MARSHALL DAY Acoustics

MANANUI MINE
ASSESSMENT OF NOISE EFFECTS

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Project: **MANANUI MINE**

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EXECUTIVE SUMMARY

This report provides an assessment of potential adverse noise effects associated with the proposed mineral sands mine situated at 713 Ruatapu Road, south of Hokitika, West Coast.

Noise effects will be reasonable

Our conservative assessment shows that noise levels from the activity will comply with the proposed daytime and night-time noise limits of 55 and 45 dB L_{Aeq} respectively at all nearby dwellings if noise mitigation measures outlined in this report are adopted. The noise limits have been derived through reference to the permitted activity standards in both the Operative District Plan (ODP) and the proposed Te Tai O Poutini Plan (TTPP) in addition to published guidance for the protection of residential amenity.

As a result, we consider noise effects from the activity will be reasonable in the context of the rural receiving environment.

Noise emissions will nominally comply with District Plan limits

For the majority of the time, noise emissions will comply with the District Plan permitted activity standards. However, with reference to the ODP, activities on site have the potential to exceed the 45 dB L_{10} noise limit that applies during the day on Sundays and Public Holidays, between 2100 and 2200 hrs Monday to Friday and 1800 to 2200 hrs on Saturdays. The ODP daytime noise limit of 55 dB L_{A10} will potentially be exceeded by a negligible 1 to 2 dB in some of the conservative scenarios we have assessed. Noise emissions from site will comply with the proposed TTPP permitted activity noise limits at all times except between 0700 and 0800 and 2000 and 2200hrs on weekends and public holidays.

Noise mitigation is required

To ensure noise effects are reasonable, noise mitigation measures are discussed in detail in this report and include:

- 3 metre high noise control bunds at specific locations along the site boundary
- Mining setback distances from the nearest existing dwellings for both the daytime and night-time periods.

Existing noise levels are dominated by traffic and surf

The existing daytime noise environment at the nearest dwellings is predominantly influenced by the traffic on Ruatapu Road (State Highway 6). At night, traffic and surf noise are notable noise sources. Ambient noise levels at the nearest properties to the site are in excess of the noise environment anticipated by the permitted activity standards set out in the District Plan.

During the day, we expect that mining activities will only just be audible during lulls in traffic. At night noise may be audible when excavation is occurring at the closest point to dwellings. However, noise levels from site will be below World Health Organisation guidance at all times, permitting residents to sleep at night with windows open.

Consent conditions are provided

Should consent be granted, in Section 7.0 we have provided suggested text for consent conditions that include recommended noise limits for the construction and operational phases of the project, and the adoption of noise mitigation.

The Applicant has offered a condition of consent requiring a Noise Management Plan (NMP) to be developed for the site. The NMP will be the reference document for the day-to-day management of noise emissions. A draft NMP has been submitted with the application.

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1.0 INTRODUCTION

Marshall Day Acoustics has been appointed by Westland Mineral Sands Co Ltd to assess the potential noise-related effects from their proposed mineral sands mine at 713 Ruatapu Road, south of Hokitika, West Coast.

This report provides:

- An overview of the proposed mining activity;
- A review of appropriate noise assessment criteria;
- A description of the existing noise environment;
- Predicted noise levels from the proposed mining activity;
- An assessment of the potential noise effects at nearby noise sensitive receivers; and
- Recommended noise-related consent conditions.

