely to be noticed by the resident and hence there will be no adverse noise effects.

The Martha Phase 4 work includes a small area by Bulltown Road that is just outside of the land use consent area that will involve an estimated eight months of earthworks (up to approximately one year if the road realignment and noise bund construction activities are included although this is weather dependent). As set out above, there is a small area opposite the north wall where the noise level will be up to 53dB L_{Aeq} during the daytime for up to three months at one dwelling. To further reduce noise levels for this dwelling would require significant additional work to develop a higher noise barrier, which would result in additional construction noise at levels that would be significantly higher than the upper limit of 53dB L_{Aeq} predicted from the pit earthworks over a similar time period. The noise effects from this construction work would be greater than the short term noise effects identified above.

In addition to the mining-related activities in the pit, there is also potential noise from the return air (exhaust) portal and shaft located at 925mRL (mine datum) and the fresh air (intake) portal located at 1003mRL to be constructed in the south wall of the Martha pit. Noise from these portals will be controlled by a combination of fan selection and the addition of a silencer to ensure the level is below 40dB L_{Aeq} and hence there will not be any cumulative noise effects on the predicted mining activities. Noise from the underground trucks dumping mined material just outside the portals will be 11dB L_{Aeq} at the boundary of the most exposed house and noise from crushing the material with a portable crusher up to 26dB L_{Aeq}.

6 RECOMMENDED CONDITIONS

As set out above, and taking into account the aim to develop a uniform noise control for all mining activities, the following conditions are recommended:

Construction Activities

1. The construction noise conditions below shall apply to the following activities authorised as part of this resource consent:
   - All road realignment work at Bulltown Road/Cambridge Road;
   - All work associated with the Project Martha noise bund/walls/fencing;
   - House relocation and demolition;
   - Construction of the lake outlet tunnel;
   - Construction of the limestone addition plant for the pit lake;
   - Construction associated with the pit lake filling pipeline corridor;
   - Rehabilitation work.

Noise Limits - Construction

2. All construction activities provided for by this consent shall not exceed the following noise limits within the boundary of Waihi Central School during the school term:

Monday – Friday	**L_{Aeq}**	**L_{AFmax}**
0830-1500	55dB	75dB

3. At all locations, including the Waihi Central School outside the times specified in Condition 2, all construction activities provided for by this consent shall not exceed the following noise limits:

Monday – Friday	*Saturdays*	*L_{Aeq}*	*L_{AFmax}*
0630-0730		*60dB*	*75dB*
0730-1800	*0730-1800*	*75dB*	*90dB*
1800-2000		*70dB*	*85dB*

4. At all other times, including Sundays and Public Holidays, the noise level from construction activities shall not exceed 40dB L_{Aeq}.

5. Construction noise shall be managed, measured and assessed in accordance with the requirements of NZS6803:1999 Acoustics – Construction Noise.

6. All construction noise shall be measured at any occupied dwelling not owned by the consent holder or related Company or not subject to an agreement with the consent holder or related Company.

7. The construction noise limits 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 noise

effects on the property caused by activities authorised under this consent are not to be taken into account for monitoring and compliance purposes.

8. The consent holder shall prepare a Noise Management Plan for certification by the Council. The objective of the Noise Management Plan is to provide detail on how compliance with conditions 2 and 3 will be achieved for the duration the construction activities referred to in condition 1. As a minimum the Noise Management Plan shall consider the requirements of Annex E of NZS 6803:1999 Acoustics – Construction Noise, design limits, complaints procedures and noise monitoring. This Noise Management Plan shall be submitted to the Council at least ten working days prior to the first exercise of this consent and the consent shall not be exercised until the Noise Management Plan has been certified by the Council. The Noise 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.

Advice Note

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

Noise Limits – Operations

9. The noise level (L_{Aeq}) at any point outside the 55dB and 50dB control boundaries around the Martha Pit shown on Figure 14 arising from mining and related activities shall not exceed the limits specified below:

		55dB Control Boundary	50dB Control Boundary
Monday – Friday	0700-2100	55 dB	50 dB
Saturday	0700-1200	55 dB	50 dB
All other times		40 dB	40 dB
Monday - Sunday	2100 - 0700	70dB L_{AFmax}	70dB L_{AFmax}

10. The noise level (L_{Aeq}) associated with the use of the CAF plant, the stockpiles at the Favona portal and polishing pond, and the pit lake filling pipeline corridor shall not exceed the limits specified below:

Monday – Friday	0700-2100	55 dB
Saturday	0700-1200	55 dB
All other times		40 dB

11. Operational noise shall be measured in accordance with the provisions of New Zealand Standard NZS6801:2008 Acoustics – Measurement of Environmental Sound and assessed in accordance with the provisions of NZS 6802:2008 Acoustics – Environmental Noise.

12. All operational noise shall be measured at any point within the boundary of any occupied residential site or the notional boundary of any occupied dwelling on any

rural site not owned by the consent holder or related Company or not subject to an agreement with the consent holder or related Company.

13. The operational noise limits 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 noise effects on the property caused by activities authorised under this consent are not to be taken into account for monitoring and compliance purposes).

14. The consent holder shall prepare a Noise Management Plan for certification by the Council. The objective of the Noise Management Plan is to provide detail on how compliance with conditions 7 to 9 will be achieved for the duration of the consent. This Noise Management Plan shall be submitted to the Council at least ten working days prior to the first exercise of this consent and the consent shall not be exercised until the Noise Management Plan has been certified by the Council. The Noise 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.

