APPENDIX J

Marshall Day Acoustics Noise Assessment

MARSHALL DAY Acoustics

WHEATSHEAF QUARRY – SULLIVAN BLOCK NOISE ASSESSMENT

Rp 001 R02 20240162 | 2 July 2024

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Project: **WHEATSHEAF QUARRY – SULLIVAN BLOCK**

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SUMMARY

We have conducted an assessment of the likely noise emissions associated with Winstone Aggregates' proposed expansion to their *Wheatsheaf Quarry* in the Selwyn District. We conclude that:

- Noise levels will comply with the existing resource consent limit of 55 dB L_{Aeq} during the day;
- This noise limit is consistent with the underlying District Plan noise standard; and
- Noise emissions, and therefore noise effects, will be consistent with the existing baseline.

The proposed expansion project will continue aggregate extraction operations into part of the adjoining 'Sullivan Block' at 668 Robinsons Road.

All processing of materials will continue to occur in the main quarry area; no crushers or screens will operate in the expansion area. In this sense, the project is similar to the previous expansion into the 'B' and 'C Block' area, which we also assessed. As with that project, 3 metre high earth bunds will be constructed around the outer perimeter of the expansion area.

The previous consents – most recently RC215749 – imposed a number of consent conditions that control noise emissions. These controls are both direct through noise limits and indirect through operational restrictions. The proposed expansion works will continue to operate within the general intent of the relevant noise conditions included in this consent.

We have measured existing noise levels at positions representing the closest dwellings to the Sullivan Block and find that, while these are influenced primarily by local road traffic, noise from quarry operations is audible during the daytime. Our previous assessment predicted noise levels of 45 - 50 dB L_{Aeq} in this area, and current emissions are in line with this.

Calculated noise levels for the proposed project do not exceed 50 dB L_{Aeq} at any dwelling. This includes the contribution from other noise sources within the quarry. Noise from works within the expansion area alone are below 45 dB L_{Aeq} for most receivers.

These noise levels comfortably achieve the previously consented noise limits and all supporting guidance. We therefore expect that noise effects will be acceptable, noting that there will be little or no change to the current situation.

As the overall scale and intensity of quarry operations will not change, noise effects from other sources will be the same, including from operation of the processing plant and quarry traffic using local roads.

We consider the current suite of conditions appropriate to control noise effects and recommend that the intent of these are retained if consent is granted.

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1.0 INTRODUCTION

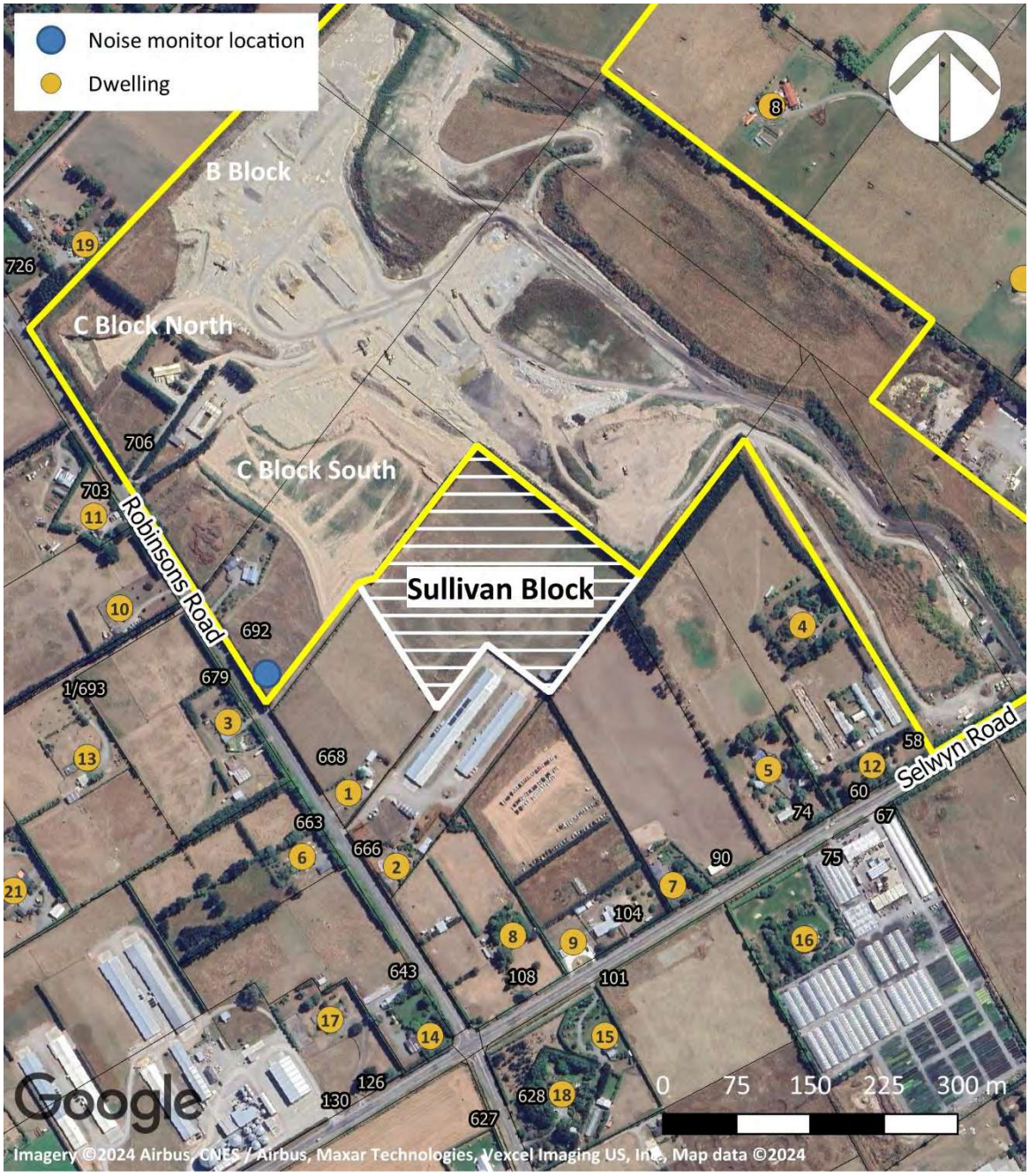
Marshall Day Acoustics has been engaged by Winstone Aggregates, a division of Fletcher Concrete and Infrastructure Limited, to assess the potential noise effects associated with the proposed expansion of their *Wheatsheaf Quarry*.