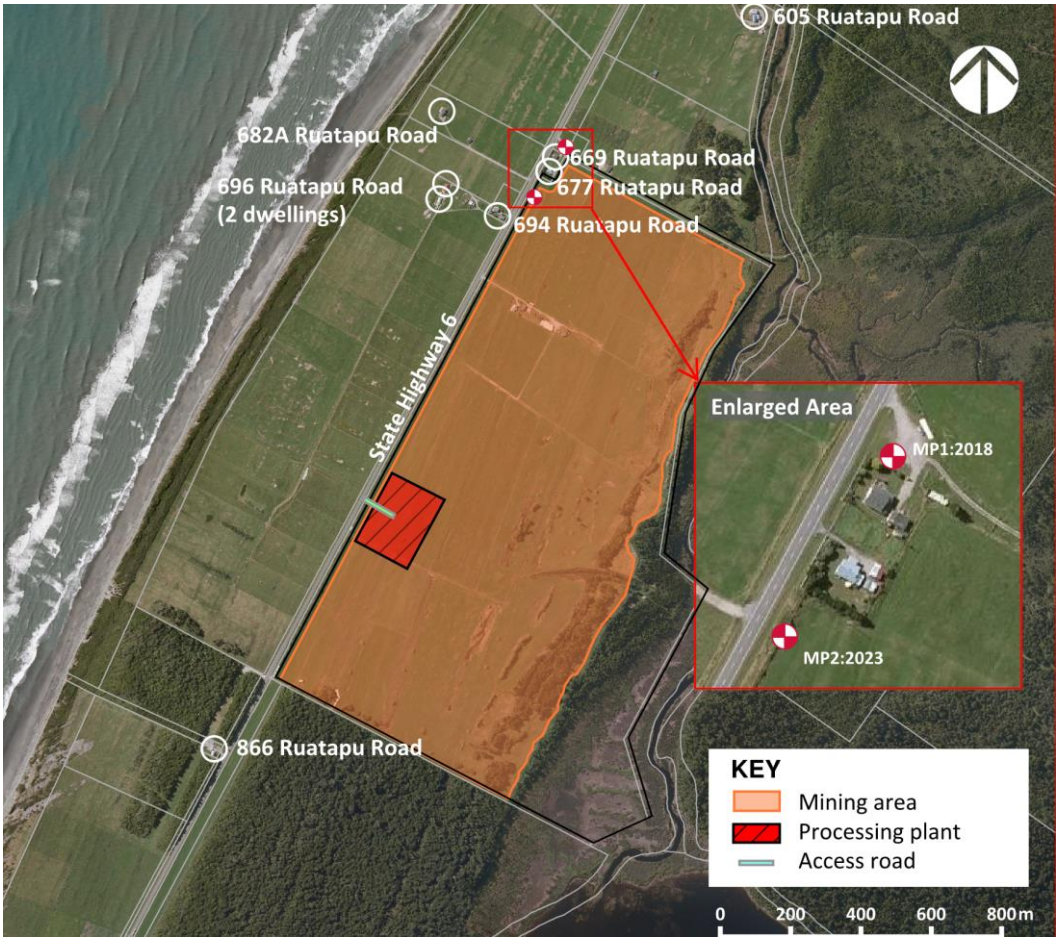
A glossary of the terminology used in this report is provided in Appendix A.

2.0 SITE & ACTIVITY DESCRIPTION

2.1 Proposed Site

The proposed mine site is located at 713 Ruatapu Road (State Highway 6). There are several dwellings nearby, as identified in Figure 1 with the closest located at 677 and 669 Ruatapu Road. As we discuss below, we have also assessed noise emissions at several sites which either have an existing consent, or have the potential, to construct a dwelling.

Figure 1: Proposed mine area, nearest dwellings, and ambient noise measurement positions.



2.2 Proposed Activity

The proposed activity is described in detail in the Assessment of Environmental Effects. However, the following aspects have a bearing on the potential noise effects.

- Mineral sand extraction will first occur in the south-west corner of the site and will broadly move in a north-south direction. Refer to Figure 2.
- Topsoil will be stripped by mobile machinery in advance of a floating dredge which is used for mineral extraction. The extracted material is screened and then pumped to the centrally located plant for processing. Following processing, tailings will be returned to the rear of the dredge pond and distributed by mobile machinery as part of the rehabilitation process. Refer to Figure 3.
- The dredge and processing plant will operate 24 hours a day. Mobile plant used for topsoil stripping and rehabilitation will only operate during the day (0700 to 1900 hrs).
- Table 1 provides a broad description of each noise generating aspect of the activity. Noise emissions from each component are provided in Section 0

Table 1: Summary of noise generating components of the activity

Activity	Description	Hours of operation
Topsoil removal / rehabilitation	Excavators, bulldozer, grader and trucks working in advance and behind the dredge, removing topsoil and distributing tailings	Daytime operation only (0700 to 1900 hrs)
Dredge	Located below existing ground level within the excavated pond. Diesel engine operation assumed for our assessment but may be powered by grid electricity in practice	24 hour operation
Field Screening Unit, pump and generator	Field Screening Unit and pump at existing ground level beside pond. Our assessment assumes power will be provided by acoustically enclosed diesel generator but may be grid electricity.	24 hour operation
Processing plant	Static processing plant at fixed location and loadout area	24 hour operation