Advice Note

i) The emission of noise from the conveyor, processing plant, to Rock and Tailings Storage Area (RTSA) authorised by Rule 5.17.4.1 of the Hauraki District Plan.
ii) The Noise Management Plan may be prepared in conjunction with any Noise Management Plans prepared in accordance with the consent requirements applying to the consent holder's other mines in the Waihi area.

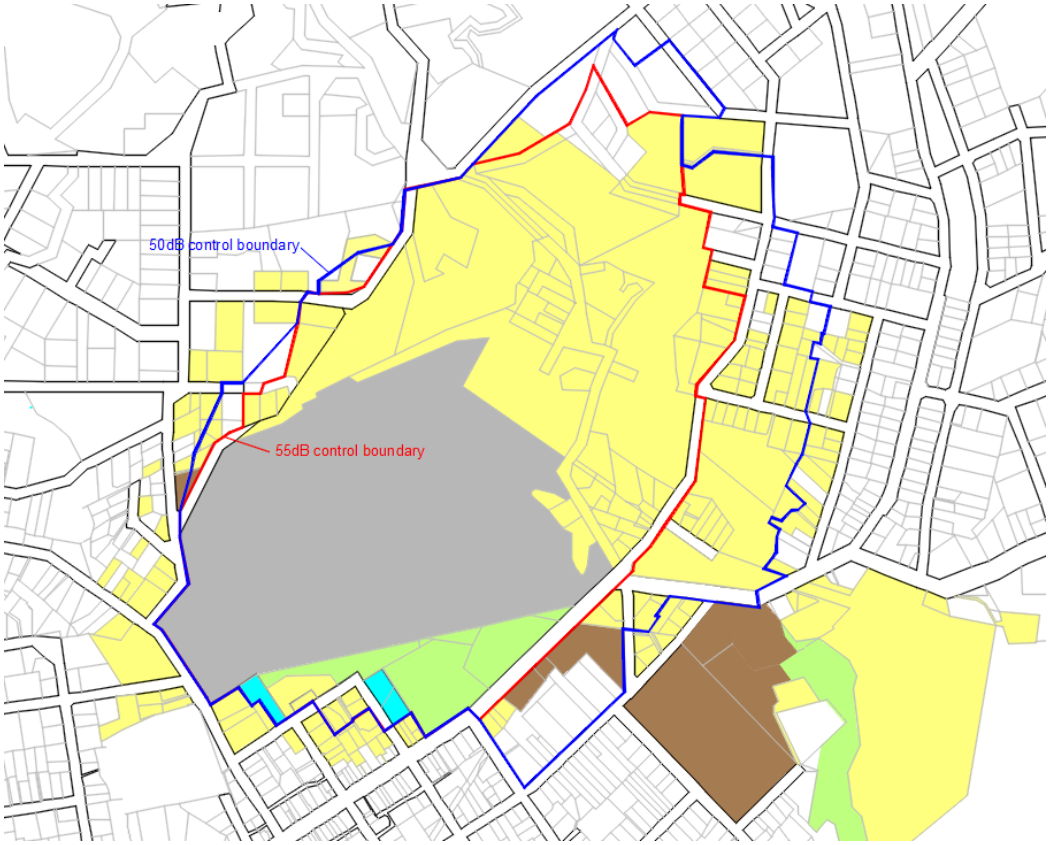

Figure 14. Location of Proposed Noise Control Boundaries

7 CONCLUSIONS

The construction and operational noise effects of the proposed development and the operation of Martha Phase 4 mine have been assessed. The proposed noise conditions reflect the current proposals to develop a uniform noise control regime for the total mining operations through a simplified condition that provides a similar level of amenity protection as existing noise conditions.

The analysis has been conservatively based on the maximum equipment operating at the most exposed locations to residents. By demonstrating it is practical to achieve the design criteria for each of these locations it is reasonable to assume all other work will comply with the noise limits with an increased factor of safety.

To achieve the design limits it will be necessary to provide a barrier to acoustically screen the closest residential sites when operating near the pit rim. The analysis shows this is practicable and the noise generated during the construction of the proposed noise bund will be within the noise limits set for construction work. Once the barrier is constructed the noise from subsequent mining will be controlled to within the proposed operational noise control boundaries. As mining proceeds the noise-generating equipment will be further away from the receiver positions, which will reduce the noise for the neighbours. In addition, as the mining proceeds the equipment will drop to a lower level so there will be greater screening to the neighbours and hence a further reduction in the noise received by the neighbours. Thus, the noise levels as predicted will quickly drop by at least 5dB and minimise any noise effects for the neighbours.

The noise level from mining at the most exposed locations on the north wall will comply with a level of 50dB L_{Aeq} with the exception of the most exposed boundary of 11 Pitt Street (Site 10, Figure 8) where the level will be up to 51dB, Site 11 (10 Pitt Street), Figure 8) where the level will be up to 52dB and 77 Bulltown Road (Site 7, Figure 8) where the level will be up to 53dB L_{Aeq}. An increase of 1dB will not be perceptible and an increase of 3dB will be just noticeable compared to the permitted activity noise level. Taking the permitted noise level into account, the existing noise

environment, and the relatively short duration of an increase of up to 3dB, the effect of this increase is considered to be minimal.

The above method of mining is the same method that has been practiced over the last 29 years around the existing mine. It has been shown to be practical to implement, and results in the minimisation of any adverse noise effects for the neighbours.

* * *