Our assessment addresses the potential noise effects arising from the proposed expansion. This report details our assessment methodology and provides a summary of our findings. A glossary of acoustical terminology used is provided for reference in Appendix A.

We have previously assessed noise at the quarry on a number of other occasions, most recently the 'B and C Block' expansions, for which resource consent was granted in 2022 (RC215749).

The extent of the site and proposed expansion area is shown below in Figure 1.

Figure 1: Aerial view of quarry site and proposed expansion area (dwellings indicated in orange)



Note: Receiver numbering order is based on the dwelling's distance from Sullivan Block

2.0 PROJECT OVERVIEW

Quarrying activity has long been established at the site. This application does not propose changes to the general methodology, which remains consistent with our noise assessment report for the previous consent.[1] The overall project description is described comprehensively in the AEE.

All processing and significant works will remain in the main quarry site. Activities in the proposed expansion will be limited to:

- Construction of earth bunds or similar measures to mitigate noise/dust/visual effects;
- Removal of soil and overburden;
- Gravel extraction;
- Transportation of aggregate; and
- Rehabilitation/clean-filling.

2.1 Extraction Methodology

The expansion area will be prepared by removing the topsoil and overburden material. This will be done progressively in stages as the quarry face moves. The initial material will be used to form bunds along the boundary as required. Excavators, loaders and trucks will be utilised for these works.

Once the site is ready for quarrying, extraction will commence from within the existing quarry pit. Material will be stripped from the quarry face using standard quarry machinery and then moved by loaders into trucks or directly to the processing plant as appropriate.

Upon completion of quarrying in each area, trucks will bring clean fill material to a tip head, from where it will be deposited and levelled using a bulldozer or similar equipment. Filling will occur progressively as material allows. We understand that the final fill height may not necessarily be all the way back to the original ground level.

All the activities described above already take place within the existing quarry and consented expansion areas. This mean that there are no 'new' noise sources associated with this proposal, although the location of activity will change as extraction, and later cleanfilling, works move into the new areas.

2.2 Consent Conditions

Table 1 overleaf highlights some of the key aspects of the current consents. We understand that activity in the main quarry area is controlled under RC145099, while that in the recent expansion areas is enabled by RC215749.

In addition, each of the consents required the establishment of earth bunds around the perimeter of the quarry. We understand that the existing bunds will remain in place along external boundaries for the duration of proposed works now sought.

Beyond being beneficial in terms of noise, this is consistent with normal practice, where the material in the bunds is used to replace the final topsoil in areas that have been rehabilitated after quarrying. The bunds are therefore one of the last features to be removed.

[1] Marshall Day Acoustics file reference Rp 001 R02 20190729, dated 14 November 2019.

Table 1: Summary of key noise-related conditions of RC145099 and RC215749

Item	Description of Conditions
Extraction volume	700,000 tonnes annually, capped at 4,000 tonnes daily.
Operating hours	Trucks only 6am - 6pm weekdays; 7am - 1pm Saturdays Only open to the public from 7am to 6pm No activities within 120m of 726 Robinsons Road before 0730
Vehicle movements	Maximum of 20 movements from 6am to 7am weekdays
Mobile machinery	No more than two loaders operating before 7am No loaders within 80m of 'Marshall' property before 7:30am Internal road to clean-fill area not used before 7am
Processing plant	Processing only 8am - 6pm weekdays; 8am - 1pm Saturdays Restrictions on placement to specified area, and at pit level

3.0 EXISTING ENVIRONMENT

The existing environment in relation to other sources of noise outside of the quarry was described in our 2019 report. We are unaware of any significant changes to the area since that time.

We have conducted updated monitoring for this project, which has been more focussed on receivers close to the extraction area. A continuous noise monitor was installed on Winstones' land at 692 Robinsons Road, directly opposite the dwelling at 679 Robinsons Road. Noise levels were recorded between 19 April and 2 May 2024.

The results are summarised in Table 2 below. This data is only for working days (including Saturdays) and has been corrected for periods of poor weather. In addition, *Anzac Day* public holiday fell within the monitoring period and has been excluded.

Table 2: Results of unattended noise monitoring

Time Period	Measured Noise Level, dB			
	L_{Aeq}	L_{A10}	L_{A90}	L_{AFmax}
Working day (0700-1800)	57	57	46	89
Early morning (0600-0700)	55	51	40	80
District Plan day (0700-2200)	56	55	43	89
District Plan night (2200-0700)	47	39	30	80

Figure 2 overleaf shows the average noise level in each hourly period, again presented for only the working days and suitable weather conditions.

The measured data shows that noise levels are consistently above 55 dB L_{Aeq} throughout the daytime. As the logger position was only around 25 metres from the road – a similar distance to the closest house – local traffic movements dominated the L_{Aeq} and L_{Amax} noise levels.

However, while we were on site quarry activity was audible during lulls in traffic. These lulls are best represented by the background (L_{90}) sound level above, which was on average 46 dB L_{A90} during the daytime period.

Table 3 describes measured noise levels at the logger position, focussing on the existing levels of noise from the quarry. Noise from traffic passing and other ambient sounds were excluded from this short-term measurement as far as possible.