Figure 2: Proposed mine path

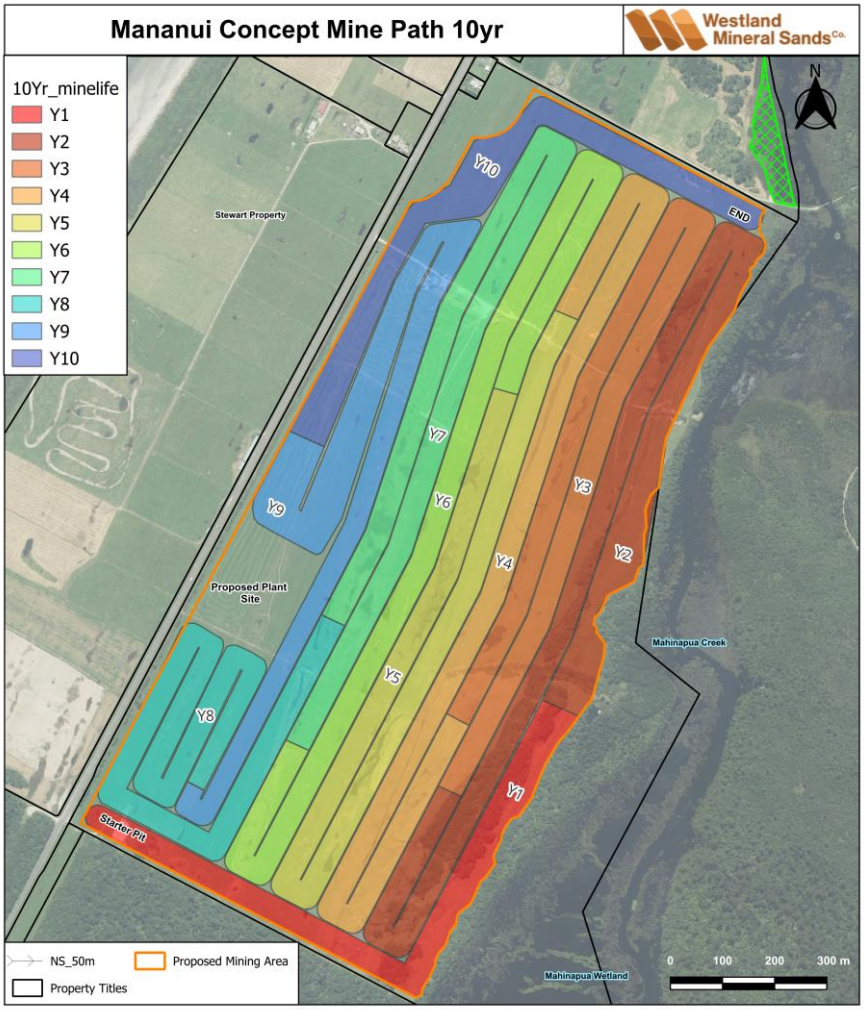
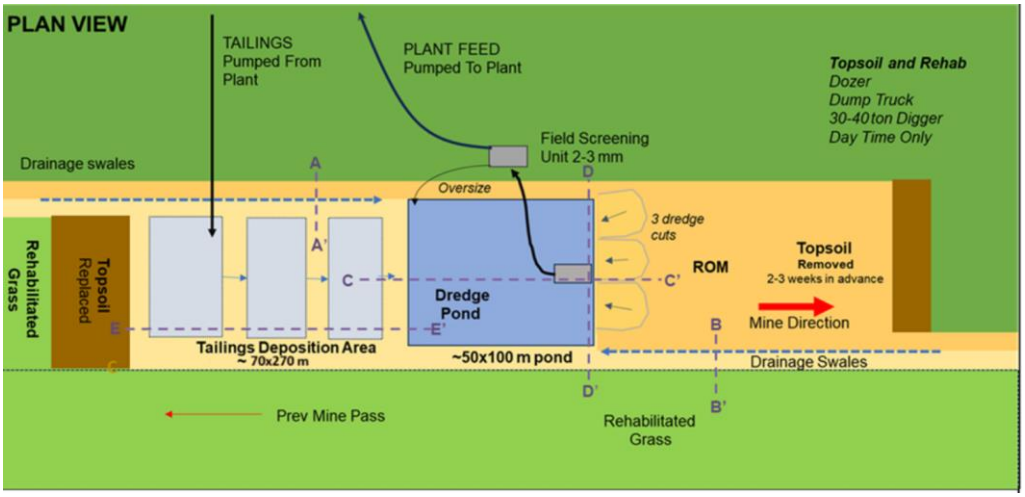


Figure 3: Indicative plan and section view of extraction process



3.0 EXISTING NOISE ENVIRONMENT

In order to quantify the existing noise environment at dwellings adjacent to the site, noise measurements were conducted in June 2023 and in May 2018 for a previous project at the site. Survey details are provided in Appendix B.

The noise measurement positions shown in Figure 1 were selected to be representative of the noise environment at the closest dwellings to the site:

- MP1 (2018) attended daytime and night-time measurements, equidistant from the State Highway as the façades of 669 & 677 Ruatapu Road at a distance of approximately 17 metres.
- MP2 (2023) unattended noise logging instrumentation, located approximately 10 metres from the State Highway.

All measurements were taken in general accordance with New Zealand Standard NZS 6801:2008 "*Acoustics- Measurement of Sound*". Measurements at both locations were collected under favourable conditions, i.e. fine with light winds, and relatively calm sea conditions.

The results of our ambient noise survey are summarised in Table 2. The duration of each measurement was 15 minutes. The location of the ambient noise measurement position is shown in Figure 1 with a red and white marker.

Further information such as equipment and calibration details are provided in Appendix B.

