HEGLEY ACOUSTIC CONSULTANTS

1/355 Manukau Road
Epsom, Auckland 1023

T: 09 638 8414
E: rhys.hegley@acoustics.co.nz

KINGS QUARRY

306 PEBBLE BROOK ROAD, WAINUI STAGE 2 EXPANSION

ASSESSMENT OF NOISE EFFECTS

Report No 19114.4

Prepared for:

Kings Quarry Limited

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Prepared by: .....

Rhys Hegley

CONTENTS

1. INTRODUCTION

Kings Quarry Limited recently gained resource consent to resume quarrying at Kings Quarry located at 306 Pebble Brook Road in Wainui. In support of that application (referred to as Stage 1), Hegley Acoustics prepared an assessment of noise and vibration effects[1]. Subsequent to that consent, the proposal is now to extend the quarry area through Pit A, to the north east of the existing quarry, and Pit B to the west (jointly referred to as Stage 2). The proposal will be lodged under the Fast-track Approvals Act 2024. This report describes the method by which noise and vibration from the proposed Stage 2 operations have been predicted and provides an assessment of that noise and vibration on the surrounding environment.

2. ASSESSMENT CRITERIA

The quarry site is zoned Special Purpose – Quarry zone in the Auckland Unitary Plan – Operative in Part (AUP), as shown on Figure 1. All surrounding sites are in the Rural – Rural Production zone and generally within the Quarry Buffer Area Overlay.

2.1. Noise Criteria

The noise criteria of the AUP are contained within H28.6.2.1, as follows:

> ***H28.6.2.1. Noise***
>
> *(1) Noise from mineral extraction activities must not exceed the noise levels in Table H28.6.2.1.1 at a notional boundary from any dwelling that existed at 1 January 2001 outside the Special Purpose – Quarry Zone.*
>
> *(2) …*
>
> *(3) Noise must be measured and assessed in accordance with New Zealand Standard on Acoustics - Measurement of Environmental Sound (NZS 6801:2008) and New Zealand Standard on Acoustics - Environmental Noise (NZS 6802: 2008).*

[1] Kings Quarry, 306 Pebble Brook Road, Wainui, Assessment of Noise Effects, Report No. 19114, February 2021