Figure 2: Measured diurnal variation in ambient noise level

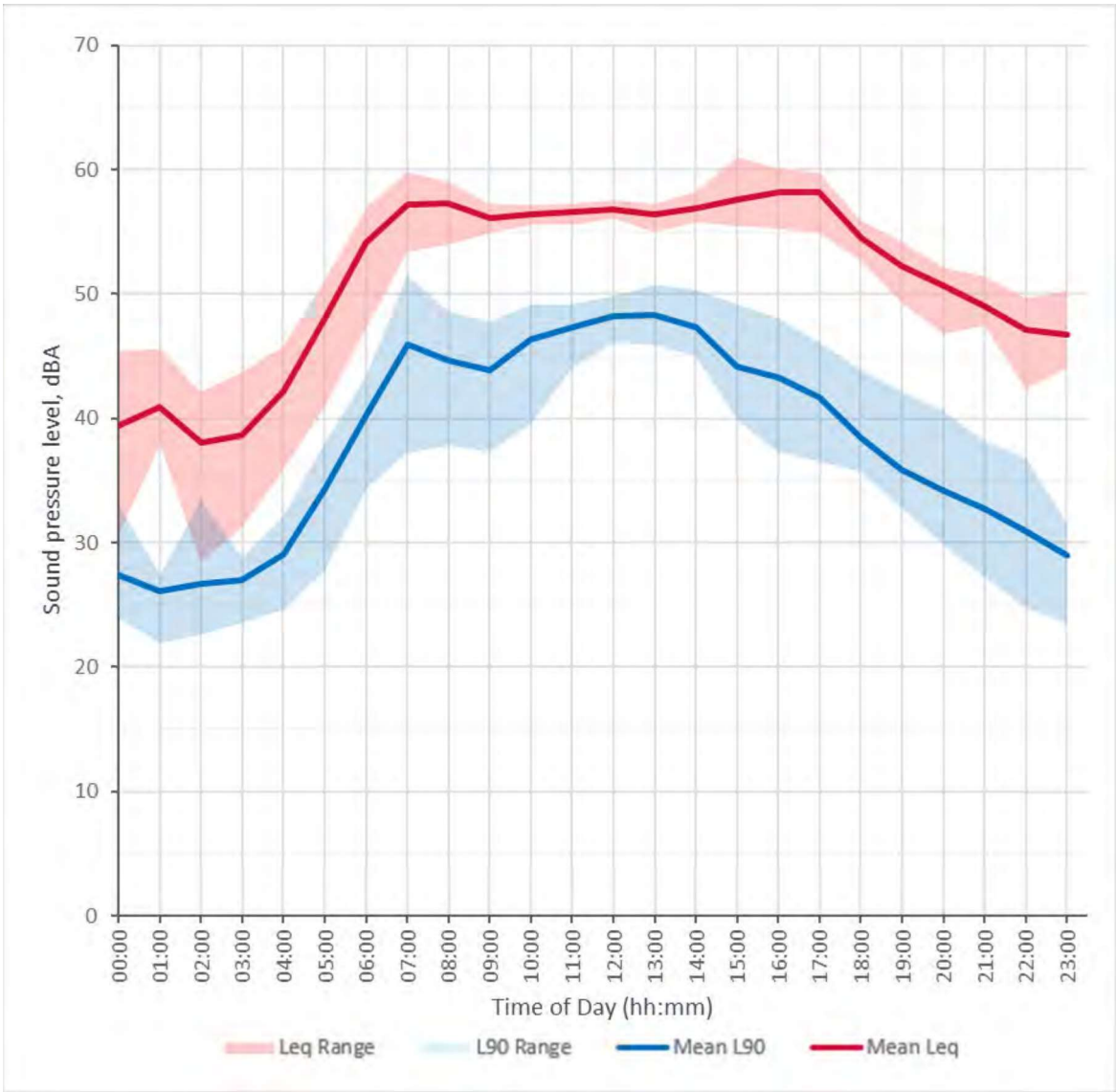


Table 3: Measured noise levels and observations during attended survey (at logger position)

Measurement Time	Measured Noise Level, dB				Comments
	L_{Aeq}	L_{A10}	L_{A90}	L_{AFmax}	
1150 hrs 19/04/24	48	48	45	71	Topsoil stripping in C Block. Use of excavator and intermittent dump truck movement clearly audible, but not dominant. L_{max} from excavator breaking tree root (or similar) – most maxima in range from 55-65 dB L_{AFmax}.

The results of our recent measurements indicate that noise emissions from the quarry are consistent with our previous calculations for this phase of development, where noise levels of 45 to 49 dB L_{Aeq} were predicted during C Block South works.

4.0 NOISE STANDARDS

The existing consent places limits on noise from the site that have been unchanged for a number of years and are consistent with the underlying District Plan noise limits and other guidance, as set out below.

4.1 Resource Consent Limits

RC215749 provides cumulative noise limits for all activities on site (i.e. the expansion areas and original quarry) in Condition 14. These limits are measured at the notional boundary of any other dwelling not owned by the consent holder:

- Daytime (0700 to 2200 hrs) – **55 dB L_{Aeq} and 85 dB L_{AFmax}**
- Night-time (2200 to 0700 hrs) – **45 dB L_{Aeq} and 70 dB L_{AFmax}**

Condition 15 requires that noise from construction activities – site establishment, the construction, rehabilitation and removal of earth bunds, overburden removal and the creation of any access roads – should be managed in accordance with New Zealand Standard NZS 6803:1999 *"Acoustics - Construction Noise"* and comply with the 'typical duration' limits set out in that Standard (see Appendix B).

We note that the daytime 85 dB L_{AFmax} noise limit was based on the operative Selwyn District Plan. The most recent version of the Plan removed the daytime L_{AFmax} limit completely (see below).

4.2 Selwyn District Plan

We understand that the decisions on the Partially Operative District Plan (PODP) Appeals Version now have legal effect. While the PODP is still undergoing the appeals process, we understand that the relevant portions for noise are not subject to appeal and therefore are very unlikely to change.

The proposed noise limits, where both the activity and the site receiving noise is in the General Rural Zone (GRUZ), from Rule NOISE-REQ1 – Table 5, are reproduced in Table 4 below. These limits also apply at the notional boundary of rural dwellings.

Table 4: PDP General rural zone notional boundary noise limits

Time Period	Noise Limit
Day – 0700 to 2200	55 dB L_{Aeq}
Night – 2200 to 0700	45 dB L_{Aeq} 70 dB L_{AFmax}

4.3 NZS 6802:2008 Upper Limits

NZS 6802:2008 *"Acoustics - Environmental Noise"* refers to the following desirable upper limits of sound exposure at or within the boundary of any residential land use:

- Daytime: **55 dB $L_{Aeq\,(15\,min)}$**
- Night-time: **45 dB $L_{Aeq\,(15\,min)}$ and 75 dB L_{AFmax}**

The noise levels provided in the Standard are intended to provide territorial authorities with appropriate guidance for the development of local noise criteria. This Standard is also referenced in the PODP and the National Planning Standards.

