



ASSESSMENT OF NOISE EFFECTS

OPARURE QUARRY SOUTH-WESTERN PIT
806 OPARURE ROAD

PREPARED FOR

Graymont (NZ) Limited

DATE

14 May 2026

Acoustic assessment prepared by Styles Group for Graymont (NZ) Limited.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	1/05/26		Draft	Jon Styles, MASNZ	Gemma Styles Consultant Styles Group
2	12/05/26		Final Draft	Director and Principal Styles Group	
3	14/05/26		Final		

Statement of experience

I am and have been the Director and Principal of Styles Group Acoustics and Vibration Consultants for 21 years. I am a Council Member of the Acoustical Society of New Zealand, and I am on the Board of Directors of the Australasian Association of Acoustical Consultants.

I have over 25 years' experience advising on the management of noise and vibration effects.

I have extensive experience advising on the management of noise and vibration effects of major and strategic infrastructure (including quarries, industrial activities, ports, roads, airports and rail). I have assessed the construction and operational noise effects from a significant number of mineral and aggregate extraction activities throughout New Zealand.

I am a regular and experienced expert witness for Council, Environment Court, District Court, High Court and Board of Inquiry hearings. I confirm that, in my capacity as author of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023. I am familiar with the Site and surrounds, having visited the Quarry on several occasions.

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Executive summary

Styles Group has assessed the operational and construction noise and vibration effects from the development, operation and progressive rehabilitation of the “South-Western Pit” (the **Proposal**) at 806 Oparure Road (the **Site**) in the Waitomo District.

We have assessed the Proposal in accordance with the permitted noise and vibration standards prescribed by the Proposed Waitomo District Plan (**PWDP**).¹

We have used computer noise modelling software to predict the noise levels arising from quarrying activities using noise measurements obtained from the operation of the existing Oparure Quarry and the pit staging plans for the South-Western Pit.

The noise modelling takes into account mobile noise sources that will operate within the South-Western Pit, including a mobile crushing plant, loaders and excavator, and trucks moving along the proposed haul road to the Oparure Quarry. The noise modelling also takes into account cumulative noise from activities that will continue to be undertaken from within the Oparure Quarry.

Our assessment demonstrates that the Proposal can readily achieve compliance with the permitted noise standards prescribed by the PWDP for noise generated from the Rural Production Zone (**RPZ**) and received at the boundary of the Site, as well as at the notional boundaries of dwellings in the General Rural Zone (**GRUZ**) that have not provided written approval to the activity. The application includes a reason for consent to exceed the permitted night-time noise standards at 966 Oparure Road. We understand this receiver has provided written approval for the Proposal.

The Proposal will include drilling and blasting to fragment the limestone resource for extraction. NOISE-R7 permits the emission of noise and vibration from blasting in the RPZ where it complies with the permitted activity standards prescribed by NOISE-S10. Our assessment confirms that noise and air-overpressure effects from blasting events in the South-Western Pit can comply with the permitted standards at all receivers. This assessment has been informed by monitoring of previous blasting events at the Oparure Quarry.

We understand that any construction works associated with the Proposal will be completed with the same machinery and plant that is used for the existing quarrying activity. The noise levels from construction work will therefore be similar to the noise levels generated during quarrying work. We have not identified any challenges in terms of complying with the permitted construction noise and vibration standards prescribed by NOISE-S9.

Our assessment demonstrates that the Proposal can readily achieve compliance with the permitted noise standards for noise and vibration generated from the RPZ and received in the GRUZ. These noise limits are designed to deliver a reasonable level of noise for receivers adjacent to significant mineral and aggregate extraction activities.

¹ Appeals Version.

1.0 Introduction

Graymont (NZ) Limited (**Graymont**) has engaged Styles Group to predict and assess the noise and vibration levels from the development, operation and progressive rehabilitation of the “South-Western Pit” (the **Proposal**) at 806 Oparure Road in the Waitomo District (the **Site**).

This report has been prepared to accompany a substantive application to the Fast-track Approvals Act 2024. This report includes:

- i. An assessment of operational noise, construction noise and noise and vibration effects from blasting in accordance with the rules and standards prescribed by the Proposed Waitomo District Plan (**PWDP**)².
- ii. Recommended noise management measures and conditions of consent based on our findings.

Our assessment is based on our understanding of the Proposal following a site visit and discussions with the project team. This report should be read in conjunction with the application site plans and the Assessment of Environmental Effects. A glossary of acoustical terms used within this document is attached as Appendix A.

2.0 The Proposal

Graymont proposes to quarry limestone from the South-Western Pit (Figure 1). The South-Western Pit will be quarried in stages, with progressive rehabilitation of each stage as new areas are opened.

The operational noise sources associated with the Proposal include mobile crushing plant, loaders and excavator, and trucks moving along the proposed 1.3 km haul road to the Oparure Quarry.

The South-Western Pit will be operated in accordance with the same operational methodology as the existing Oparure Quarry. The material extracted from the South-Western Pit will be processed using existing fixed processing plant and facilities located in the Oparure Quarry.

We understand the Proposal will not increase the current production rates (or vehicle movements) generated by the current operation of the Oparure Quarry. The projected production rates of the South-Western Pit and associated traffic movements are expected to be similar to historical and current production rates associated with the Oparure Pit. This will include drilling and blasting of limestone at intervals of 7 to 10 days to achieve similar production rates.

Initially, the quarrying in the South-Western Pit will be concurrent with the existing operation to meet expected future demand for limestone products. When the resource is depleted at the end of the life of the Oparure Pit, the South-Western Pit is expected to become the only source

² We understand that the relevant rules and standards are not subject to appeal and can be treated as operative.

of limestone at this quarry site. All phases including the transition phase will involve the same plant, equipment and processes.



Figure 1 The existing Oparure Quarry, and the proposed South-Western Pit (57.4ha)

3.0 The Site and surrounding environment

Figure 2 displays the PWDP zoning arrangements across the Site and surrounding environment. The South-Western Pit and Oparure Quarry are in the Rural Production Zone (**RPZ**) of the PWDP. The peripheral areas of the Site (outside of the Pit) and the surrounding land are in the General Rural Zone (**GRUZ**). The notation 'RPROZ03' identifies Oparure Quarry as a scheduled rural production site and significant mineral resource.

The receivers of noise (dwellings) are generally consolidated along the Oparure Road corridor and sparsely scattered across the land surrounding the Site. The receivers are identified on the map in Appendix B.