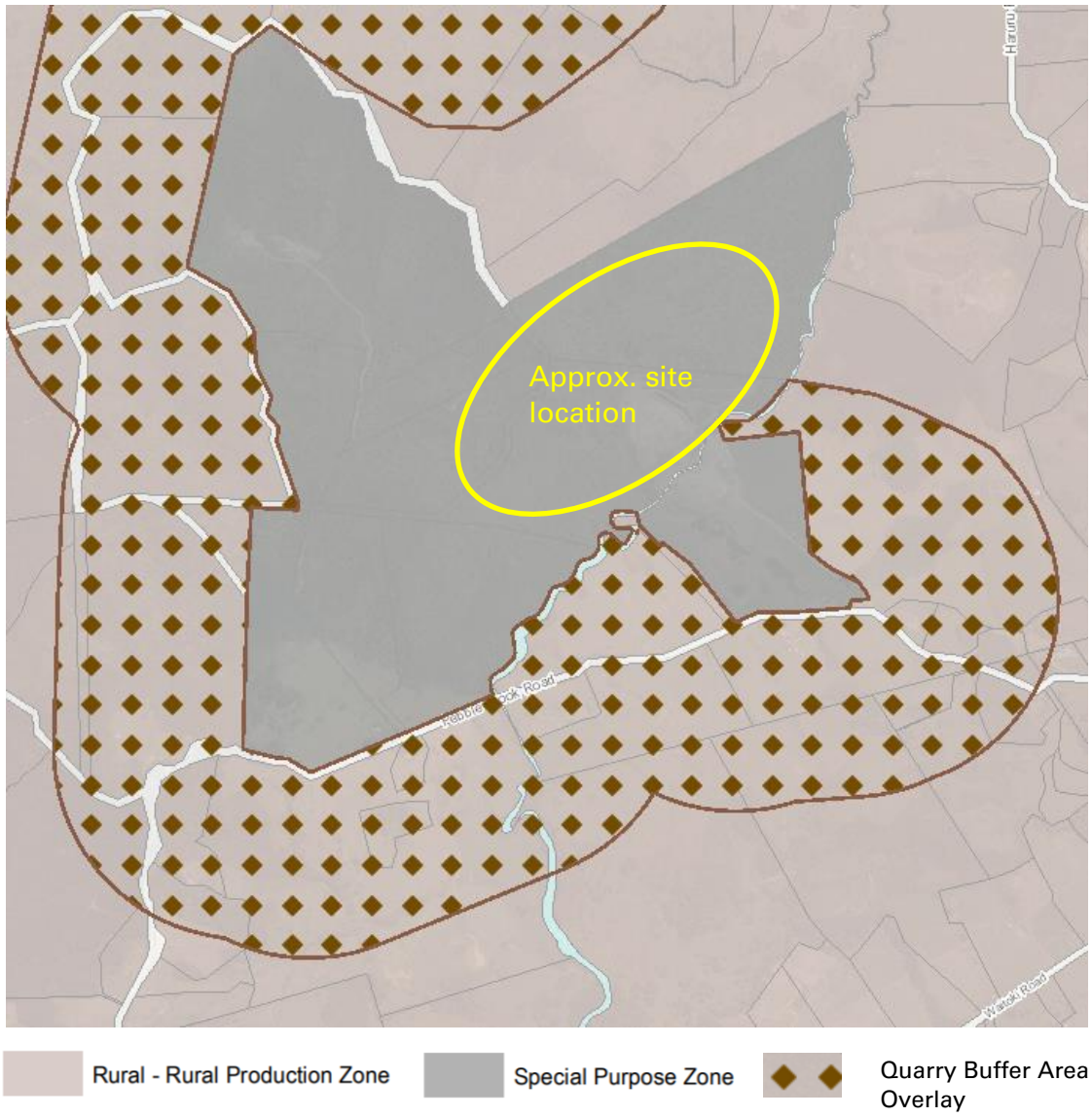

Figure 1. Part AUP Zoning Map

Table H28.6.2.1.1

Times	***Noise Levels***
7am – 9pm, Monday to Friday	L_{Aeq} *55dB*
7am – 4pm, Saturday	L_{Aeq} *55dB*
All other times and on public holidays	L_{Aeq} *45dB* L_{AFmax} *75dB*

2.2. Vibration and Blast Criteria

The vibration criteria of the AUP are contained within H28.6.2.2, as follows:

H28.6.2.2. Vibration and blasting

(1) Noise created from the use of explosives must not exceed a peak overall sound pressure of 128dB L_{zpeak}.

(2) The measurement of blast noise (air blast) and ground vibration from blasting must be measured at the notional boundary of a dwelling that existed at 1 January 2001.

(3) Vibration generated by blasting shall be measured within a building in accordance with Appendix J of Part 2 of Australian Standard AS 2187 2006.

(4) All blasting is restricted to:

(d) 9am-5pm, Monday to Saturday;

(e) an average of two occasions per day over a calendar fortnight; and

(f) except where necessary because of safety reasons.

[There are no sections (a), (b) or (c) to this part of the rule]

(5) Blasting activities must be controlled to ensure any resulting ground vibration does not exceed the limits set out in German standard DIN 4150-3 1999: Structural vibration – Part 3 Effects of vibration on structures ["DIN 4150"] *when measured on the foundation in the horizontal axis on the highest floor of an affected building.*

(6) A siren must be used prior to blasting to alert people in the vicinity.

The vibration limits of DIN 4150 are frequency dependent, as summarised below:

Table 1. DIN 4150 Vibration Limits

Type of structure	Guideline values for velocity, v_i, in mm/s			
	Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor at all frequencies
	1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz*	
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
*) At frequencies above 100 Hz, the values given in this column may be used as minimum values.				

The above conditions were adopted as the base for Stage 1 consent conditions.

3. THE PROPOSAL

In terms of activities and plant, Stage 2 will be a continuation of the Stage 1 quarry activities. No new plant or activities are proposed. The most significant change proposed is in the additional area to be quarried with some additional, minor, amendments to how the plant will be positioned in A Pit (compared to the current quarry) and to the number of road trucks visiting the site. The proposal for Stage 2 can be described as:

1. Quarrying will begin with A Pit. Overburden will be removed with a 26T excavator and loaded into a dump truck;

2. The dump truck will transport the overburden to the southern end of A Pit where the same excavator will spread the material. No cleanfill will be imported to the site;

3. Once the rock is exposed, A Pit will progress by a series of benches with the majority of the plant operating at the base of the bench which, therefore, offers a degree of screening to the neighbouring sites. Excavation of A Pit differs from the existing quarry and from B Pit in that the crusher will remain in the existing quarry for the life of A Pit. Initially, the weak, fractured rock will be loaded by an excavator directly into dump trucks to transport to the crusher;

4. The intact rock below will be drilled and blasted as required by an independent contractor. Analysis has assumed a top of the hole hammer drill will be used;

5. The fractured rock will then be loaded into a dump truck by the excavator for transport to the crusher located in the existing quarry for processing;