4.4 World Health Organisation Guidelines

The World Health Organisation (WHO) Guideline Values for Community Noise[2] give guidelines for environmental noise exposure. For community or environmental noise, the critical health effects (those effects which occur at the lowest exposure levels) are sleep disturbance; annoyance (moderate, high); and speech interference/communication disturbance.

The WHO Guideline Values for these three critical health effects for community or environmental noise are presented in Table 5. These Guideline Values are the exposure levels that represent the onset of the effect for the general population. That is, at these noise levels, critical health effects only begin to appear in a small number of vulnerable or sensitive groups.

Table 5: WHO Guideline Values for the critical health effects of community or environmental noise

Specific Environment	Critical health effect(s)	L_{Aeq} dBA	Time base (hours)	L_{Amax} dBA
Outdoor living area	Serious annoyance, daytime & evening	55	16	-
	Moderate annoyance, daytime & evening	50	16	-
Dwellings, indoors Inside bedrooms	Speech Intelligibility and moderate annoyance, daytime & evening	35	16	-
	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values) night-time	45	8	60

5.0 CALCULATED NOISE LEVELS

We have estimated the worst-case quarrying noise levels that will be generated at various times over the lifespan of the proposed expansion area. The following scenarios have been developed for our calculations.

Table 6: Operational noise modelling scenarios

Scenario	Sullivan Block	Existing Quarry
1 (pre)	Overburden removal at existing ground level	Final extraction in C Block South Cleanfill in C Block North General processing and loadout ongoing
2 (mid)	Extraction half complete, work direction from north-east at pit level Overburden removal at existing ground level in south-eastern half	Final extraction in C Block South Cleanfill in north portion of quarry General processing and loadout ongoing
3 (end)	Final extraction in south-eastern corner at maximum pit depth	Cleanfill in C Block South General processing and loadout ongoing
4 (post)	Cleanfill back to original ground level	Rehab works in C Block South Processing ceased but trucks/loadout ongoing

[2] Berglund, Lindvall and Schwela, *Guidelines for Community Noise*, World Health Organization 1999.

The following plant in Table 7 has been included for each operational scenario. This includes the equipment for both the existing and proposed expansion areas. The final stage has a reduced amount of equipment on the assumption that processing will have ceased because no new aggregate is being extracted.

Table 7: Noise source data for calculations

Item	Noise Level	Source Height*, m	Quantity per Scenario			
			1 (pre)	2 (mid)	3 (end)	4 (post)
Front end loader	105 dB L_{WA}	1.5	4	3	4	3
Excavator	108 dB L_{WA}	2.0	2	2	1	1
Dozer	110 dB L_{WA}	2.0	1	0	1	1
Barmac crusher	105 dB L_{WA}	3.0	1	1	1	0
Processing plant†	118 dB L_{WA}	2.5	1	1	1	0
Dumper truck	83 dB L_{AE} at 10 m	1.5	1	1	0	0
Truck and trailer	86 dB L_{AE} at 10 m	1.5	20 per hour			
Cleanfill truck	81 dB L_{AE} at 10 m	1.5	8 per hour			
Light vehicle	70 dB L_{AE} at 10 m	1.0	16 per hour			

** Modelled noise source height relative to source's local terrain elevation (e.g. above pit base or above existing ground).*
† Mobile processing plant consisting of crushing and screening units.

No tonal reversing alarms will be used, in accordance with the existing resource consent. Such noise has therefore not been considered in our assessment.

We note that the processing plant does not necessarily operate every day and is moved within the existing quarry area as required. Our calculations focus on the worst case scenario when this plant is in use, as it is generally one of the primary sources of noise associated with quarrying.

5.1 Modelling Methodology

Computer noise modelling was undertaken using the SoundPLAN v9.0 suite of noise modelling software. This software implements calculation procedures described in International Standard ISO 9613-2:1996 *"Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*" that assume 'supportive' (i.e. worst-case) propagation conditions such as moderate downwind (from source to receiver) or under a temperature inversion.

Our modelling is based on the following underlying information and assumptions:

- Topography based on 2023 LiDAR data to capture existing pit depth relative to surrounding ground.
- LiDAR point elevations in quarry pit simplified to remove screening from temporary stockpiles etc.
- Ground absorption within the quarry site is 'hard' (G=0.0) and 'mixed' (G=0.5) elsewhere.
- No acoustic screening or shielding from barriers or bunds outside of the site (i.e. on other properties) has been allowed for.

3 metre high earth bunds have been modelled around the southern and eastern edges of the proposed extraction area, in addition to those already existing.

5.2 Model Results

5.2.1 Operational Noise

The results of our noise modelling are shown below in Table 8, with the cumulative (existing and new activities) level shown and contribution of plant working in the new areas in brackets and smaller font. The values are calculated at the notional boundary of each dwelling. The results are also shown graphically as noise contour plots in Appendix C.

Table 8: Calculated noise levels at dwelling notional boundaries

No.	Receiver	Calculated Activity Noise Level, dB $L_{Aeq\ (15\ min)}$ Cumulative level (with new contribution alone in brackets)			
		Pre-Sullivan	Mid-Sullivan	End-Sullivan	Post-Sullivan
1	668 Robinsons Road	48 (44)	50 (46)	50 (41)	47 (47)
2	660-666 Robinsons Road	46 (42)	47 (44)	46 (40)	43 (41)
3	679 Robinsons Road	49 (43)	49 (45)	49 (41)	47 (46)
4	58 Selwyn Road	50 (44)	50 (43)	50 (39)	46 (44)
5	74 Selwyn Road	48 (43)	49 (43)	49 (37)	46 (44)
6	663 Robinsons Road	47 (42)	48 (43)	48 (39)	45 (44)
7	90 Selwyn Road	46 (42)	48 (42)	48 (37)	44 (43)
8	108 Selwyn Road	45 (41)	47 (41)	47 (37)	44 (42)
9	104 Selwyn Road	45 (41)	47 (41)	47 (37)	44 (42)
10	701 Robinsons Road	49 (42)	49 (42)	48 (37)	45 (43)
11	703 Robinsons Road	50 (41)	50 (41)	49 (39)	45 (42)
12	60 Selwyn Road	47 (42)	48 (42)	47 (37)	45 (43)
13	1/693 Robinsons Road	47 (41)	47 (41)	47 (38)	44 (42)
14	643 Robinsons Road	42 (39)	45 (38)	45 (34)	40 (38)
15	101 Selwyn Road	44 (39)	45 (37)	45 (33)	41 (38)
16	75 Selwyn Road	46 (39)	47 (39)	47 (35)	42 (39)
17	126 Selwyn Road	44 (39)	45 (40)	45 (35)	42 (40)
18	628 Robinsons Road	43 (38)	45 (38)	44 (34)	41 (38)
19	726 Robinsons Road	46 (36)	46 (37)	44 (36)	41 (37)
20	8 Selwyn Road	50 (39)	49 (39)	49 (38)	44 (40)
21	2/693 Robinsons Road	45 (38)	46 (39)	45 (35)	42 (40)
22	8A Selwyn Road	47 (38)	47 (35)	47 (37)	42 (38)
23	740 Robinsons Road	47 (37)	47 (37)	46 (38)	42 (39)
24	736 Robinsons Road	47 (36)	47 (37)	46 (37)	42 (39)
25	2/81 Alameda Place	41 (35)	44 (35)	44 (34)	39 (35)