Table 2: Summary of ambient noise survey results

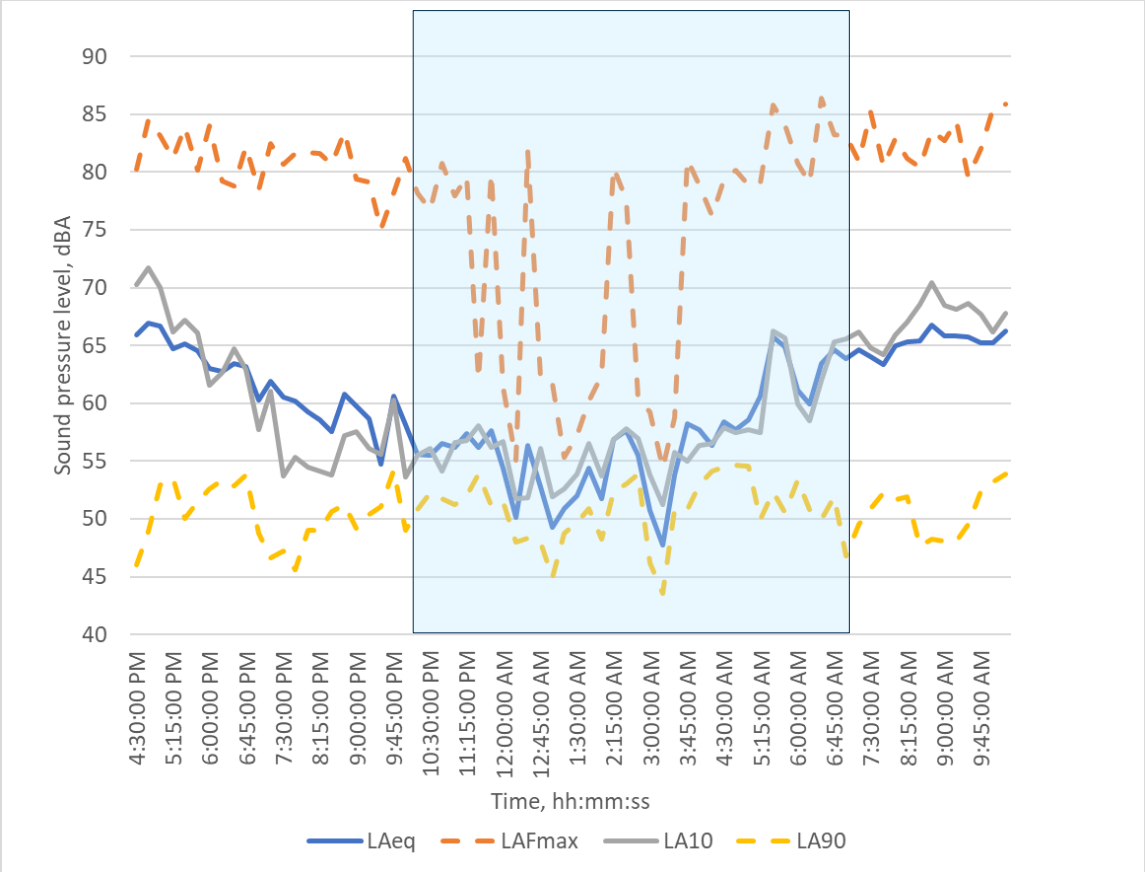
Position: Time	Measured noise levels				Comments
	dB L_{Aeq}	dB L_{A10}	dB L_{A90}	dB L_{AFmax}	
Daytime					
MP1: 1633	52	55	48	63	State Highway traffic generally dominant; sea contributes throughout and dominant at times; birds contribute at times.
MP1: 1653	52	55	46	66	
MP2: average	64	64	54	70	Average of data collected between 1630 to 2200 and 0700 to 1030.
Night-time					
MP1: 2211	51	53	45	70	Sea generally dominant; three vehicle passes on State Highway during measurement; birds audible at times.
MP1: 2227	48	51	45	60	Sea dominant; birds audible at times. No car passes on State Highway during measurement period.
MP2: average	59	57	51	73	Average of data collected Measured between 2200 to 0700. Occasional vehicle passes through this period

The surveys show that daytime ambient noise levels near the proposed mine during fine, calm conditions are dominated by traffic on State Highway 6. Although the sea was relatively calm during our noise surveys, it still contributed significantly to the measured noise levels during the day, and was a notable source at night.

During the day, noise levels at the closest dwellings to the site are in the mid to high 50's dB L_{Aeq}. At night, noise levels in those periods without traffic is in the order of 50 dB L_{Aeq}.

The noise measurements indicate dwellings closest to the site already experience a noise environment in excess of the levels anticipated by the permitted activity standards set out in the District Plan.

Figure 4: Measured noise level data at MP2 (Night-time period shaded blue)



4.0 NOISE ASSESSMENT CRITERIA

4.1 Operative District Plan Noise Standards

The proposed mine and surrounding land is zoned *Rural* under the Operative District Plan (ODP). The District Plan noise standards applicable to the site are as follows:

> ***Noise***
> *(all activities except forestry, and agricultural activities)*
>
> | | |
> |---|---|
> | *0700-2100 hrs Mon-Fri*
0700-1800 hrs Saturday | *55 dB L_{A10} at any point within the notional boundary of a residential activity.* |
> | *All other times including public holidays* | *45 dB L_{A10} at any point within the notional boundary of a residential activity.* |
>
> *All measurements are to be taken and assessed in accordance with the New Zealand Standards 6801: 1991 "Measurement of Sound" and 6802: 1991 "Assessment of Environmental Sound" and amendments thereto.*

As extraction and processing activity is proposed to occur 24 hours per day, seven days per week, the critical noise limit is 45 dB L_{A10} at the notional boundaries of the nearest residential activities. The ODP does not reference any construction noise standards.