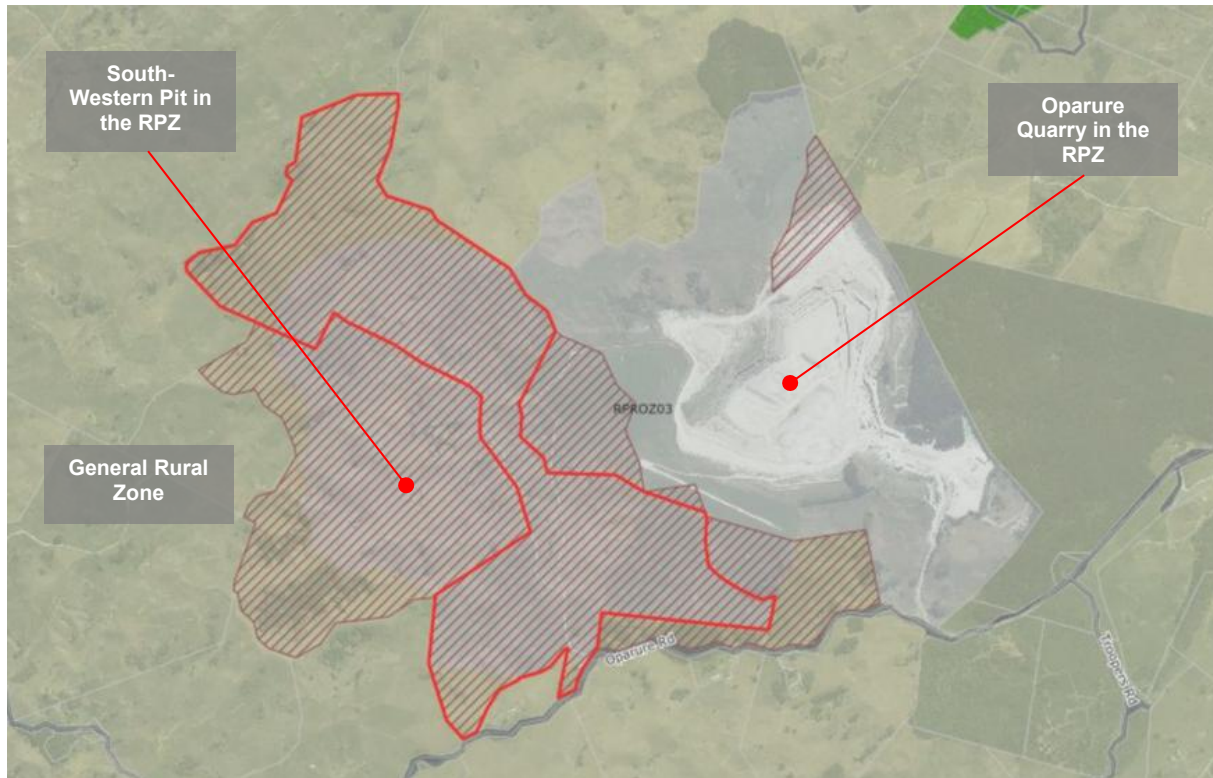


Figure 2 PWDP Zoning

Cross Hatching represents the PWDP Indicative Rural Production Areas (RPROZ03)

4.0 Operational noise assessment

The Proposal involves noise sources required to quarry, process and transport limestone, including mobile crushing plant, loaders and excavator, and trucks moving along the proposed haul road to the Oparure Quarry.

We have predicted the operational noise from the Proposal in accordance with the permitted noise levels prescribed by the PWDP for noise generated in the RPZ and received in the GRUZ.

4.1 Operational noise standards

The applicable PWDP noise standards that control operational noise levels generated from the RPZ are set out below:

Noise-S4. Noise standards for the industrial and rural production zones

1. Within the rural production and industrial zones, noise generated by an activity must not exceed the following noise limits at the legal boundary of the site or the nearest practical measuring point to that boundary:

Time	Noise limit
7am – 7pm	75 dBA (L _{Aeq})
7pm – 10pm	65 dBA (L _{Aeq})
10pm – 7am	60 dBA (L _{Aeq})
10pm – 7am	90 dBA (L _{Amax})

AND

- Noise generated by an activity in the rural production and industrial zones must not exceed the following noise limits at any point within any residential zone, or, at or within the notional boundary of any noise sensitive activity in the general rural, tourism, rural lifestyle, settlement, future urban, natural open space, open space or Māori purpose zones:

Time	Noise limit
7am – 7pm	55 dBA (L _{Aeq})
7pm – 10pm	50 dBA (L _{Aeq})
10pm – 7am	45 dBA (L _{Aeq})
10pm – 7am	75 dBA (L _{Amax})

Advice Notes

Noise measurement

Noise shall be measured in accordance with NZS 6801:2008 “Acoustics - Measurement of environmental sound” and assessed in accordance with NZS 6802:2008 “Acoustics - Environmental noise”, unless otherwise specified elsewhere in this plan.

4.2 Reasons for consent

The noise level predictions (set out in Section 5.4) demonstrate that the Proposal can comply with the permitted daytime noise standards at the notional boundary of all dwellings on adjacent sites.

The noise level predictions also demonstrate that the Proposal can comply with the permitted noise standards for the prescribed evening and night-time periods at all receivers, with the exception of 966 Oparure Road. We understand that 966 Oparure Road has provided written approval for the Proposal. Potential noise effects on this party have therefore been disregarded.

5.0 Operational noise modelling and predictions

We have used DGMR iNoise computer noise modelling to predict the cumulative noise levels from noise sources within the South-Western Pit, as well as the simultaneous operation of noise sources (including operation of fixed processing plant) within the Oparure Quarry.

We have predicted the noise levels throughout the life of the South-Western Pit using the pit staging plans for five selective 'year' scenarios (Year 1, Year 5, Year 13, Year 33 and Year 53) that are based on the 12 development stages of the South-Western Pit.

The staging plans lodged with the application should be referred to for a full understanding of the way that the quarry will be developed.

The noise level predictions have been prepared in accordance with the methods in International Standard ISO 9613-1/2. The noise level predictions assume meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6802:2008.

The computer noise models are three-dimensional and take into account the topography, buildings, ground coverage, the physical attributes of the various quarrying sound sources, location of receivers and many other physical factors. The input parameters for the noise model are set out in Table 1.

Table 1 Noise model input parameters

Parameters/calculation settings	Details
Software	DGMR iNoise 2026
Calculation method	ISO 9613-1/2
Meteorological parameters	Single value, C0 = 0
Ground attenuation over land	General method, ground factor: 1
Air temperature	293.15K
Atmospheric pressure	101.33kPa
Air humidity	60%
Receiver heights (relative)	1.5m above ground
Building heights (nominal)	4m

5.1.1 Noise measurements and source levels

Styles Group performed noise measurements at Oparure Quarry to derive sound power (source) levels of the rock crusher, excavator, load, screen and washing plant, as well as truck movements within the Site. These noise measurements have been used to predict the cumulative noise levels from activities in the South Western Pit and fixed processing plant within the Oparure Quarry.

The noise measurements were performed in generally calm and fine meteorological conditions, well within the requirements of the relevant New Zealand standards. Noise level measurements were undertaken at close range for some plant and machinery, and at larger distances from the processing plant and larger noise sources.



Figure 3 Examples of noise measurements performed by Styles Group at Oparure Quarry

5.2 Quarry noise sources

The measurement data for the primary noise sources are set out in Table 2. These data represent a selection of the most useful near-field measurement results. All measurements were undertaken for sufficiently long periods to obtain a stable noise measurement result in terms of the L_{Aeq} . Pass-by measurements have been measured using L_{Aeq} or SEL metrics for use in the model to create line sources of equal noise output per lineal metre.

The measurements were used to generate sound power levels for use in the noise model, and the resulting predictions have been corroborated with the measurements undertaken at greater distances from the sources. This improves the certainty and veracity of the modelled noise levels. The sound power levels derived from the measurements are shown in Table 2 below.

Table 2– Noise level measurement results used in noise modelling

Plant	L_{wA}
Ag lime processing plant	109 dB
Ball Mill	108 dB
Bull Dozer	109 dB
Excavator loading trucks	113 dB
Grader	97 dB
Light Vehicles	75 dB ¹
Quarry truck	74 dB ²

¹ Sound power level per metre based on 25 light vehicles per hour

² Sound power level per metre based on 25 trucks per hour

5.3 Adjustments for special audible characteristics and duration

5.3.1 Special audible characteristics

Section 4.3 of NZS 6802:1991 states that “*Noise that has special audible characteristics, such as tonality or impulsiveness, is likely to arouse adverse community response at lower levels than noise without such characteristics*”.

The noise from the Proposal will generally be experienced by receivers beyond the Site as a broadband and relatively low-level hum, with occasional instances of individual machinery operating where they are not screened by topography.

We have recommended a condition of consent that will require all permanent mobile plant that may operate at or near the areas of the South-Western Pit that are not screened from

neighbouring properties (such as the plant used for overburden stripping) be fitted with broadband reverse alarms, rather than tonal reverse beepers.

Machinery that operates in positions well screened from neighbours, (such as the mobile crusher) may use tonal reverse alarms if it is not practicable to fit broadband alarms (on the basis that they will not be audible at the receiving sites).