5.2.2 Predicted Maximum Noise Levels

In our experience, the maximum (L_{AFmax}) noise levels from quarries are typically influenced by short duration activities such as loaders tipping of aggregate, truck body rattle (particularly when empty) and topsoil removal. Use of the processing plant, which is generally considered as the highest noise item, is more steady in nature and does not often govern the L_{AFmax} noise levels.

During extraction and loading, our experience is that the highest maximum noise levels can be up to around 15 to 20 dB higher than the L_{Aeq} values. Based on the data presented above, this would result in noise levels up to around 70 dB L_{AFmax}.

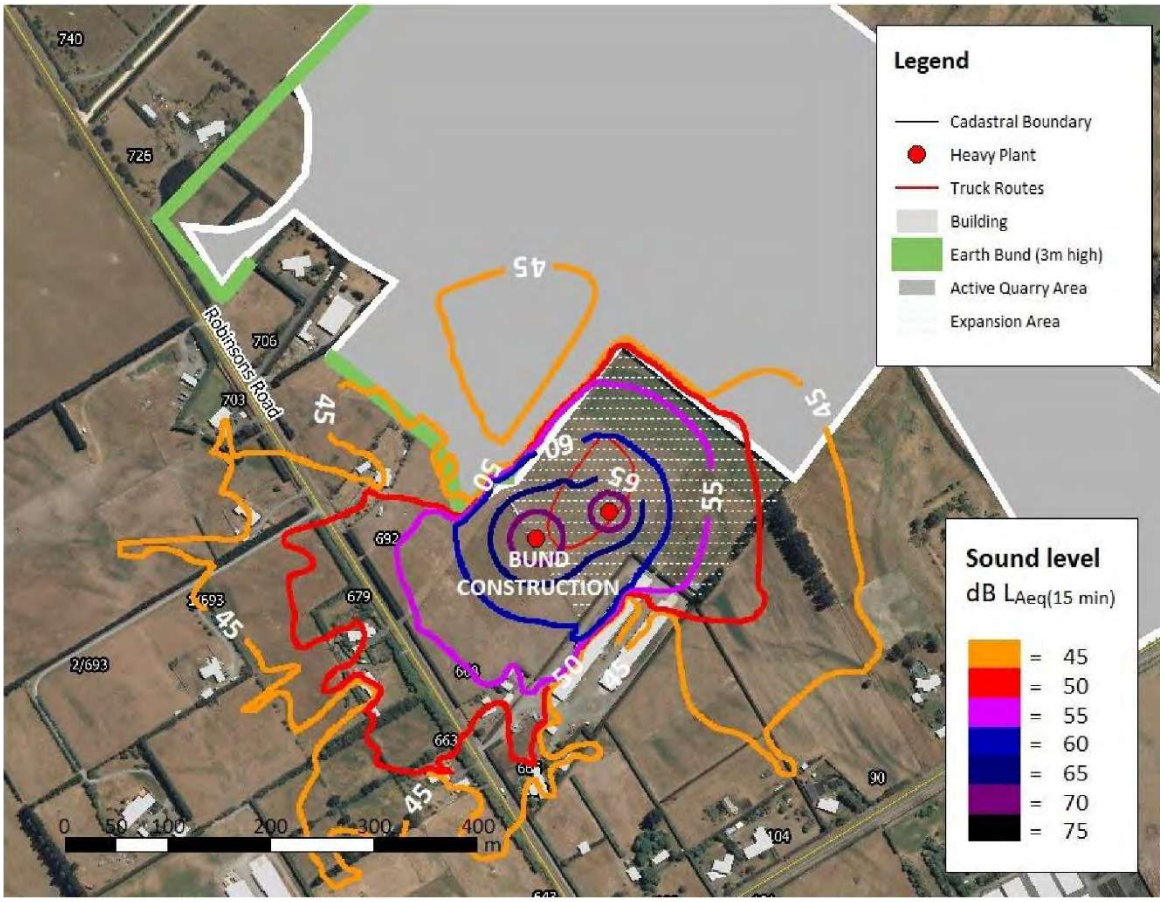
This is also consistent with the data in Table 3, which provides our observations from topsoil stripping, measured approximately 200 metres away behind the bund. Most noise events were between 55 and 65 dB L_{AFmax}, while one stand-out event was measured at 71 dB L_{AFmax}. This was due to a hard object breaking in the ground when moved by the excavator working at ground level; this was presumed to be a tree root or similar.

5.2.3 Construction Noise

Activities such as construction of the earth bunds and initial ground clearance are assessed as construction noise. In our experience, bund construction is often the highest noise level event because of the decreased distances to dwellings and because the works are unscreened.

An example of noise during bund construction is presented below. This shows that even the most stringent construction noise limit that would apply to *long duration* activities (70 dB L_{Aeq}) would be achieved at all sensitive receiver locations.

Figure 3: Noise contours for bund construction



6.0 NOISE ASSESSMENT

6.1 Comparison with Noise Limits

Noise levels at all dwellings listed in Table 8 comply with the 55 dB L_{Aeq} daytime noise limits in the existing resource consent conditions. Compliance with the 85 dB L_{AFmax} limit is also expected at all dwellings.