6. A Hyundai HL 760-7 front end loader will load road trucks with the processed rock for export from the quarry;

7. 94 truck and trailer trips (188 movements) are expected per day. This represents an increase from the 50 daily trips (100 movements) of the current consent. Two of the return trips (4 movements) will occur between 6.30 and 7.00am, which remains unchanged from the current consent;

8. Once quarrying at A Pit is complete, the overburden will be removed from B Pit with A Pit becoming the cleanfill;

9. The process for overburden and rock removal from B Pit is the same as for the existing quarry but differs slightly from A Pit in that the crusher (which is a mobile crusher) will move about B Pit, following the cut face. This means that rather than being located in the existing quarry (like A Pit) the crusher, front end loader, and road trucks will all work at the cut face and in close proximity to the excavator and rock drill.

10. When completed, the stockpiled cleanfill in A Pit will be reinstated over the full extent of the quarry using the excavator and dump truck;

11. Throughout quarrying, a water truck will be used to manage the dust.

The proposal is for the Stage 2 quarry to adopt the same operating hours as Stage 1, that is:

1. Quarry operational hours will be from 5am – 7pm Monday to Saturday only and not on public holidays;

2. Turck movements to and from the site, and the loading of the trucks, will be limited to 6.30am to 5.30pm (Monday to Saturday). Between 6.30am and 7.00am, there will be no more than two return truck trips (including their loading);

3. Other than trucks and their loading there will be no noise generating quarrying and mineral extraction activities including overburden removal works before 7.00am (Monday to Saturday).

While 1 – 3 above do not provide any detail on what could occur at the quarry between its opening at 5.00am and the commencement of quarrying at 7.00am, they make it clear that, whatever the activity, it is not to be intensive. Added to this is that the activity must comply with the night time noise limits of

H28.6.2.1(3). For completeness, it is understood that the activities proposed between 5.00am to 7.00am will, other than the two truck trips, relate to administration and preparing for the day.

H28.6.2.1 requires that only those dwellings built after 1 January 2001 and which are outside of the Special Purpose – Quarry Zone, be considered. Figure 2 and Table 2 identify the assessment receivers.