For ease of application, we recommend that all plant and machinery used on-site (except the mobile crusher) are fitted with broadband reverse alarms. This avoids any need for additional noise management measures and allows for all plant and machinery to be used in all areas of the South-Western Pit (except the mobile crusher).

Based on these recommendations, our own noise measurements on the Site and our experience with similar large quarries around New Zealand, it is our opinion that an adjustment for special audible characteristics is not required for the noise sources associated with the activity.

5.3.2 Duration

No adjustment for duration has been applied to the predicted noise levels. The noise modelling assumes that all noise sources could operate consistently throughout the working day.

5.4 Predicted noise levels at dwellings on adjacent sites

Table 3 overleaf sets out the predicted noise levels at the notional boundary of dwellings on adjacent sites.

The noise level predictions show that the Proposal will achieve compliance with the maximum noise levels permitted by the PWDP at the notional boundary of all dwellings, with the exception of 966 Oparure Road (this exception only applying in the evening and night-time periods).

Table 3 Noise level predictions

Receiver address	Existing Oparure Quarry Noise Emissions	Site establishment	Year 1	Year 5	Year 13	Year 33	Year 53	Compliance with permitted noise standards for noise received at the notional boundary of dwellings in the Rural Zone		
	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	55 dB L _{Aeq} (7am- 7pm)	50 dB L _{Aeq} (7pm – 10pm)	45 dB L _{Aeq} (10pm – 7am)
1026 Oparure Road	30 dB	36 dB	32 dB	31 dB	32 dB	34 dB	35 dB	Yes	Yes	Yes
1027 Oparure Road	34 dB	40 dB	37 dB	36 dB	38 dB	39 dB	39 dB	Yes	Yes	Yes
1074 Oparure Road	32 dB	<36 dB	<36 dB	<36 dB	<38 dB	<39 dB	<39 dB	Yes	Yes	Yes
1230 Oparure Road	30 dB	<36 dB	<36 dB	<36 dB	<38 dB	<39 dB	<39 dB	Yes	Yes	Yes
15 Waipapa Road	31 dB	<36 dB	<36 dB	<36 dB	<38 dB	<39 dB	<39 dB	Yes	Yes	Yes
188 Waipapa Road	30 dB	35 dB	33 dB	32 dB	33 dB	34 dB	35 dB	Yes	Yes	Yes
202 Waipapa Road	30 dB	<36 dB	33 dB	32 dB	33 dB	34 dB	35 dB	Yes	Yes	Yes
238 Waipapa Road	28 dB	34 dB	32 dB	31 dB	32 dB	33 dB	33 dB	Yes	Yes	Yes
369 Boddie Road	28 dB	<32 dB	<31 dB	<32 dB	<31 dB	<31 dB	<32 dB	Yes	Yes	Yes
422 Waipapa Road	28 dB	32 dB	31 dB	30 dB	31 dB	31 dB	32 dB	Yes	Yes	Yes
531 Boddie Road	30 dB	<32 dB	<31 dB	<32 dB	<31 dB	<31 dB	<32 dB	Yes	Yes	Yes
574 Oparure Road	31 dB	<35 dB	<35 dB	<35 dB	<34 dB	<35 dB	<35 dB	Yes	Yes	Yes
576 Oparure Road	29 dB	<35 dB	<35 dB	<35 dB	<34 dB	<35 dB	<35 dB	Yes	Yes	Yes
618 Oparure Road	36 dB	35 dB	35 dB	35 dB	35 dB	35 dB	35 dB	Yes	Yes	Yes

Receiver address	Existing Oparure Quarry Noise Emissions	Site establishment	Year 1	Year 5	Year 13	Year 33	Year 53	Compliance with permitted noise standards for noise received at the notional boundary of dwellings in the Rural Zone		
	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	dB L _{Aeq}	55 dB L _{Aeq} (7am- 7pm)	50 dB L _{Aeq} (7pm – 10pm)	45 dB L _{Aeq} (10pm – 7am)
696 Oparure Road	38 dB	38 dB	38 dB	38 dB	38 dB	38 dB	38 dB	Yes	Yes	Yes
697 Oparure Road	37 dB	37 dB	37 dB	37 dB	37 dB	37 dB	33 dB	Yes	Yes	Yes
859 Oparure Road	38 dB	41 dB	38 dB	37 dB	38 dB	39 dB	39 dB	Yes	Yes	Yes
873 Oparure Road	37 dB	43 dB	39 dB	38 dB	39 dB	40 dB	40 dB	Yes	Yes	Yes
952 Troopers Road	31 dB	35 dB	34 dB	34 dB	34 dB	34 dB	34 dB	Yes	Yes	Yes
966 Oparure Road*	38 dB	51 dB	42 dB	42 dB	43 dB	46 dB	47 dB	Yes	No	No
971 Troopers Road	34 dB	35 dB	34 dB	34 dB	34 dB	34 dB	34 dB	Yes	Yes	Yes
973 Troopers Road	35 dB	37 dB	36 dB	35 dB	36 dB	36 dB	37 dB	Yes	Yes	Yes

* We understand written approval has been provided from 966 Oparure Road

5.5 Noise level predictions - Site boundary

NOISE-S4(1) of the PWDP requires compliance with the permitted noise limits to be assessed at the boundary of the site that the noise is generated on.

The noise level contours to illustrate the extent of the noise across the surrounding environment are provided in Appendix C. The noise level contours provided in Appendix C demonstrate that the L_{Aeq} noise levels will comply with the PWDP permitted noise limits that apply at the site boundary.

5.6 Assessment of operational noise effects

We understand that the RPZ anticipates and provides for the operation of quarries of regional significance, including their growth and expansion³.

The predictive noise modelling we have undertaken demonstrates that the Proposal can readily achieve compliance with the permitted noise levels prescribed by the PWDP when measured and assessed at the boundary of the Site, as well as the notional boundary of adjacent dwellings, except 966 Oparure Road. We understand that 966 Oparure Road has provided written approval to the activity and effects on this receiver are therefore to be disregarded.

The noise modelling takes into account the operation and locations of operational noise sources throughout the extraction life of the South-Western Pit. The predictions demonstrate there will be variation in the noise levels received at the nearby receivers depending on the phase of work being undertaken at any given time, as well as the location of the plant. Generally, the highest noise levels will be received when there is overburden stripping being undertaken at the higher and most exposed parts of the footprint. The noise level predictions demonstrate that compliance with the daytime noise limits is generally achieved by a significant margin, even when plant is operating in the most exposed positions.

The activity is located in the GRUZ, a zone which anticipates and provides for the noise generated from mineral and aggregate extraction and processing activities. Our noise modelling and predictions demonstrate that the Proposal can readily achieve compliance with the permitted noise standards for noise generated from the RPZ and received in the GRUZ at all receivers that have not provided written approval for noise. We consider that the noise will be reasonable in this context.

³ RPROZ-SCHED1 – Scheduled rural production sites.

6.0 Effects of blasting

The Proposal will include drilling and blasting to fragment the limestone resource for extraction. Drilling and blasting of limestone is typically carried out at intervals of 7-10 days to achieve extraction rates.

We understand that the Proposal involves the same blasting methods that are used in the Oparure Pit.

6.1 Permitted activity standards for blasting

NOISE-R7 permits the emission of noise and vibration from blasting where it is undertaken in the GRUZ or RPZ and where it complies with the permitted activity standards prescribed by NOISE-S10. NOISE-S10 requires:

1. The activity must only occur in the general rural or rural production zone [sic]; and
2. Noise generated by blasting/use of explosives must not exceed a peak sound pressure of 120dB (Lzpeak) when measured at any point within any residential zone, or, at or within the notional boundary of any noise sensitive activity; and
3. A level of 115 dBA may be exceeded on up to 5% of the total number of blasts over a period of 12 months; and
4. Blasting must not occur outside of the hours of 9am – 5pm, Monday to Saturday; and
5. Blasting, which may include a series of one or more blasts undertaken within a short time period, must not occur more than once per day. This requirement does not apply to minor blasts as identified in the Australian and New Zealand Environment Council - Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration, September 1990 or to blasting necessary for safety purposes; and
6. Vibration generated by blasting/use of explosives must not exceed the guideline values in Tables 1 and 3 of DIN 4150 inside any building, except in the case of a building located on property under the same ownership or management as that of the party blasting/using explosives.