We understand that the status of the activity will either be Discretionary or Restricted Discretionary, of which noise is a matter of discretion. We have therefore considered the following documents in assessing the potential for noise effects.

4.2 Te Tai o Poutini Plan

The Te Tai o Poutini Plan (TTPP) is proposed to replace the Buller, Grey and Westland District Plans. This plan has recently been notified and hearings are not yet complete. While it has no legal weight in terms of our compliance assessment (i.e. there are no noise rules with immediate legal effect), it does indicate the anticipated noise environment for the area in the future.

We also note that any future plan will have to give effect to the National Planning Standards, which require noise to be assessed in line with current best practice and, in particular, New Zealand Standard NZS 6802:2008 *"Acoustics - Environmental Noise"*. (The ODP refers to the 1991 version of this Standard.) This will necessitate adoption of the L_{Aeq} assessment parameter, rather than the L_{A10} limit currently used in the ODP.

Under the TTPP, surrounding areas to the south and east site are proposed to be rezoned as Open Space Zone. Most of the surrounding land to the west and north would remain rural.

The proposed plan provides the following noise limits:

Table 3: Te Tai O Poutini District Plan noise limits

Zone	Times	Rule
General Rural Zone	*0700 - 2200 hrs Mon – Fri* *08:00 -2000 hrs Weekends and public holidays*	*55 $L_{Aeq\,(15\,min)}$ at any point within the notional boundary of any sensitive activity within any site receiving noise*
	2200 – 0700 hrs Mon – Fri *2000 -0800 Weekends and public holidays*	*45 dB $L_{Aeq\,(15\,min)}$ at any point within the notional boundary of a residential activity.*
	2200-0700 All days	*75 dB L_{AFmax} at any point within the notional boundary of any sensitive activity within any site receiving noise*

The TTPP noise limits are consistent with the ODP's limits for the rural and settlement areas, although the hours of application and noise metrics differ.

The proposed noise limits are common in rural areas and represent a slightly modernised version of the existing rules.

4.3 World Health Organisation Guidelines

The World Health Organisation (WHO) Guidelines for Community Noise (Berglund, Lindvall and Schwela, 1999) provide 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 and annoyance.

These guideline values are the exposure levels that represent the onset of the effect for the general population.

Table 4: WHO guideline values for the critical health effects of community or environmental noise

Specific Environment	Critical health effect(s)	dB L_{Aeq}	Time base (hours)	dB L_{AFmax}
Outdoor living area	Serious annoyance, daytime & evening	55	16	-
	Moderate annoyance, daytime & evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

4.4 NZS 6802:2008 Guideline Upper Noise Limits

The 2008 version of NZS 6802:2008 *"Acoustics - Environmental Noise"* (note that the District Plan refers to the 1991 version) makes reference to the following guideline upper limits of sound exposure at or within the notional boundary of a rural dwelling:

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

4.5 NZS 6803:1999 Construction Noise Standard

The appropriate guidance for assessing construction noise in New Zealand is NZS 6803: 1999 *"Acoustics - Construction Noise"*. Activities on site that would generally be considered as construction noise include the construction of site access roads, perimeter bunding, construction of processing plant and site buildings. NZS 6803 sets out the following noise limits:

Residential zones and dwellings in rural areas:

Table 2 – Recommended upper limits for construction noise received in residential zones and dwellings in rural areas

Time of week	Time period	Duration of work					
		Typical duration (dBA)		Short-term duration (dBA)		Long-term duration (dBA)	
		L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
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

Time of week	Time period	Duration of work					
		Typical duration (dBA)		Short-term duration (dBA)		Long-term duration (dBA)	
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

In table 2:

a) "Short-term" means construction work at any one location for up to 14 calendar days;

b) "Typical duration" means construction work at any one location for more than 14 calendar days but less than 20 weeks; and

c) "Long-term" means construction work at any one location with a duration exceeding 20 weeks.

4.6 Discussion of Noise Assessment Criteria

The ODP daytime and night-time noise limits of 55 and 45 dB L_{A10} respectively are consistent with the guideline noise limits provided in the latest version of NZS 6802, and the WHO guideline value to minimise the onset of serious annoyance. However, we note that the 45 dB L_{A10} noise limit applies during the day on Sundays and Public Holidays which, as we discuss below, is not required to provide appropriate residential amenity. The ODP also uses the L_{A10} metric rather than L_{Aeq} - L_{Aeq} parameter represents current industry best practice and is referenced in the proposed TTPP, applicable New Zealand noise assessment standards and WHO guidance.