As the consented noise limits are also consistent with the PODP noise standards, the noise levels will be within the range allowed for permitted activities.

6.2 Noise Effects at Dwellings

Noise from activities within the proposed new extraction area itself will be relatively low at dwellings, compared with the highest levels of quarry noise (governed by other activities such as the processing plant). The highest levels from activities in the Sullivan Block alone are 44 - 47 dB L_{Aeq} across the phases of works modelled.

Overall, we anticipate that noise effects will remain in keeping with those currently experienced for the majority of dwellings.

We note that all predicted noise levels are well within the upper guidelines given by WHO and NZS 6802, and do not exceed 50 dB L_{Aeq} at any dwelling, which is 5 dB below the District Plan standards.

The closest privately-owned dwellings on Robinsons Road (Receivers 1-3) have cumulative quarry noise levels predicted of between 45 and 50 dB L_{Aeq}, of which the contribution from new activity in the Sullivan Block alone is generally not above 45 dB $L_{Aeq.}$

Noise levels were predicted at these dwellings in our 2019 report in the range of 45 to 49 dB L_{Aeq}, with the highest levels likely to occur at the final stage of C Block South extraction works. The latest predicted levels in Table 8 are generally around 49 dB L_{Aeq} throughout, as it is assumed that activity will occur concurrently in C Block South and the Sullivan Block, as cleanfilling will be occurring at the same time as adjacent extraction, etc. The Sullivan Block is a similar distance from the dwellings as C Block South, hence noise levels will be consistent with the current baseline.

Dwellings on Selwyn Road (numbers 58 to 108) are also close to the Sullivan Block. Those farthest east are closer to the quarry entrance and also receive noise from operation of the processing plant and other activities on site. No perceptible change in noise level is expected at these dwellings.

On the other side, the dwellings at 104 and 108 Selwyn Road currently receive noise from the site at around 45 dB L_{Aeq} (based on our 2019 report). Predicted levels from Sullivan Block works alone are up to 41 dB L_{Aeq}, with cumulative noise levels now predicted of up to 47 dB L_{Aeq}. This represents a modest increase in quarry noise levels, which may be just perceptible in the most sensitive situations. The overall noise level at these properties is unlikely to change due to the existing influence of road traffic noise.

6.3 Quarry Traffic on Public Roads

As with our 2019 report, we have not specifically assessed noise from trucks on the surrounding road network as we understand that there will be no changes to the number of truck movements to or from the site because of this application. We therefore assume that there will be no change to the current environment.

7.0 CONCLUSIONS

Our assessment has considered noise emissions from activities in both the proposed expansion area and in the existing quarry site. In summary we find that:

- Noise during the construction phase – initial topsoil removal and establishment of the boundary earth bunds – will comfortably comply with the construction noise limits in NZS 6803:1999.
- Noise from excavation, aggregate extraction, cleanfilling and rehabilitation activities in the Sullivan Block will be below 45 dB L_{Aeq} at all but the closest dwelling, which will receive levels of up to 46 dB L_{Aeq}.
- Cumulative noise from Sullivan Block activity, plus other plant within the main quarry will not exceed 50 dB L_{Aeq} at any dwelling.
- The highest predicted noise levels are therefore 5 dB below the consented noise limits and the underlying District Plan noise standards.
- Most dwellings close to Robinsons Road and Selwyn Road already receive road traffic noise at higher levels than the proposed quarry activity;
- Maximum noise levels are unlikely to exceed 75 dB L_{AFmax} at dwellings.

Based on these points, we expect that noise levels will be consistent with current operations. We therefore expect that overall noise effects from quarry activities will be acceptable.

We recommend that the current suite of noise related conditions are retained for the purpose of this expansion, should consent be granted.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).
Background sound	The sound that is continuously present in a room our outdoor location. Often expressed as the A-weighted sound level exceeded for 90 % of a given time period i.e. L_{A90}.
C-weighting	A frequency weighting used to approximate the response of the human ear to sounds with strong low frequency components (typically between 25 and 125 Hz) at high noise levels (typically greater than 85 decibels).
dB	Decibel. The unit of sound level.
L_{A90}	The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level.
L_{AE}	Exposure Level. An A-weighted measure of the total sound energy over a certain time period, compressed into 1 second. Used to describe the sound energy of a single event, such as a train pass-by or an aircraft flyover.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time–weighting i.e. L_{AFmax}
L_P	Sound pressure level. The sound level measured at distance from a source. Distinctly different from sound power level (L_W)
L_W	Sound Power Level. The calculated level of total sound power radiated by a sound source. Usually A-weighted i.e. L_{WA}.
Notional boundary	A line 20 metres from any side of a dwelling, or the legal boundary where this is closer to the dwelling. This definition is from NZS 6802:2008.
Special audible characteristics	Distinctive characteristics of a sound that make it more likely to cause annoyance or disturbance. A penalty of up to 5 decibels can be applied when assessing sounds with SAC Examples are tonality – a hum or a whine) and impulsiveness – bangs or thumps.

APPENDIX B CONSTRUCTION NOISE LIMITS FROM NZS 6803:1999

Noise limits from NZS 6803:1999 *"Acoustics – Construction Noise"* are commonly incorporated into resource consent conditions as part of an overall strategy to control effects. In summary, this standard allows construction noise levels during daytime to be somewhat higher than for permanent noise sources on the basis that the effects are of relatively short duration, whilst maintaining appropriate amenity at night to permit sleep.