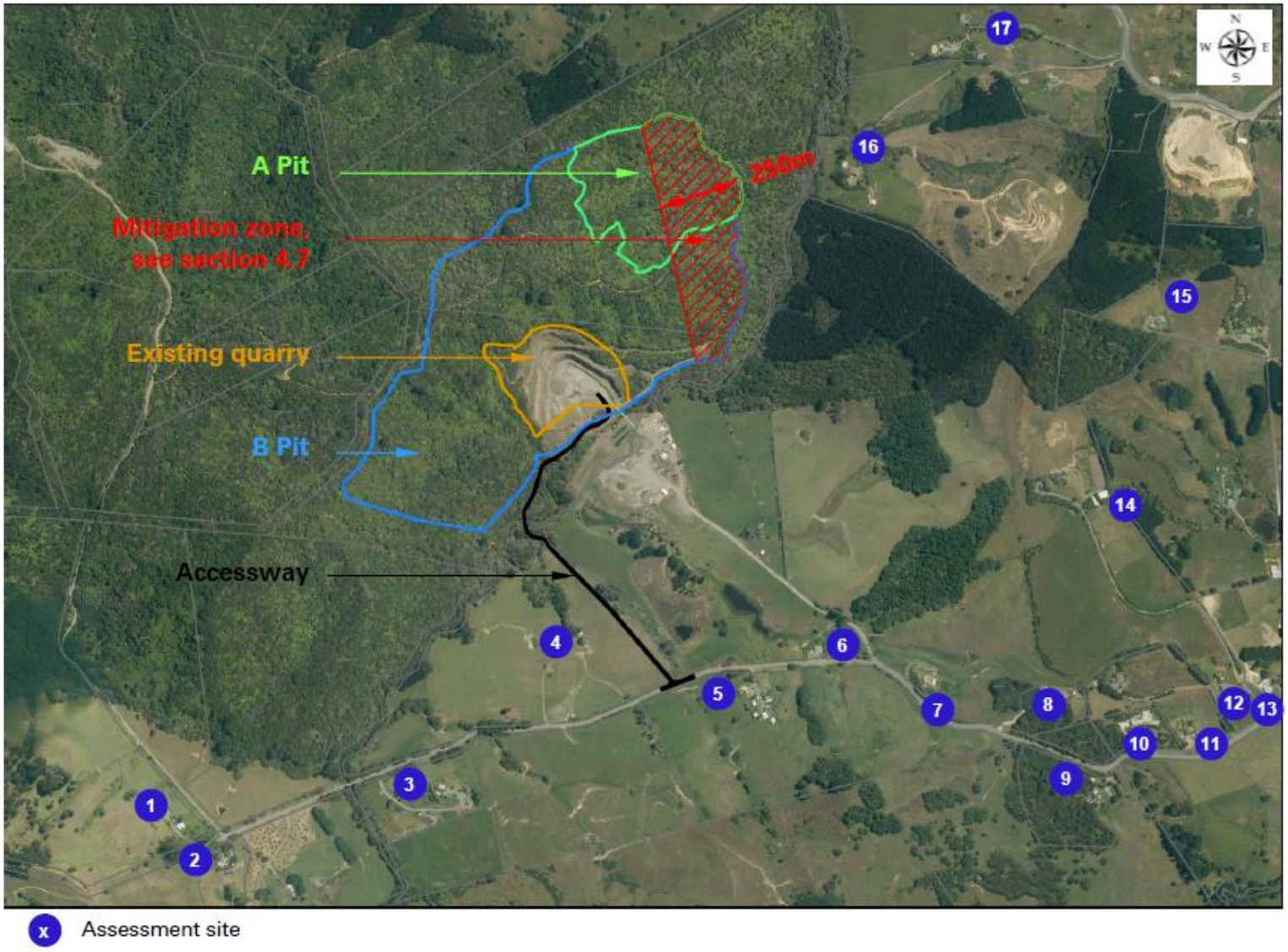

Figure 2. The Proposal and Surrounding Area

4. NOISE PREDICTION

4.1. Predictor

Noise from the proposed activities was calculated to the surrounding sites using the Predictor noise modelling software. Predictor is a three dimensional modelling tool in which a full scale model of the proposal and surrounding area is developed. Calculations are in accordance with ISO 9613 parts 1 and 2 and include all variables that affect the propagation of noise. These include:

1. A plan of the proposal, allowing the distances between the quarry activities and the various receivers to be determined;

2. The ground contours of the existing land and of the proposed quarry to allow topographical screening to be determined;

3. Ground cover, which affects noise propagation. Analysis is based on a soft surface outside of the hard quarry; and

4. The noise levels from individual items of plant used, which are discussed in more detail below.

4.2. Quarry Plant

The plant proposed for the quarry is identified in Section 2. The base noise data for each item of plant required by Predictor was gathered through measurements of similar plant operating at other locations and is reported below.

Table 2. Modelled Sound Power Data

Plant	Sound Power, dBA						
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Excavator	84	95	94	96	95	94	93
Front End Loader	88	96	101	102	101	102	97
Mobile Crusher	89	106	104	107	106	105	100
Rock Drill	97	97	104	108	110	111	109

Plant	Sound Power, dBA						
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Dump Truck	72	84	94	98	104	107	102
Water Truck	93	99	94	96	98	96	88
Road Truck within quarry, full	87	80	78	83	89	91	85
Road Truck within quarry, empty	85	87	82	89	95	99	97
Quarry Truck on road, empty	95	88	86	91	98	99	96

4.3. Receivers

The existing dwellings neighbouring the proposal have been included in the analysis. Where these dwellings were visible from the road, they have been modelled with the correct number of floors, as this can affect topographical screening. In situations where the dwellings were not visible, they have conservatively been assumed to be of two storey construction. All results reported below are the levels predicted at the most exposed façade of each dwelling.

4.4. Modelled Scenarios

Noise levels from the operation of the quarry will vary over time as the plant moves about the quarry and as the quarry face itself progresses into the hill. To account for this, plant has been modelled in a variety of locations over the life of the quarry with only the uppermost levels being reported below. There will be times when noise levels are lower than reported.

While there will be no overlap in the quarrying activities of Stage 1, A Pit and B Pit, the analysis includes the predicted levels from the scenarios considered for the previous Stage 1 to ensure seamless integration of Stage 2.

For clarity, it is noted that quarrying at B Pit requires overburden to be placed in the quarried A Pit. This was modelled, in the same way as the placement of overburden from A pit was modelled. What will not occur, and what has not been

modelled, is for quarrying and overburden placement from A and B Pits (and the existing pit) to occur simultaneously. In other words, the quarrying of A and B Pits will not occur at the same time and the quarrying of B Pit and the placement of overburden to A Pit have been modelled.

4.5. Averaging

Noise varies over time and, for its assessment, NZS 6802 permits averaging over the day time period of 7.00am to 9.00pm (or 4.00pm on Saturdays). It is unlikely that the activities proposed for the quarry, and therefore the noise, will be constant for the full 14 hour day time period of the AUP (9 hours on Saturdays) meaning that averaging would therefore be appropriate. However, for simplicity, and a small factor of safety, the assessment has excluded averaging.