Our noise measurements indicate that the nearest residential properties to the site experience a daytime noise environment in the mid to high 50s dB L_{Aeq} which is a higher noise environment than anticipated by both the ODP and TTPP for the zone. Similarly, the ambient noise environment at night is in the order of 50 dB L_{Aeq} which is above the permitted activity noise environment for the zone as anticipated by both the ODP and TTPP.

Based on the above review, we consider the following noise levels will result in acceptable noise effects at neighbouring dwellings:

- Daytime: 0700 to 2200 hrs 55 dB $L_{Aeq(15\ min)}$
- Night-time: 2200 to 0700 hrs 45 dB $L_{Aeq(15\ min)}$ and 75 dB L_{AFmax}

The noise limits will apply at any point within the notional boundary of a dwelling when measured and assessed in accordance with NZS 6801:2008 "*Acoustics – Measurement of environmental sound*" and NZS 6802:2008 *"Acoustics - Environmental Noise"*.

Construction activities, such as the construction of building, access roads and the formation of earth bunds for noise control purposes, must be planned and managed in accordance with New Zealand Standard NZS 6803: 1999 *"Acoustics - Construction Noise"*.

5.0 PREDICTED NOISE LEVELS

5.1 Prediction Methodology

To accurately predict noise levels, the noise modelling package SoundPLAN has been used. Calculations in SoundPLAN are based on ISO 9613-2:1996 "*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*". This method has the scope to consider a range of factors affecting the sound propagation including:

- The magnitude of the noise source in terms of sound power;
- The distance between source and receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces;
- The hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity.

In ISO 9613, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level. The Standard adopts the conservative approach of assuming that wind is always blowing from the noise sources to the receiver locations. The equations and calculations also hold for average propagation under a well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights.

5.2 Input Noise Data

During the operational phase of the mine, the principal noise sources will be located at the excavation area and at the processing plant. Our modelling has been based on noise source data collected through noise measurements of similar plant and equipment at the applicant's Nine Mile mine, in addition to other mining and processing operations around New Zealand.

We have used the sound power levels provided in Table 5 for our predictions. As noted above, we have assumed conservative source noise levels based on site power being provided by diesel generators. We expect that operational noise levels on site will be less in practice if grid power is provided.

Table 5: Sound power levels of mining plant and equipment

Quantity	Plant and equipment	Sound power level (L_{Aeq} basis), dB L_{AW}
	Excavation	
1	Dredge (diesel)	107
2	Excavator (Volvo EC380 or similar)	102
1	Dozer (CAT D6 or similar)	105
1	Field screening unit	97
1	Diesel generator (with noise control)	97
1	220kW pump	99
1	Grader (CAT 120 Grader or similar)	108
1	Loader (Volvo L180H or similar)	109
1	Integrated tool carrier	109
2	Dump truck (Volvo A40D or similar))	86 dB L_{AE} at 10m
	Wet Concentrate Plant (WCP)	
1	Gravity Spiral concentrator (and associated plant)	106
2	Loader (Volvo L180H or similar)	109
1	Diesel generator (with noise control)	97
1	Excavator (Volvo EC380 or similar)	102
1	200 kW Slurry pump	99

Truck and trailer movements at the processing plant have been modelled based on a sound exposure level of 84 dB L_{AE} at 10 metres from a pass-by of a truck and trailer unit on a gravel road. Our model includes two movements occurring within a 15-minute period.

We understand that there will be a number of other noise sources on site at various stages such as employee vehicle movements and sporadic daytime use of the workshop. These noise sources are considered to be negligible in the context of overall noise emission from mining activity and have therefore been excluded from our model.

5.3 Noise Mitigation Measures

The predicted noise levels in Section 5.4 include the following noise mitigation measures:

- Minimum three metre high southern and northern noise control bunds at the locations shown in Figure 5. Whilst the central bund shown in Figure 5 is not strictly required for noise control purposes, and is not included in our modelling, it will reduce noise emissions from the site to the west of the State Highway.
- Based on the modelled noise sources, a setback of 85 metres from a dwelling notional boundary is required to comply with the daytime noise limit of 55 dB L_{Aeq}. At night, the setback increases to 115 metres. When operational, the actual setbacks required to comply will be determined once on-site equipment sound power levels can be measured. Given the conservatism in our assessment, we anticipate that setbacks are likely to reduce.

Figure 5: Proposed minimum three-metre-high noise bund locations

5.4 Modelling Scenarios & Predicted Noise Levels

The greatest potential for adverse noise effects is when mineral extraction is occurring closest to the existing residences to the northwest, west and southwest. To investigate the highest potential adverse noise effects during the day and night, we have predicted worst case noise levels for the scenarios described in Table 6. The location of the noise sources for each scenario can be seen in Appendix C.