This Standard includes a table of recommended noise limits, depending on the duration of noise as follows:

- "Short-term" means construction work at any one location for up to 14 calendar days;
- "Typical duration" means construction work at any one location for more than 14 calendar days but less than 20 weeks; and
- "Long-term" means construction work at any one location with a duration exceeding 20 weeks

The Standard provides the following noise limits:

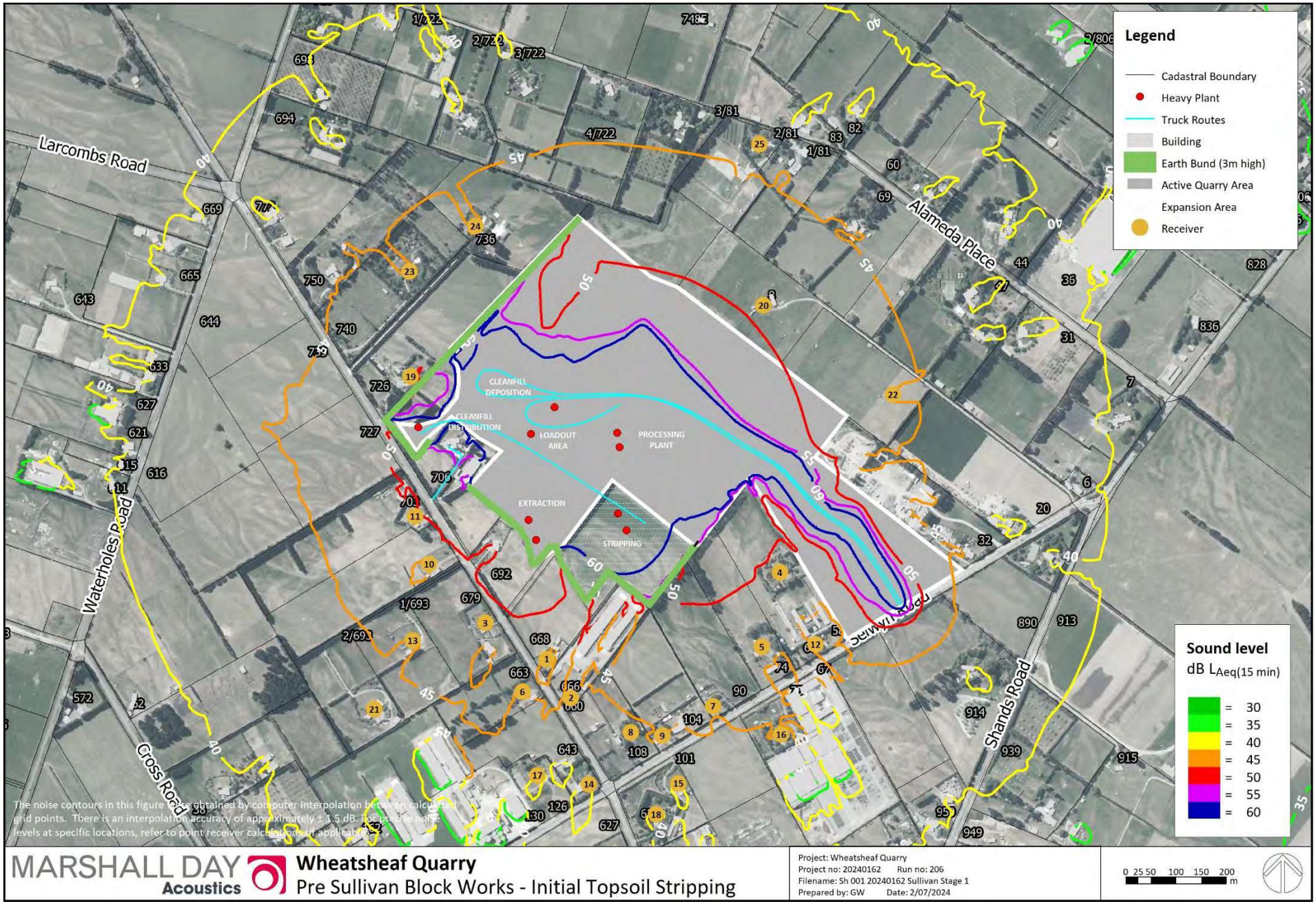
Table C1: Recommended upper limits for construction noise received in residential zones and dwellings in rural areas (Table 2 from NZS 6803: 1999)

Time of week	Time period	Typical duration		Short-term duration		Long-term duration	
		dB L_{Aeq}	dB L_{Amax}	dB L_{Aeq}	dB L_{Amax}	dB L_{Aeq}	dB L_{Amax}
Weekdays	0630-0730	60	75	65	75	55	75
	0730-1800	75	90	80	95	70	85
	1800-2000	70	85	75	90	65	80
	2000-0630	45	75	45	75	45	75
Saturdays	0630-0730	45	75	45	75	45	75
	0730-1800	75	90	80	95	70	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75
Sundays and public holidays	0630-0730	45	75	45	75	45	75
	0730-1800	55	85	55	85	55	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75