4.6. Special Audible Characteristics

NZS 6802 notes that noise with special audible characteristics, such as tonality or impulsiveness, is likely to arouse adverse community response at lower levels than noise without such characteristics and provides a method of assessing such noises. One of the activities undertaken on site that could potentially have a special audible characteristic would be tonal reversing alarms of the plant. However, the assessment has been undertaken on the basis that the onsite plant will use broadband reversing alarms. For this reason, no correction has been applied to the assessed values for the presence of a special audible characteristic.

4.7. Mitigation

The approach taken for predicting noise from each modelled scenario has been to assume that all quarry plant (drill, excavator, crusher, front end loader and trucks) all operate at once and together, in a relatively confined location. The likelihood is that such an assumption overpredicts noise as it is unlikely that the truck and the front end loader loading it will both work together and whether the front end loader will work at the same time as the excavator and/or crusher is unknown. Regardless, predictions using this assumption show that noise to all

but one receiver complies with the consented noise limits without specific mitigation.

The one receiver where all plant operating at once would result in non-compliant levels is Site 16 (782 Haruru Road). For this receiver, mitigation is required for compliance. The proposal is to limit the plant that can operate in the most exposed location to Site 16. Specifically, the quarry can operate normally except when activities are within 250m of the eastern extent of the quarry (Figure 1 shows this zone):

1. The rock drill cannot work at the same time as the excavator and crusher until all plant has dug itself into the site enough that the quarry edge breaks the line of sight between the plant and Site 16; and

2. Trucks cannot be loaded out prior to 7.00am until the loader can operate from a position that does not have line of site to Site 16.

In addition to the above mitigation, a Quarry Noise and Vibration Management Plan (QNVMP) is recommended for the management of effects.

4.8. Predicted Levels

Table 3 shows the resulting levels based on the prediction methodology described above. Separate levels are given for the clearing of the over burden and the subsequent quarrying of the rock, both of which are day time activities. Each of these levels includes noise from the rock drill, which adds between 1 and 3dB to the reported levels. It is relevant to note that the drill will only be used periodically before blasting and is therefore not continuous.

The night time levels from trucks being loaded and exporting the processed material from site are also reported.

Table 3. Summary of Noise Levels to Surrounding Houses

Site (Fig 1)	Address	Predicted Noise Levels, dB			
		Day Time		Night Time	
		Over Burden	Quarrying	Trucks, Loader	
		L_{Aeq}	L_{Aeq}	L_{Aeq}	L_{AFmax}
1	306 Pebble Brook Road	43	46	36	45
2	305 Pebble Brook Road	43	46	36	47
3	251 Pebble Brook Road	48	50	40	56
4	220 Pebble Brook Road	54	55	45	62
5	175 Pebble Brook Road	53	53	42	59
6	170 Pebble Brook Road[1]	52	53	41	54
7	144 Pebble Brook Road	50	50	38	51
8	124 Pebble Brook Road	43	45	33	49
9	101 Pebble Brook Road	47	47	35	45
10	96 Pebble Brook Road	44	45	34	43
11	78 Pebble Brook Road	46	46	37	42
12	72 Pebble Brook Road	40	41	30	41
13	68 Pebble Brook Road	49	49	36	40
14	70 Pebble Brook Road	39	43	33	47
15	66 Pebble Brook Road	34	37	27	41
16	782 Haruru Road	55	55	43	58
17	778 Haruru Road	52	53	40	57

1. Property addresses have been taken from the Auckland Council Unitary Plan. It is understood that this property may also be referred to as 162 Pebblebrook Road.

5. NOISE ASSESSMENT

The assessment of quarry noise has been undertaken against the noise rules of the AUP (H28.6.2.1) on the basis that compliance confirms that the effects are reasonable. For this reason, an assessment against the current ambient sound level was not considered necessary.

Table 3 shows that, even when considering the worst possible combinations of plant operating at any one time, day time activities are fully compliant with the 55dB L_{Aeq} criterion of the AUP. Similarly, noise from the proposed night time activities will comply with the AUP limits of 45dB L_{Aeq} and 75dB L_{AFmax}. This being

the case, it is concluded that the resulting levels will be reasonable and the effects, therefore, appropriate.

It is noted that while the proposal is for the quarry to remain open until 7.00 pm, the noise rule requires that, after 4.00pm on Saturdays, any quarry activities are to comply with the lower, night time limit.