Table 6: Modelled scenarios

		Noise sources (operating/not operating)			
Scenario	**Location**	**Dredge**	**Trommel, pump and generator**	**Topsoil removal / rehabilitation**	**Processing plant**
1	North west DAYTIME	✓	✓	✓	✓
2	North west NIGHT-TIME	✓	✓	✗	✓
3	South west DAYTIME	✓	✓	✓	✓
4	South west NIGHT-TIME	✓	✓	✗	✓
5	West DAYTIME	✓	✓	✓	✓
6	West NIGHT-TIME	✓	✓	✗	✓

The predicted noise levels for each scenario are summarised in Table 7 in terms of the noise metric L_{Aeq}. Noise levels would typically be 2dB higher if presented as the L_{A10} metric used in the ODP. For noise contour plots of these scenarios, refer to Appendix C.

Table 7: Predicted noise levels at noise sensitive receivers for each Scenario

Receiver	Predicted noise level at notional boundary, dB $L_{Aeq(15\ min)}$					
	1 Daytime Northwest (Note 1)	2 Night-time Northwest (Note 1)	3 Daytime Southwest	4 Night-time Southwest	5 Daytime West	6 Night-time West
694 Ruatapu Road	53	42	38	37	50	44
696 Ruatapu Road	50	40	37	36	46	40
677 Ruatapu Road	54	42	35	34	49	44
669 Ruatapu Road	53	40	34	33	47	41
682A Ruatapu Road	48	37	33	33	42	36
605 Ruatapu Road	46	34	30	< 30	35	32
604 Ruatapu Road	43	34	< 30	< 30	34	32
866 Ruatapu Road	40	37	44	42	37	37
962 Ruatapu Road	31	< 30	32	< 30	< 30	< 30
1028 Ruatapu Road	< 30	< 30	32	< 30	< 30	< 30
DOC Lake Māhinapua Campsite (Note 2)	30	< 30	32	< 30	< 30	< 30
Future Dwellings (Note 3)						
663 Ruatapu Road (house bus)	55	42	34	33	45	40
682A Ruatapu Road	50	39	34	34	44	38
682B Ruatapu Road	53	40	36	35	46	40

Notes:

1 As discussed in Section 7, and based on the currently modelled noise sources, a setback of 85 metres from a dwelling notional boundary is required to comply with the daytime noise limit of 55 dB L_{Aeq}. At night, the set back increases to 115 metres.

2 Whilst the Lake Māhinapua campsite is not identified as a noise sensitive location in the either the ODP or TTPP, our assessment shows noise levels will be very low in all scenarios assessed.

3 We have provided noise level predictions for potential future dwelling at these 3 locations, identified in Appendix C.

The predicted noise levels show all operational scenarios can occur and comply with the proposed project noise limits of 55 and 45 dB L_{Aeq} during the day and night respectively. Noise levels will be lower when excavation is occurring further away from dwellings which will be for most of the time.

In respect of compliance with the ODP noise limits, the activity will not comply with the 45 dB L_{10} limit that applies during the day on Sundays and public holidays, between 2100 and 2200 hrs Monday to Friday, and 1800 to 2200 hrs on Saturdays. The 55 dB L_{A10} daytime limit will also potentially be exceeded by a negligible 1 to 2 dB in some of the scenarios modelled in Table 7.

The activity will comply with the proposed TTPP permitted activity noise limits except for 0700 to 0800 and 2000 to 2200hrs on weekends and public holidays.

6.0 ASSESSMENT OF NOISE EFFECTS

Our assessment of six conservative operational scenarios shows the proposed activity can comply with the proposed noise limits of 55 and 45 dB L_{Aeq} during the day and night respectively. These noise limits have been derived through reference to both the operative and proposed District Plans, in addition to published guidance for the protection of residential amenity. As a result, we consider noise levels for each of these conservative scenarios to be reasonable in the context of the Rural receiving environment and that noise effects will therefore be acceptable. For the majority of the time, when excavation is occurring further from dwellings, noise levels will be lower and potential adverse noise effects will correspondingly reduce as the separation distance increases.

Mining noise effects within the proposed TTPP Open Space zone to the east and south of the mine site will be minimal. Noise levels at the Māhinapua Campsite will generally be less than 30 dB L_{Aeq} and we expect that mining activities will be inaudible. Mining noise may be audible at times on the closest parts of the Māhinapua Walkway to mining activity but will be received as low noise levels for relatively brief periods.

The existing daytime ambient noise environment at the nearest dwellings is dominated by traffic on the State Highway. For the majority of the time, we expect mining activity would only just be audible during lulls in traffic.

At night, whilst surf noise and passing traffic provides useful masking noise at nearby dwellings, noise from the site may be audible when excavation is occurring at the closest point to dwellings. However, noise levels from site will be below World Health Organisation guidance at all times permitting residents to sleep at night with windows open.

Taking into account the controls proposed as consent conditions, outlined in Section 7.0 below, we consider the potential noise effects from the proposed project will be acceptable.

7.0 RECOMMENDED CONSENT CONDITIONS

To ensure that noise from the activity is adequately controlled throughout the life of the consent, we recommend that the following noise related conditions are included in the consent.

These conditions contain noise limits that are broadly equivalent to the District Plan noise standards. We have proposed adopting the 2008 versions of NZS 6801 and NZS 6802 as these versions are considered industry best practice. The primary result of adopting these standards is the use of the L_{Aeq} noise metric.