The Proposal is to undertake all blasting in compliance with the permitted activity standards prescribed by NOISE-R7 and NOISE-S10 of the PWDP.

We are confident that blasting events in the South-Western Pit can comply with the permitted activity standards prescribed by NOISE-S10 of the PWDP based on previous monitoring we have undertaken, the separation distances available, and the ability for the blast process to be designed⁴ to achieve compliance with the relevant limits.

⁴ There are a number of ways that vibration can be managed to achieve compliance with the relevant limits whilst maintaining an acceptable yield and fracture. This can include the varying the hole diameter, depth, spacing and decking of charges, varying the maximum instantaneous charge weight (**MIC**) and manipulation of a number of other variables.

6.2 Vibration monitoring of blast events in the Oparure Pit

Styles Group supervised vibration monitoring of six blast events conducted within the Oparure Pit to determine the level of vibration currently being generated. The vibration generated by six discrete blast events was measured at the entrance to the Spellbound caves approximately 800m north-north-east of the closest edge of the Oparure Pit.

The instrumentation was supplied by Styles Group and the installation was carried out under our supervision by Graymont staff.

The seismograph was fixed to the ground by bolting it to an existing concrete pad at the entrance to the cave. The instrument recorded the peak particle velocity (**PPV**) every five seconds. A trigger of 0.5 mm/s PPV was set to record the full wave file and frequency analysis of each blast event. However, the vibration levels were very low and the trigger value was never exceeded. The data we have collected simply comprises the PPV data for each axis of movement at the time of the event.

Table 4 sets out the highest PPV value for each blast event, along with the date, time, MIC and our observations of the data.

Table 4 Vibration monitoring results of blast events at Oparure Pit

Date	Time	MIC	PPV	Comments
Jul 28 2021	1248	56 kg	0.205 mm/s	Event barely measurable above ambient vibration / limits of instrument detection
Aug 3 2021	1451	20 kg	0.229 mm/s	Event barely measurable above ambient vibration / limits of instrument detection
Sept 20 2021	1050	22 kg	<0.127 mm/s	Event not measurable above ambient vibration / limits of instrument detection
Sept 29 2021	1215	95 kg	0.213 mm/s	Event barely measurable above ambient vibration / limits of instrument detection
Oct 6 2021	1441	48 kg	0.205 mm/s	Event barely measurable above ambient vibration / limits of instrument detection
Oct 21 2021	1348	43 kg	0.323 mm/s	Event barely measurable above ambient vibration / limits of instrument detection

The vibration from blast events was not able to be measured accurately due to the very low levels. In one case the blast event was undetectable and in all other cases the vibration level was only marginally above the limits of detection of the instrumentation. This means that the vibration levels from blasting were very likely to have been less than the values reported. The only meaningful conclusion that can be reached from the data is that the vibration levels were no greater than the values reported. All events were generally below the level that a human would normally be able to perceive.

The monitoring we have undertaken confirms that blasting in the South-Western Pit can readily achieve compliance with the limits based on the separation distances available.

6.3 Assessment of potential vibration effects on dwellings

The subjective experience of airblast over-pressure levels from blasting at up to the permitted level of 120dBZ L_{peak} at any notional boundary could be described as a low frequency 'pulse' and sometimes a rumble that is often 'felt' more often than it is heard.

The level is generally low and would not typically be described as disturbing or problematic, especially if the event is expected within a window of time. The airblast over-pressure may cause windows to deflect slightly. This is very noticeable when an observer witnesses the reflections of a window vibrating. There is no danger of damage to buildings at levels that do not exceed 120dBZ L_{peak} .

6.4 Potential effects on the Spellbound Caves

We understand that the Spellbound caves are the closest accessible commercial/ recreational caves to the Proposal. Any vibration from blasting in the South-Western Pit is expected to be lower than blasting events in the Oparure Quarry due to the greater separation distance.

We understand that no adverse effects on the Spellbound caves arising from blasting in the Oparure Pit have been reported. We have not identified the potential for adverse effects on the caves from blasting in the South-Western Pit.

We understand that the blasting required in the South-Western Pit will be similar in size and MIC to the current blasting regime. Given that the South-Western Pit is approximately twice as far away from the Spellbound caves as the Oparure Pit, the vibration levels will be considerably lower and below the detection limits of standard measurement equipment. We expect that the vibration will be imperceptible to humans.

7.0 Construction noise and vibration effects

The construction of haul roads and other temporary infrastructure (such as drainage) will be required periodically throughout the staged extraction process.

The Proposal is to undertake all construction work in compliance with the permitted construction noise and vibration standards prescribed by NOISE-S9 of the PWDP.

7.1 Permitted construction noise and vibration standards

NOISE-S9 prescribes the following permitted standards for noise and vibration from construction activities:

1. The noise from construction activities must be measured, assessed, managed and controlled in accordance with the requirements of New Zealand Standard NZS 6803:1999 Acoustics – Construction noise; and

2. The vibration from construction activities must be measured, assessed, managed and controlled in accordance with the requirements of German Standard DIN 4150-3:1999 Structural vibration – Effects of vibration on structures.

7.2 Assessment of compliance with permitted construction noise and vibration standards

We understand that any construction works will be completed with the same machinery and plant (i.e. trucks and excavators) that is used for the existing quarrying activity. The noise levels from construction work will therefore be similar to the noise levels generated during typical quarrying work. The noise level predictions in Table 3 demonstrate that noise from construction work can comply with the applicable daytime construction noise limits.

Any vibration from construction activities will readily comply with the limits in German Standard DIN 4150-3:1999 Structural vibration – Effects of vibration on structures (the **DIN limits**) based on the separation distances to adjacent dwellings.

We have not identified any challenges in terms of complying with the permitted construction noise and vibration standards prescribed by NOISE-S9 (1) and (2).

8.0 Recommended conditions of consent

We recommend conditions of consent that deliver the following outcomes:

Activity	Recommendation
Operational noise	We recommend a condition requiring compliance with the maximum permitted noise levels prescribed by NOISE-S4, except at 966 Oparure Road (where written approval has been provided).
Reverse alarms	We recommend a condition that prohibits the use of tonal reverse alarms on all plant and machinery that are permanently operated within the South-Western Pit. The condition should specify that broadband reverse alarms shall be fitted to all plant requiring reverse alarms (except the mobile crusher).
Construction noise and vibration	We recommend a condition requiring compliance with the maximum permitted construction noise and vibration levels prescribed by NOISE-S9 (1) and (2).
Blasting	We recommend a condition requiring compliance with the permitted activity standards prescribed by NOISE-S10 of the PWDP. NOISE-S10 requires that: 1. The activity must only occur in the general rural or rural production; and

Activity	Recommendation
	2. Noise generated by blasting/use of explosives must not exceed a peak sound pressure of 120dB (LZ_{Peak}) when measured at any point within any residential zone, or, at or within the notional boundary of any noise sensitive activity; and 3. A level of 115 dBA may be exceeded on up to 5% of the total number of blasts over a period of 12 months; and 4. Blasting must not occur outside of the hours of 9am – 5pm, Monday to Saturday; and 5. Blasting, which may include a series of one or more blasts undertaken within a short time period, must not occur more than once per day. This requirement does not apply to minor blasts as identified in the Australian and New Zealand Environment Council - Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration, September 1990 or to blasting necessary for safety purposes; and 6. Vibration generated by blasting/use of explosives must not exceed the guideline values in Tables 1 and 3 of DIN 4150 inside any building, except in the case of a building located on property under the same ownership or management as that of the party blasting/using explosives.