To supplement the assessment, Table 4 below shows the changes in the predicted upper level of quarry noise between the currently consented Stage 1 and the proposed Stage 2. It is noted that Stage 1 has not yet commenced (although it is understood that operations will commence soon following the completion of the roading upgrades). This means that neighbours to the quarry will not have experienced the predicted Stage 1 levels.

In preparing the following Table:

1. Between Stages 1 and 2, some receivers have been renumbered. For this reason, the Table below reports the receiver address first followed by its site number used for each stage.

2. For Stage 1, the noise from quarry activities was reported separately from quarry trucks on Pebble Brook Road. For the current Stage 2, Table 3 includes the cumulative noise effects from both activities. Later in the report, truck noise alone is reported in a separate table. As such, to compare Stages 1 and 2, the previously reported Stage 1 noise levels have been modified to reflect the sum of noise from quarrying only and road trucks only. (A conclusion of the Stage 1 analysis was that those receivers that are exposed to the highest levels of quarry noise receive relatively low levels of noise from the road trucks, and vice versa. In such situations, there was no cumulative effect. The Stage 2 analysis benefited from this finding by considering the two together rather than separately).

Table 4. Comparison between the Noise Levels of Stages 1 and 2

Address	Report Reference		Predicted Levels, dB L_{Aeq}				Change due to S2
	Stage 1	Stage 2	Stage 1			Stage 2	
			Quarry Only	Trucks Only	Sum[1]		
306 Pebble Brook Rd	1	1	NA[2]	20	NA[2]	46	NA[2]
305 Pebble Brook Rd	2	2	40	21	40	46	+6
251 Pebble Brook Rd	3	3	47	27	47	50	+3
220 Pebble Brook Rd	B	4	52	38	52	55	+3
175 Pebble Brook Rd	4	5	49	48	52	53	+1
170 Pebble Brook Rd	5	6	48	48	51	53	+2
144 Pebble Brook Rd	A	7	44	46	48	50	+2
124 Pebble Brook Rd	6	8	42	37	43	45	+2
101 Pebble Brook Rd	7	9	37	44	45	47	+2
96 Pebble Brook Rd	8	10	37	42	43	45	+2
78 Pebble Brook Rd	9	11	36	46	46	46	0
72 Pebble Brook Rd	10	12	36	37	40	41	+1
68 Pebble Brook Rd	11	13	35	46	46	49	+3
70 Pebble Brook Rd	12	14	43	26	43	43	0
66 Pebble Brook Rd	13	15	35	22	35	37	+2
782 Haruru Rd	14	16	46	19	46	55	+9
778 Haruru Rd	NA[3]	17	NA[3]	NA[3]	NA[3]	53	NA[3]

1. When summing noise from different activities, it is the noise energy that is added together rather than the noise levels. As the ear does not respond to noise energy in a linear fashion, the two levels cannot be summed arithmetically. In other words, 50dB + 50dB ≠ 100dB. Instead, noise levels are added together logarithmically, meaning 50dB+ 50dB = 53dB.

2. Noise to this site was not reported as it is the quarry manager's dwelling.

3. This dwelling was added to the Stage 2 analysis due to its proximity to Pit A.

When interpreting changes in noise level, 3dB is considered to be the smallest noticeable by the average person. A 5dB change is clearly noticeable while a 10dB change in level is an apparent halving, or doubling, in level. Based on this:

1. There would therefore be a negligible change in noise level between Stages 1 and 2 to 66, 70, 72, 78, 96, 101, 124, 144, 170 and 175 Pebble Brook Road.

2. The change in level to 68, 220 and 251 Pebble Brook Road is considered small.

3. The change in the predicted level of noise to 305 Pebble Brook Road and 782 Haruru Road would be moderate to large.

Regardless of any changes in level between Stages 1 and 2, analysis demonstrates that it will be practicable for the activities of both Stages to comply with the quarry zone noise rule (H28.6.2.1) of the Auckland Unitary Plan – Operative in Part (AUP).

6. BLAST NOISE AND VIBRATION

Blast effects associated with quarrying are typically managed through the size, and partly through the method, of blasting. Given the nearest assessment point is over 200m from the proposed blasting, it is considered that blast management can reasonably be expected to control the effects to well within the limits of the AUP/ proposed condition 31.

Proposed condition 31 limits blasting to a peak overall sound pressure of 128dB L_{zpeak} at the notional boundary of a neighbour. Numerically, this is a large number. However, its reference to the L_{zpeak} metric is important. Essentially, the L_{zpeak} occurs too fast for the ear to respond to, meaning an event at this level would appear quieter than 128dB. The L_{zpeak} metric is typically used for hearing protection. For disturbance from short duration noises, the L_{AFmax} metric is common.