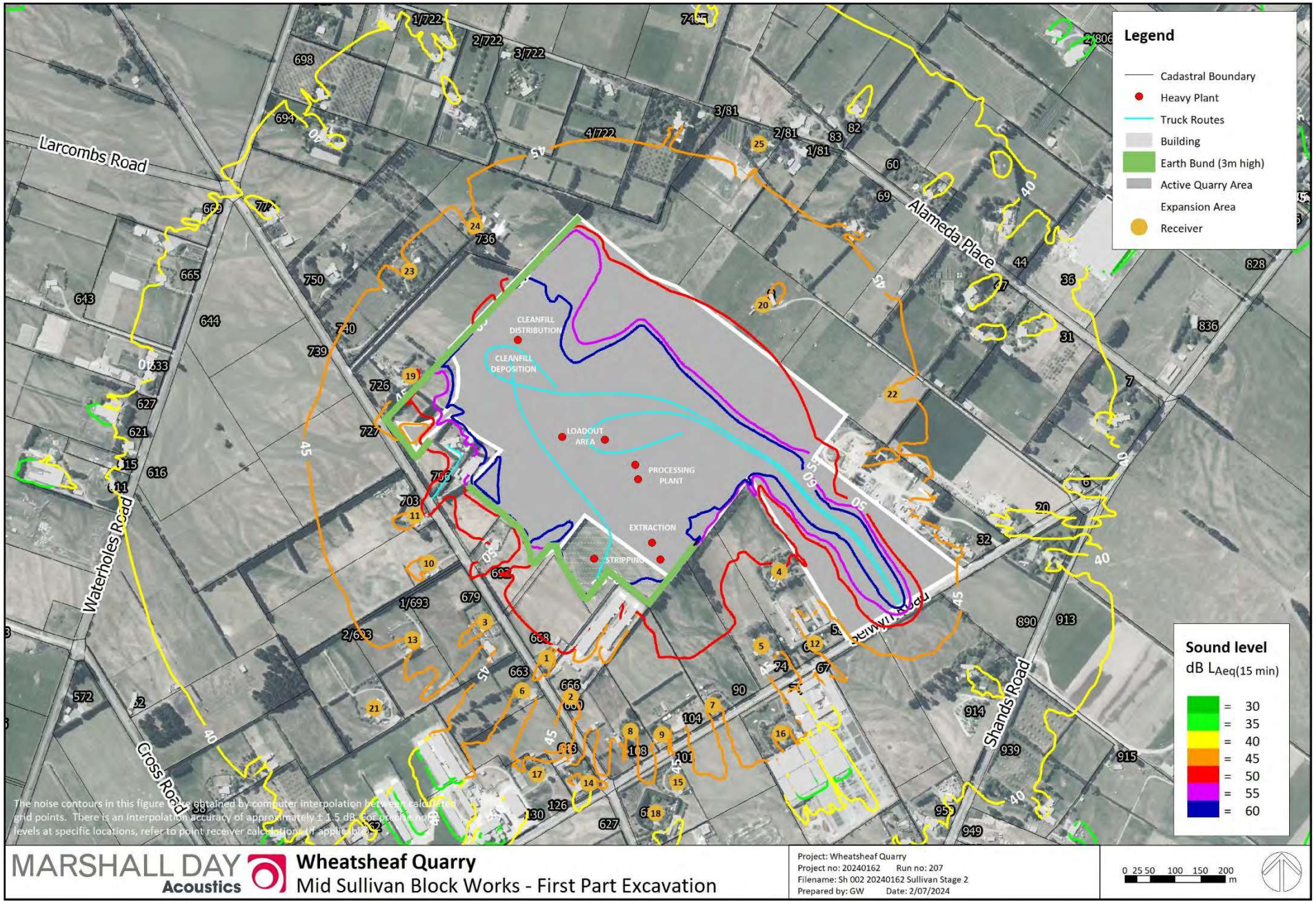
APPENDIX C NOISE CONTOUR PLOTS

See following pages

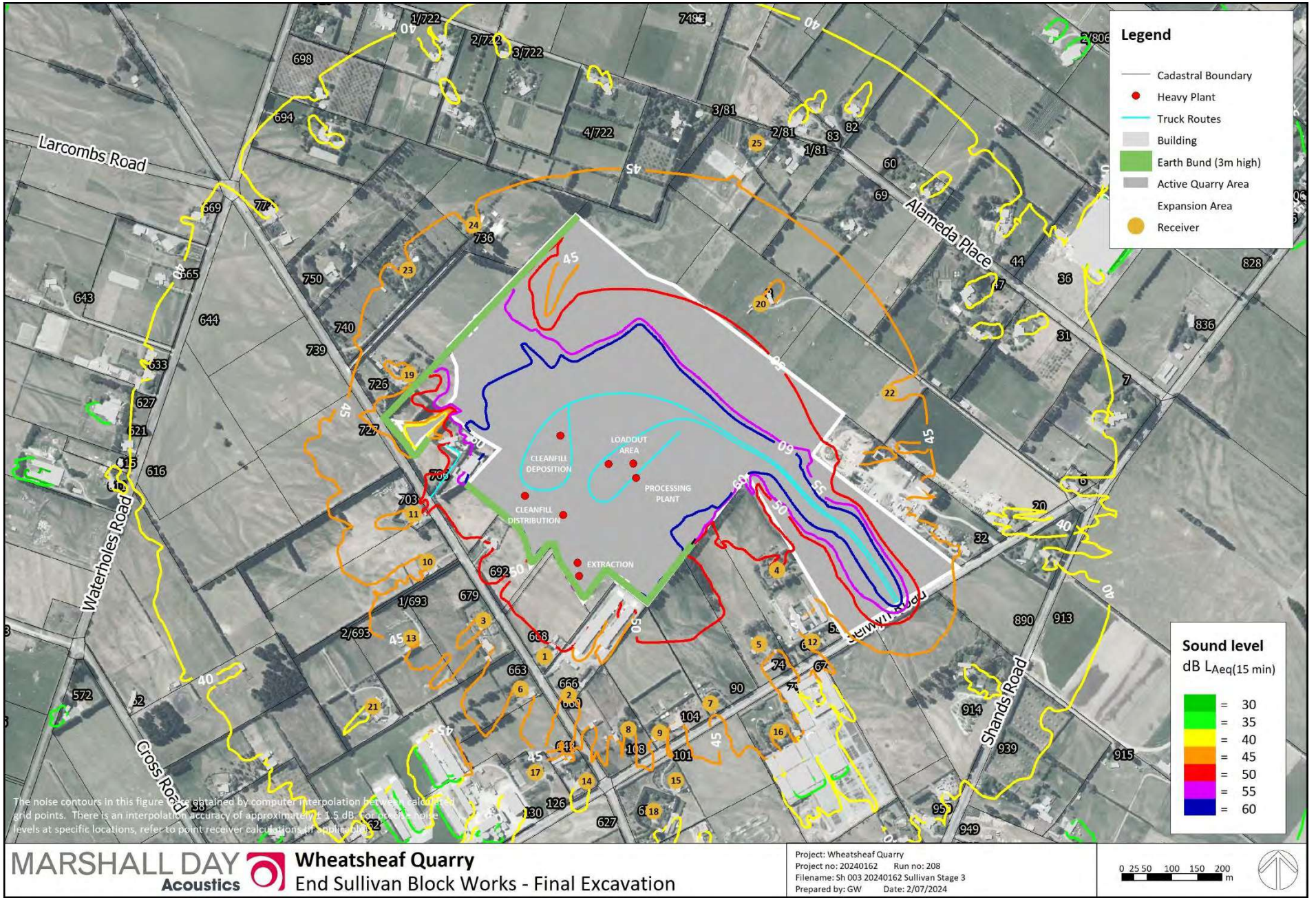
C1 Scenario 1 – Pre Sullivan Block Works



C2 Scenario 2 – Mid Sullivan Block Works



C3 Scenario 3 – End Sullivan Block Works



C4 Scenario 4 – Post Sullivan Block Works