9.0 Summary of noise and vibration effects

Our assessment confirms the noise and vibration effects from the construction and operation of the South-Western Pit will readily comply with the relevant standards prescribed by the PWDP. The only exception is for operational noise generated during the prescribed evening and night-time periods at the notional boundary of 966 Oparure Road, where works may potentially exceed the permitted standards. We understand that this receiver has provided written approval for noise and effects on this party are to be disregarded.

We have assessed the potential effects against the following criteria:

- Less than minor effects are those which are discernible day to day effects but are too small to be troublesome or annoying to most people.
- Minor effects are those which are clearly noticeable and may cause adverse reaction from time to time and for some people.

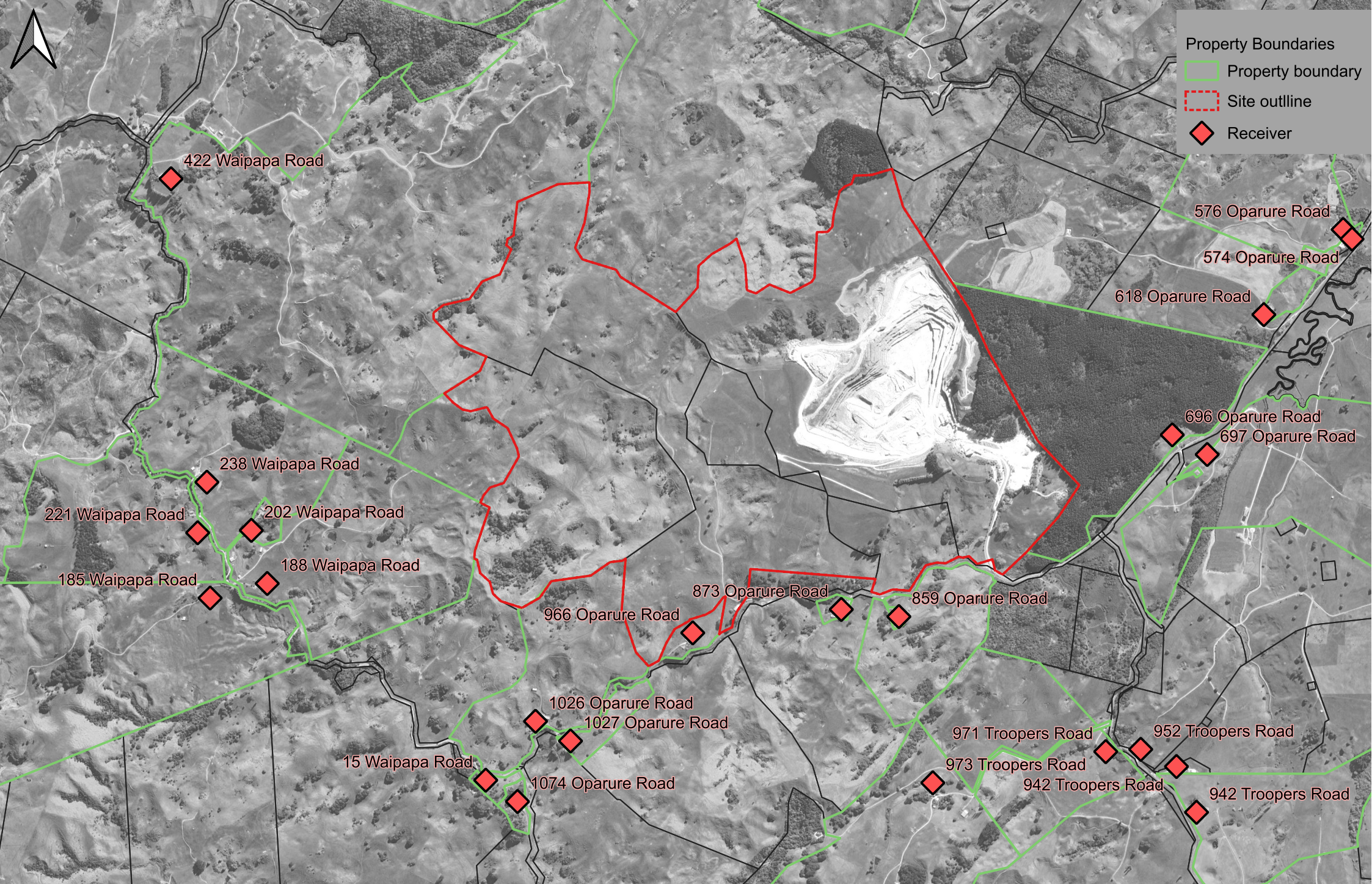
- More than minor effects are those which will be (at least) problematic and likely to result in adverse reaction from most people.

We consider that the noise and vibration effects from the Proposal will be less than minor.

Appendix A Glossary of terms

Noise	A sound which serves little or no purpose for the exposed persons and is commonly described as 'unwanted sound'. The definition of noise includes vibration under the Resource Management Act.
dB (decibel)	The basic measurement unit of sound. The logarithmic unit used to describe the ratio between the measured sound pressure level and a reference level of 20 micropascals (0 dB).
A-weighting	A frequency filter applied to the full audio range (20 Hz to 20 kHz) to approximate the response of the human ear at lower sound pressure levels.
Ambient noise	Ambient noise is the total of all noise within a given environment, comprising a composite of sounds from sources near and far.
L_{A90(t)} (dB)	The A-weighted sound level in decibels equalled or exceeded for 90% of the measurement interval. It is the component of the total sound that subjectively is perceived as continuously present. Used in New Zealand as the descriptor for background noise in the 2008 versions of the N.Z. Standards NZS 6801 and NZS 6802.
L_{Aeq(t)} (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it takes into account the total sound energy over the time period of interest.
L_{AFmax} (dB)	The maximum A-weighted sound pressure level recorded during the measurement period using a fast time-weighting response.
Noise rating level	A derived noise level used for comparison with a noise limit.
Notional boundary	A line 20 metres from any side of a residential unit or other building used for a noise sensitive activity, or the legal boundary where this is closer to such a building.
NZS 6801:2008	N.Z. Standard NZS 6801:2008 Acoustics – Measurement of environmental sound.
NZS 6802:2008	N.Z. Standard NZS 6802:2008 Acoustics – Environmental noise.
ISO 9613-1/2	International Standard ISO 9613-1/2 Attenuation of sound during propagation outdoors.
DIN 4150–3:1999	German Standard DIN 4150-3:1999 Structural Vibration – Part 3: Effects of vibration on structures. Typically adopted for the assessment of structure borne vibration in New Zealand.
PPV	Peak particle velocity, measured in mm/s. The standard metric for the measurement of ground borne vibration in New Zealand. The instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.