Although blasting is not limited to weekdays, given the limited occasions that it will occur, and the explanation of the actual noise relating to this activity described above, it is not considered necessary to limit blasting to weekdays only.

7. ROAD TRAFFIC NOISE

The AUP only concerns itself with noise generated from the activities located within a specific site and does not address off-site effects. However, as quarries are typically located in rural areas, it is usual for the associated truck movements to represent a large proportion of the traffic on local roads and, therefore, provide a significant contribution to the noise received by those living in close proximity to the roads. While truck movements on roads is a permitted activity through Rule E26.2.3.2 (A68), it has become common practice to consider the noise effects from quarry trucks on the local roads, which this section addresses.

7.1. Assessment Criteria

The AUP noise rules begin with the General Standards (E25.6.1) which require assessment in accordance with NZS 6802, which in turn states that '*... assessment of specific sources of sound including road or rail transport ... requires special techniques that generally are outside the scope of this Standard*'. As such, the AUP is not intended for the assessment of road traffic noise. However, given the general lack of alternative assessment methods for quarry traffic noise, there is an attraction to a simple comparison against the AUP limits of 55dB L_{Aeq}/45dB L_{Aeq} day/ night, as such levels are available and understood.

While simple, the above approach disregards the fact that people's reaction to road traffic noise generally differs from that of general residential and industrial noise intended for control by the AUP. NZS 6806: 2010 'Acoustics - Road-traffic Noise - New and Altered Roads' (NZS 6806) has been specifically written for the assessment of road traffic noise. This Standard, however, is also not considered

entirely appropriate for assessing the noise from quarry trucks, as it was developed for the enablement of new roads or significant upgrades to existing roads. As such, both assessment approaches are considered below.

The assessment has not considered the L_{AFmax} level from truck movements. The reason for this is that this metric (which provides a description of short duration events such as impact noise or bangs) would be affected, if not totally controlled, by body rattle which in turn, would be a function of the state of the road and the construction and use of the individual trucks. As such, these events could not be predicted with any certainty. It is noted that NZS 6806 has removed the L_{AFmax} for this same reason (difficulty in accurate prediction).

7.2. Truck Noise Prediction

Truck noise has been predicted with the same Predictor noise model as was used to determine operational noise. The differences were the base noise data, which was updated to that of measurement data of quarry trucks on metal roads. Receiver points were also adjusted where necessary to represent the most exposed façade to traffic noise rather than quarry noise. The prediction point has remained at the notional boundary which, being 20m from the façade, differs from that of NZS 6806 which requires the dwelling façade. The resulting increase in reported levels has been disregarded and is assessed directly against the NZS 6806 criterion making for a conservative approach.

For analysis, all 94 trucks visiting the site have been allocated to the day time period with the exception of two return truck trips between 6.30am and 7.00am.

7.3. Truck Noise Levels

The following Table summarises the truck noise levels to the neighbouring sites. These levels exclude all other traffic movements on Pebble Brook Road.

Table 5. Truck Noise Levels

Site (Fig 1)	Address	For assessment against the AUP criteria, dB L_{Aeq}		For assessment against the NZS 6806, dB $L_{Aeq(24hr)}$
		Day	Night	
1	306 Pebble Brook Road	23	18	21
2	305 Pebble Brook Road	24	18	22
3	251 Pebble Brook Road	30	25	28
4	220 Pebble Brook Road	41	36	39
5	175 Pebble Brook Road	51	44	49
6	170 Pebble Brook Road	51	44	49
7	144 Pebble Brook Road	49	43	47
8	124 Pebble Brook Road	40	34	38
9	101 Pebble Brook Road	47	40	45
10	96 Pebble Brook Road	45	39	43
11	78 Pebble Brook Road	49	43	47
12	72 Pebble Brook Road	40	34	38
13	68 Pebble Brook Road	49	42	47
14	70 Pebble Brook Road	29	23	27
15	66 Pebble Brook Road	24	19	22
16	782 Haruru Road	22	16	20
17	778 Haruru Road	20	14	18

7.3. Truck Noise Assessment

Table 5 shows that the noise from trucks using Pebble Brook Road and the site accessway complies with the AUP limits of 55dB L_{Aeq} during the day time and 45dB L_{Aeq} during the night time. Further, if the average level of the full 24 hour period is considered, levels also comply comfortably with the 57dB $L_{Aeq(24\ hr)}$ threshold required by NZS 6806 for consideration. Put another way, the noise from quarry trucks on Pebble Brook Road is considered by NZS 6806 to result in noise levels that are too low to merit assessment.

Both assessment methods indicate that noise from quarry trucks will be reasonable to those close to Pebble Brook Road allowing the conclusion that the effects will be reasonable.

8. PROPOSED CONDITIONS

The proposal is for the Stage 2 expansion to include the same noise management conditions from the Stage 1 resource consent, as shown in the following proposed conditions:

i. *Quarry operational hours must be limited to between 5am – 7pm Monday to Saturday. Quarrying activity must not occur on Sundays and Public Holidays.*

ii. *Truck movements in and out of the site, including the loading of trucks, must be limited to between 6.30am - 5.30pm. Between 6.30am and 7.00am, there shall be no more than two return truck trips (and their loading).*

iii. *Noise generating quarrying or mineral extraction activities, including overburden removal works, must not commence prior to 7am.*

iv. *Noise arising from operation of the quarry activity (excluding blasting) and associated truck movements on the subject site must be measured in accordance with the provisions of NZS 6801:2008 Acoustics – Measurement of environmental sound and must also be assessed in accordance with NZS 6802:2008 Acoustics – Environmental noise, and must not exceed the following noise levels in the Table below when measured at a notional boundary of any dwelling that existed at 1 January 2001 outside the Special Purpose – Quarry Zone:*

Times	*Noise Levels*
7am – 9pm, Monday to Friday	L_{Aeq} *55dB*
7am – 4pm, Saturday	L_{Aeq} *55dB*
All other times and on public holidays	L_{Aeq} *45dB* L_{AFmax} *75dB*

Advice Note

The consent holder is reminded of their general obligation under section 16 of the Resource Management Act 1991 to adopt the best practicable option to ensure that the emission of noise does not exceed a reasonable level.

The proposed vibration conditions are as per the Stage 1 consent, which were based on rule H28.6.2.2, and are as follows:

v. *Blast noise created from the use of explosives must be managed so as to not exceed a peak overall sound pressure of 128dB L_{zpeak}.*

The measurement of blast noise (air blast) and ground vibration from blasting must be measured at the notional boundary of a dwelling that existed at 1 January 2001.

Vibration generated by blasting must be measured within a building in accordance with Appendix J of Part 2 of Australian Standard AS 2187-2006.

All blasting must be restricted to:

a) *9am-5pm, Monday to Saturday;*

b) *an average of two occasions per day over a calendar fortnight; and*

c) *except where necessary because of safety reasons.*

Ground vibration resulting from blasting activities must not exceed the limits set out in German standard DIN 4150 - 3 1999: Structural vibration – Part 3 Effects of vibration on structures when measured on the foundation in the horizontal axis on the highest floor of an affected building.

A siren must be used prior to blasting to alert people in the vicinity.

vi. *The consent holder must ensure all mobile equipment is fitted with broadband reversing alarms, if audible reversing signals are necessary.*

In addition to the Stage 1 conditions, the following two additional monitoring conditions are proposed as part of the Stage 2 application:

vii. *The Consent Holder must engage a suitably qualified person to prepare an annual report auditing on-going compliance with the noise limits in condition iv. The report must be submitted to Council*

annually. Should access to a property for the purpose of this monitoring not be granted, that property may be excluded from the reporting.

viii. *The Consent Holder must engage a suitably qualified person to monitor noise and vibration from each blast for compliance with condition v. The results must be submitted to Council annually. Should access to a property for the purpose of this monitoring not be granted, that property may be excluded from the reporting.*

I consider that these conditions are appropriate and will ensure that noise and vibration effects are within the levels prescribed by the AUP.

9. CONCLUSIONS

Analysis of noise and vibration from the activities associated with the proposed extension of Kings Quarry shows that it will operate within the relevant noise and vibration limits of the AUP. This is on the proviso that:

1. When activities are within 250m of the eastern extent of the quarry:

    a. The rock drill cannot work at the same time as the excavator and crusher until all plant has dug itself into the site enough that the quarry edge breaks the line of sight between the plant and Site 16; and

    b. Trucks cannot be loaded out prior to 7.00am until the loader can operate from a position that does not have line of site to Site 16.

2. Activities prior to 7.00am shall be limited to two return truck movements to site including their loading out with aggregate;

3. During day time hours (7.00am – 9.00pm Monday to Friday and 7.00am to 4.00pm Saturday), trucks exporting aggregate from site will be limited to 94 return visits; and

4. If audible reversing warning signals are necessary, site plant will use broadband reversing alarms.

Not only is noise from trucks on the local roads not addressed by the noise rules of the AUP but road traffic is a permitted activity under E26.2.3.2 (A68). Regardless, an assessment against specifically developed criteria demonstrates that the predicted levels can be considered reasonable.

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