Appendix B Map of receivers



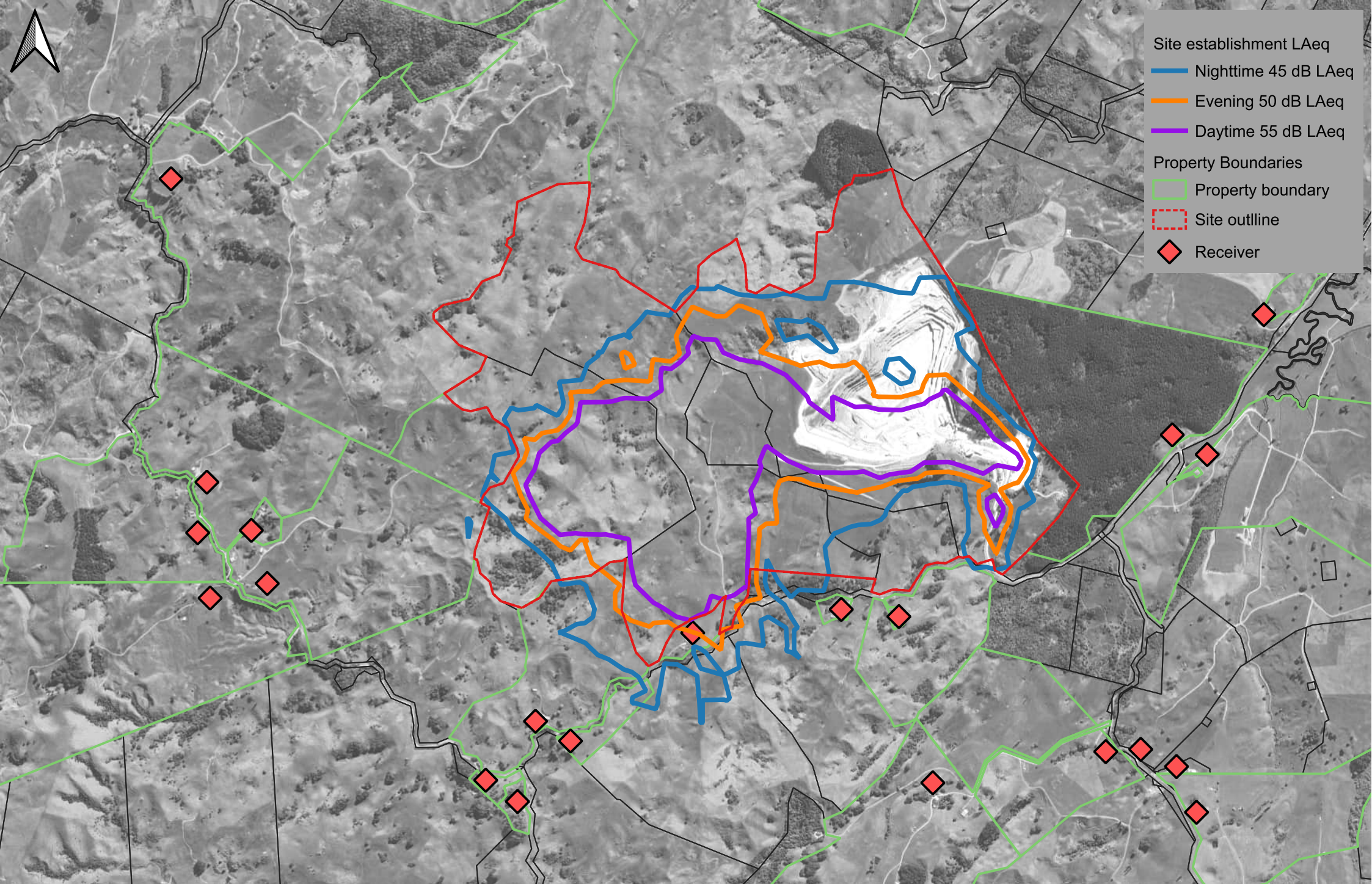
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Receivers
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers

Appendix C Predicted noise rating level contours

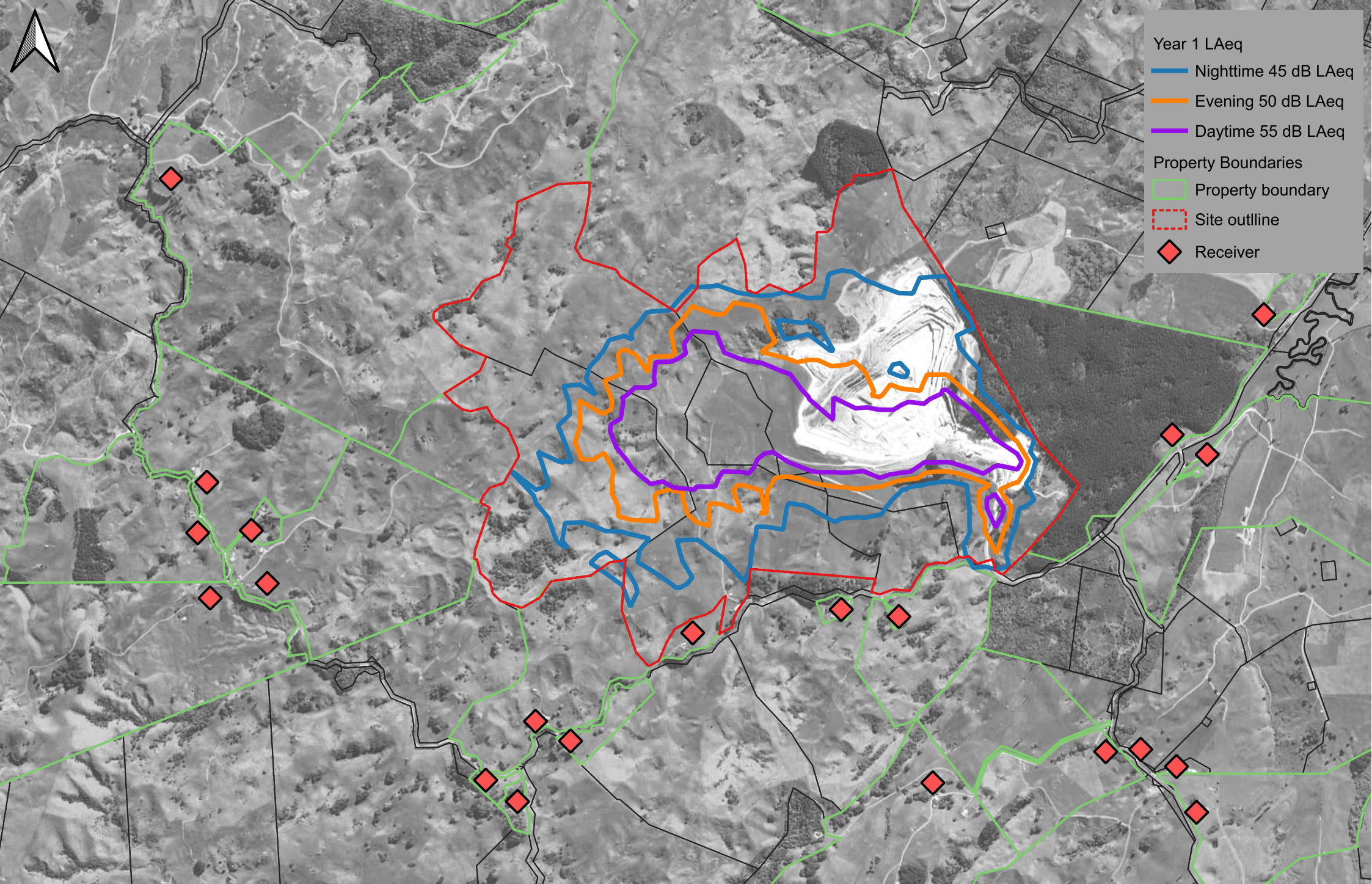


- Site establishment LAeq
- Nighttime 45 dB LAeq
 - Evening 50 dB LAeq
 - Daytime 55 dB LAeq
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Site establishment noise contours
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers

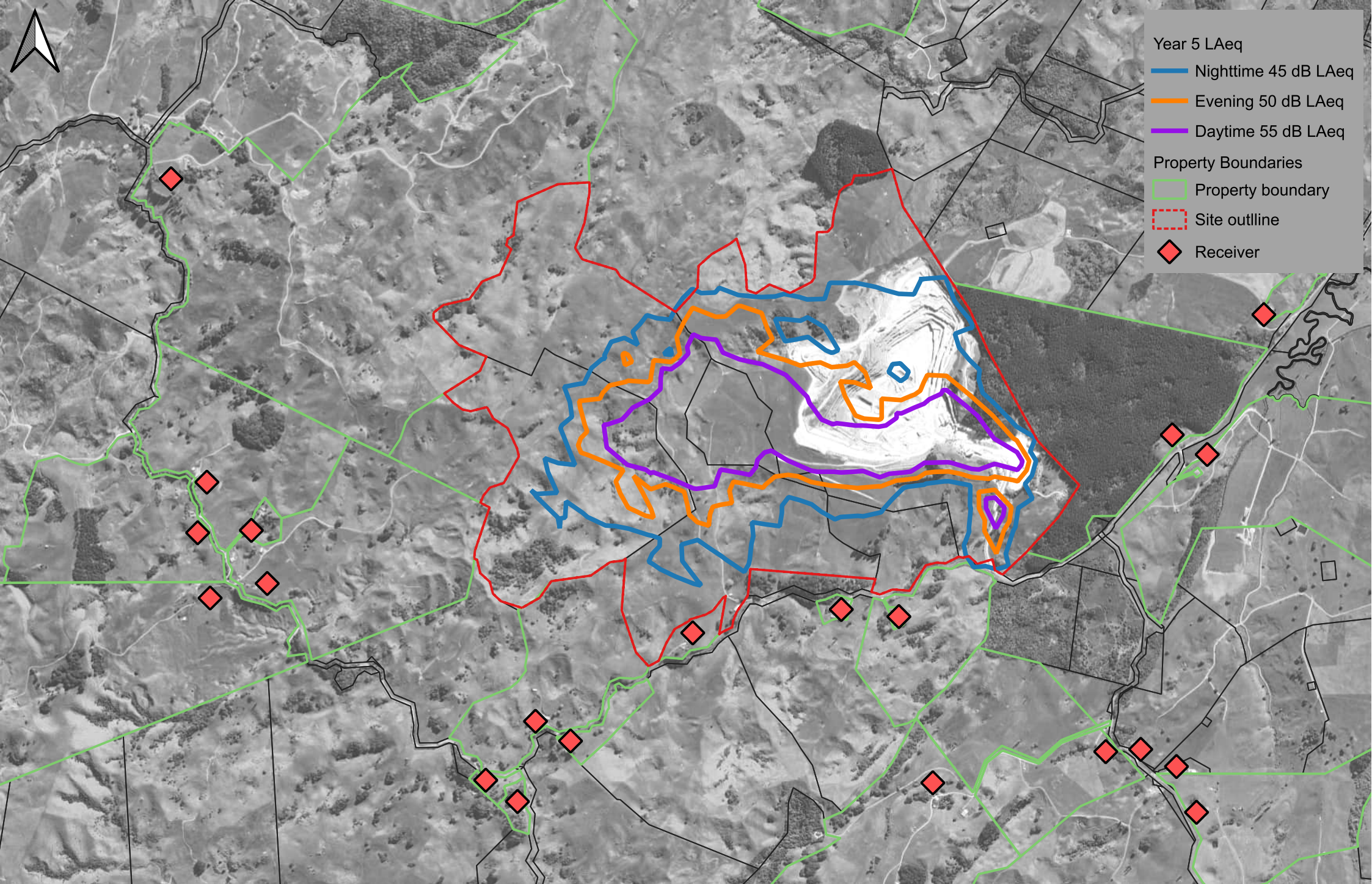


- Year 1 LAeq
- Nighttime 45 dB LAeq
 - Evening 50 dB LAeq
 - Daytime 55 dB LAeq
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Year 1 LAeq noise contours
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers

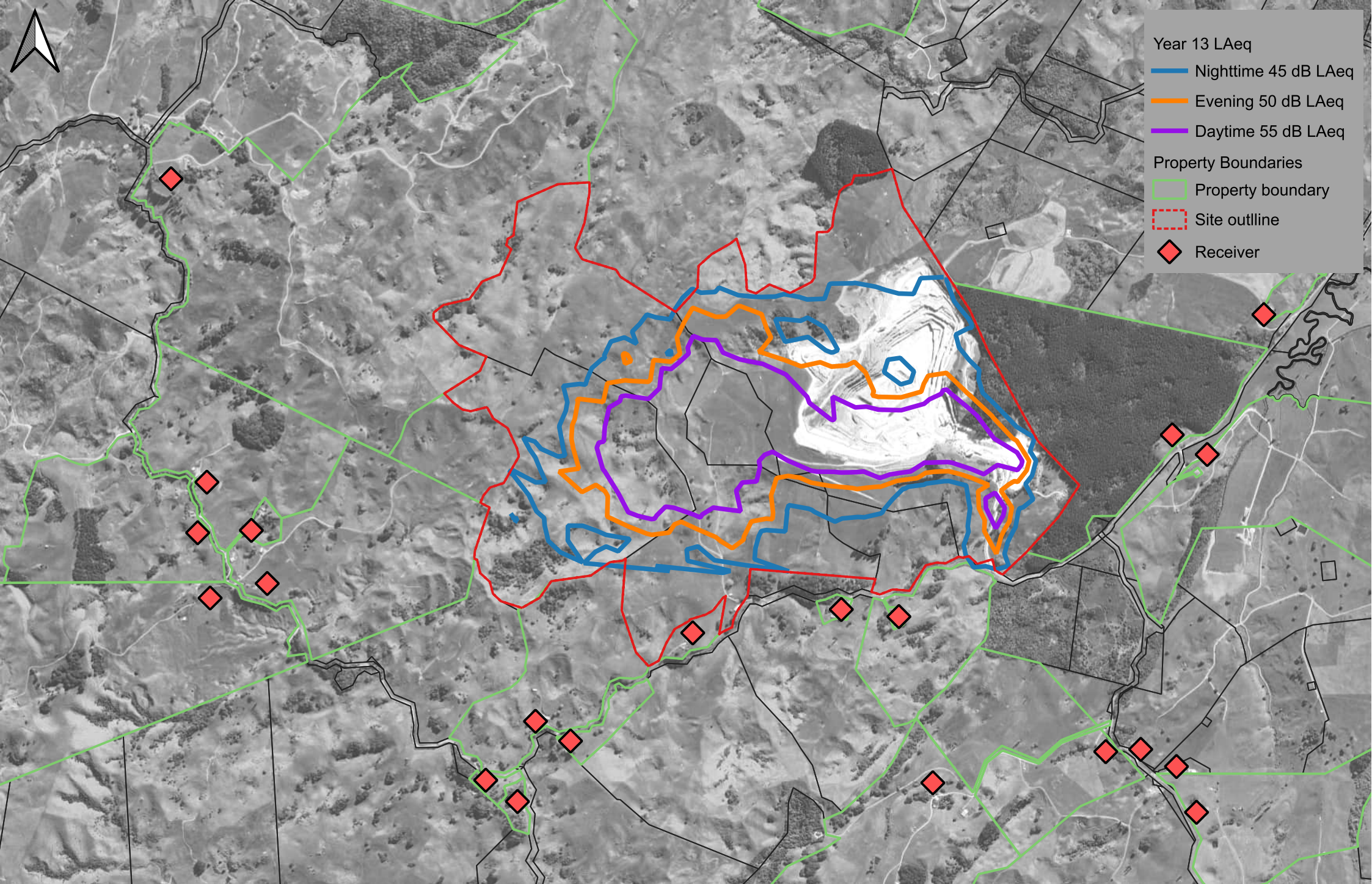


- Year 5 LAeq
- Nighttime 45 dB LAeq
 - Evening 50 dB LAeq
 - Daytime 55 dB LAeq
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Year 5 LAeq noise contours
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers

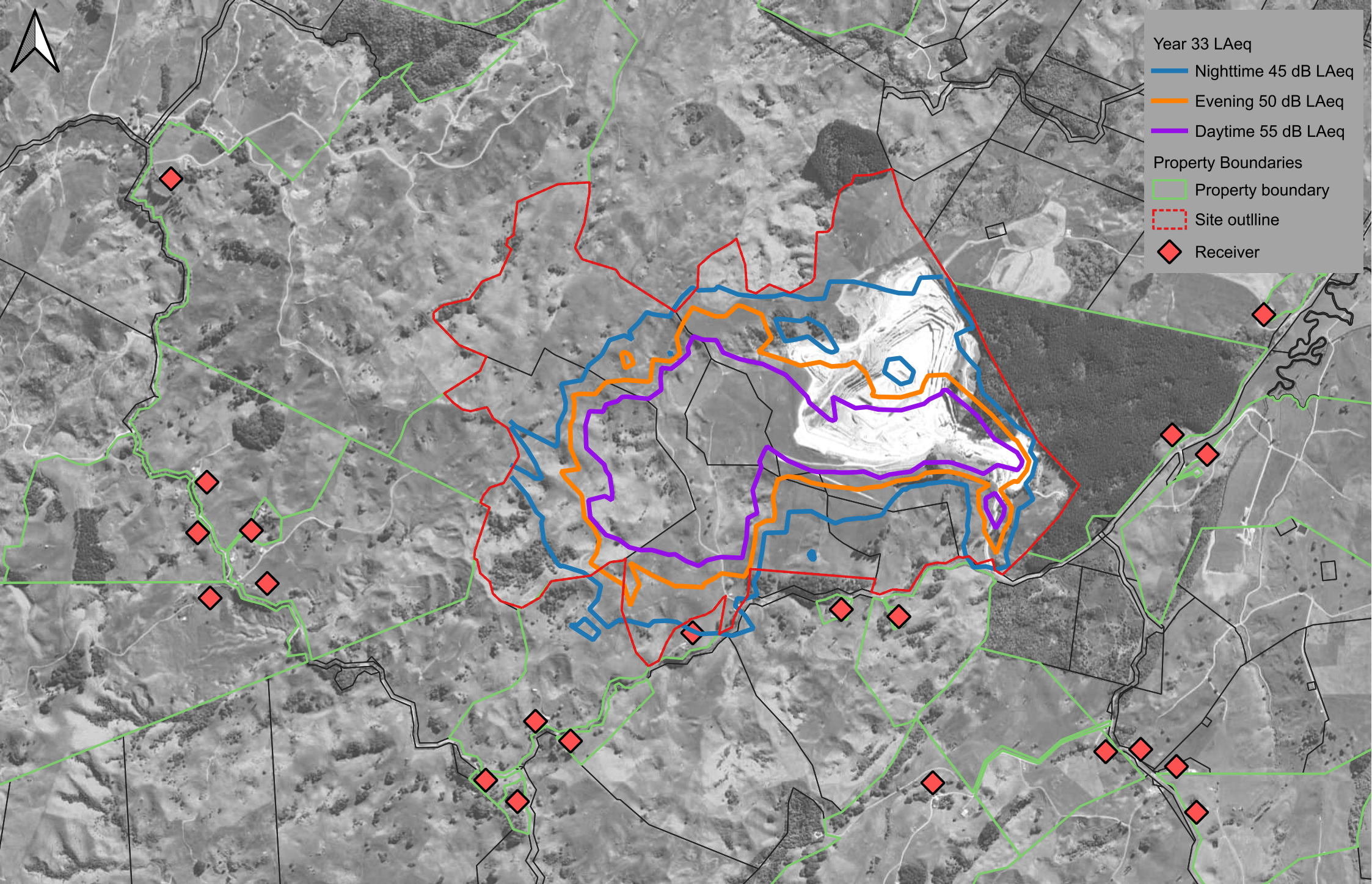


- Year 13 LAeq
- Nighttime 45 dB LAeq
 - Evening 50 dB LAeq
 - Daytime 55 dB LAeq
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Year 13 LAeq noise contours
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers

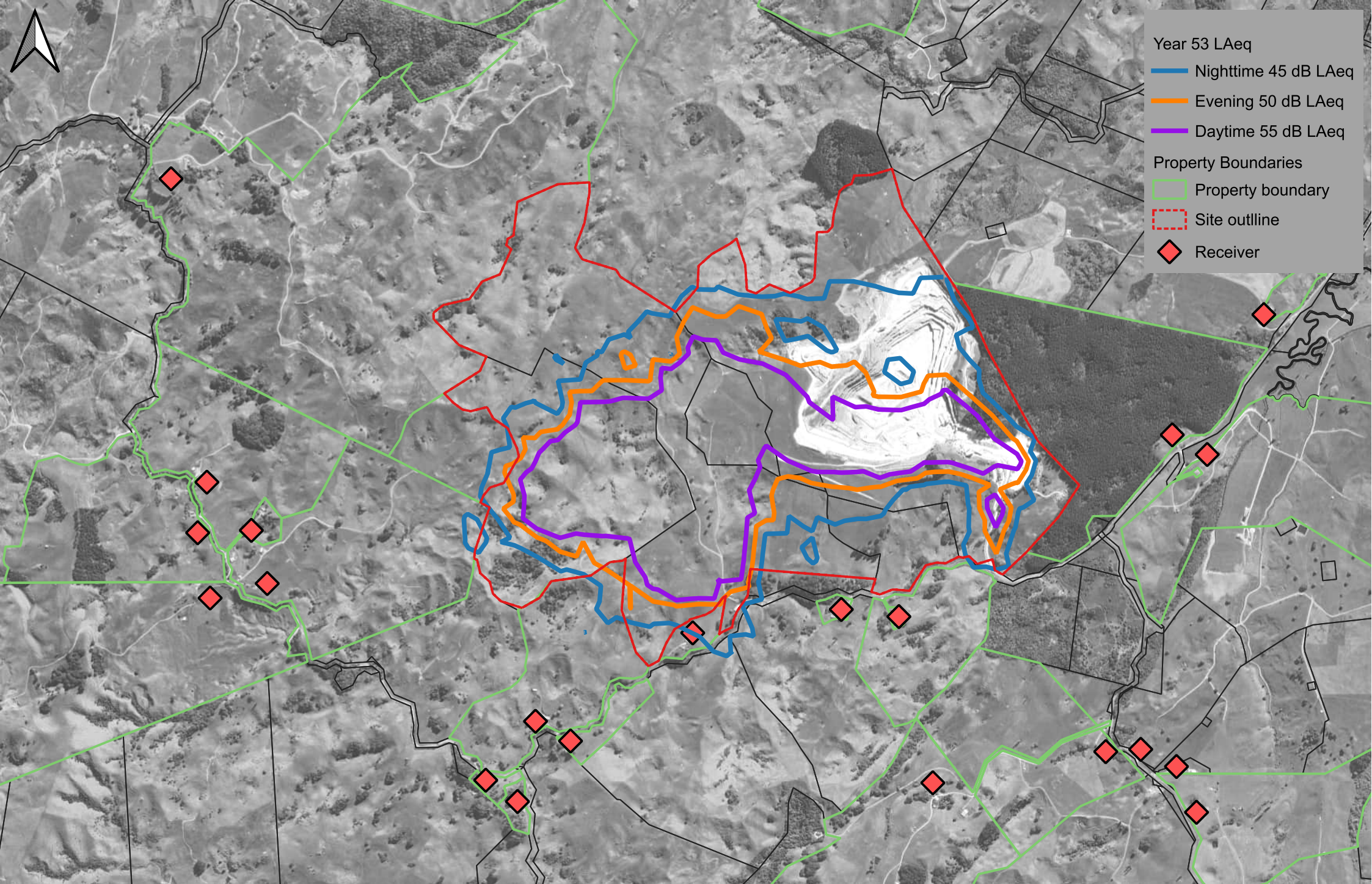


- Year 33 LAeq
- Nighttime 45 dB LAeq
 - Evening 50 dB LAeq
 - Daytime 55 dB LAeq
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Year 33 LAeq noise contours
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers



- Year 53 LAeq
- Nighttime 45 dB LAeq
 - Evening 50 dB LAeq
 - Daytime 55 dB LAeq
- Property Boundaries
- Property boundary
 - Site outline
 - Receiver



Title	Year 53 LAeq noise contours
Project	Oparure Quarry South-Western Pit
Client	Graymont (NZ) Limited

Date	07/05/26
Revision	V1
Author	M. Chambers