1. Mining activities shall be conducted such that the following noise limits are not exceeded within the notional boundary of any dwelling:

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

   "Notional boundary" means a line 20 metres from the façade of any building used for residential activity, or the legal boundary of the site on which the building is located where the boundary is closer to the building than 20 metres.

   Noise shall be measured and assessed using New Zealand Standard NZS 6801:2008 *"Acoustics - Measurement of environmental sound"* and NZS 6802:2008 *"Acoustics - Environmental Noise"*, respectively.

2. The consent holder shall undertake compliance noise monitoring within 30 days of mining and processing operations occurring. All noise monitoring shall be made available to the Westland District Council within two weeks of completion of each monitoring visit.

3. 3 metre high noise control bunds shall be constructed for the minimum extent shown in Figure XX. N.B. We note that additional bunding and/or planting may be required for landscape purposes.

4. Mining activities (excluding construction activities) must not occur within the following setback distances from the notional boundaries of 669, 677 and 694 Ruatapu Road at the following times:

   - 85 metres between 0700 and 2200 hrs, and
   - 115 metres between 2200 and 0700hrs.

   Council may grant approval for these setback distances to be reduced on receipt of a noise assessment report from a suitably qualified acoustics professional that confirms the noise limits in Condition XX can still be achieved.

5. Construction activities such as the formation of site roads, building structures and earth bunds for noise control purposes shall be planned and managed in accordance with New Zealand Standard NZS 6803:1999 *"Acoustics - Construction Noise"*.

6. Mining operations shall utilise the best practicable option to minimise noise at all times. This includes regular replacement of worn parts, maintenance of mufflers, lubrication of all moving parts to avoid speaks and squeals, and appropriate operation of all equipment.

7. Site vehicles shall not be fitted with tonal or beeper reversing alarms.

8. The consent holder shall prepare a Noise Management Plan (NMP) to control day-to-day noise emissions from the site. As a minimum that Plan shall include:

   - The person responsible for implementing the NMP
   - Applicable noise conditions relating to noise
   - Training of staff relating to how to minimise noise and vibration

- Maintenance schedule for site access road surfaces to avoid excessive noise and vibration
- Activity risk analysis for noise generation
- Method for handling complaints.

We have prepared a draft NMP which has been submitted with the Application.

With respect to proposed condition 6, broadband reversing alarms or strobe lights are suitable alternatives if a reversing alarm is required. These alarms can be sourced from suppliers such as the following:

- Ashdown-Ingram New Zealand. Ph 0800 445 889
  http://www.ashdown-ingram.co.nz/nz/contact-us
- Rearsense Warning Systems. Ph 0800 888 665
  http://www.rearsense.co.nz/contact/
- Airdraulic Birco Group, Australia. Ph +61 2 9882 3444,
  http://www.abgpl.com.au/messages/new (also supply 'BACKBLITZ' strobe light devices)

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
Masking Noise	Intentional background noise that is not disturbing, but due to its presence causes other unwanted noises to be less intelligible, noticeable and distracting.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
SPL or L_P	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. dB = 20 x log(P/Pr)
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\ (t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{A90}	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
L_{A10}	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
SEL or L_{AE}	Sound Exposure Level The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
NZS 6801:1991	New Zealand Standard NZS 6801:1991 *"Measurement of Sound"*
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of environmental sound"*
NZS 6802:1991	New Zealand Standard NZS 6802:1991 *"Assessment of Environmental Sound".*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise"*
NZS 6803:1999	New Zealand Standard NZS 6803: 1999 *"Acoustics - Construction Noise"*

APPENDIX B NOISE SURVEY DETAILS

The key details of the 2023 noise survey is as follows:

Date: 1630hrs 21 June to 0700hrs 22 June 2023

Personnel: Stephen Compton, Marshall Day Acoustics

Weather: 5°C-16°C, 90% cloud cover, calm conditions

Instrumentation: NTi XL2-TA analyser, serial A2A-20483-E0, calibration due 01/04/2024
Brüel & Kjær Type 2250 analyser, serial 2683036, calibration due 22/09/2024
Brüel & Kjær Type 4231 calibrator, serial 1882775, calibration due 20/02/2024

Calibration: Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.1 dB.

The key details of the 2018 noise surveys are as follows:

B1 Daytime Noise Survey

Date: 30 May 2018, 1630 – 1715 hours

Personnel: Aaron Staples, Marshall Day Acoustics

Weather: 8°C, 90% cloud cover, calm conditions

Instrumentation: Brüel & Kjær Type 2250 analyser, serial 2488377, calibration due 02/08/2018
Brüel & Kjær Type 4231 calibrator, serial 1882775, calibration due 08/02/2019

Calibration: Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.2 dB.

B2 Night-time Noise Survey

Date: 30 May 2018, 2200 – 2245 hours

Personnel: Aaron Staples, Marshall Day Acoustics

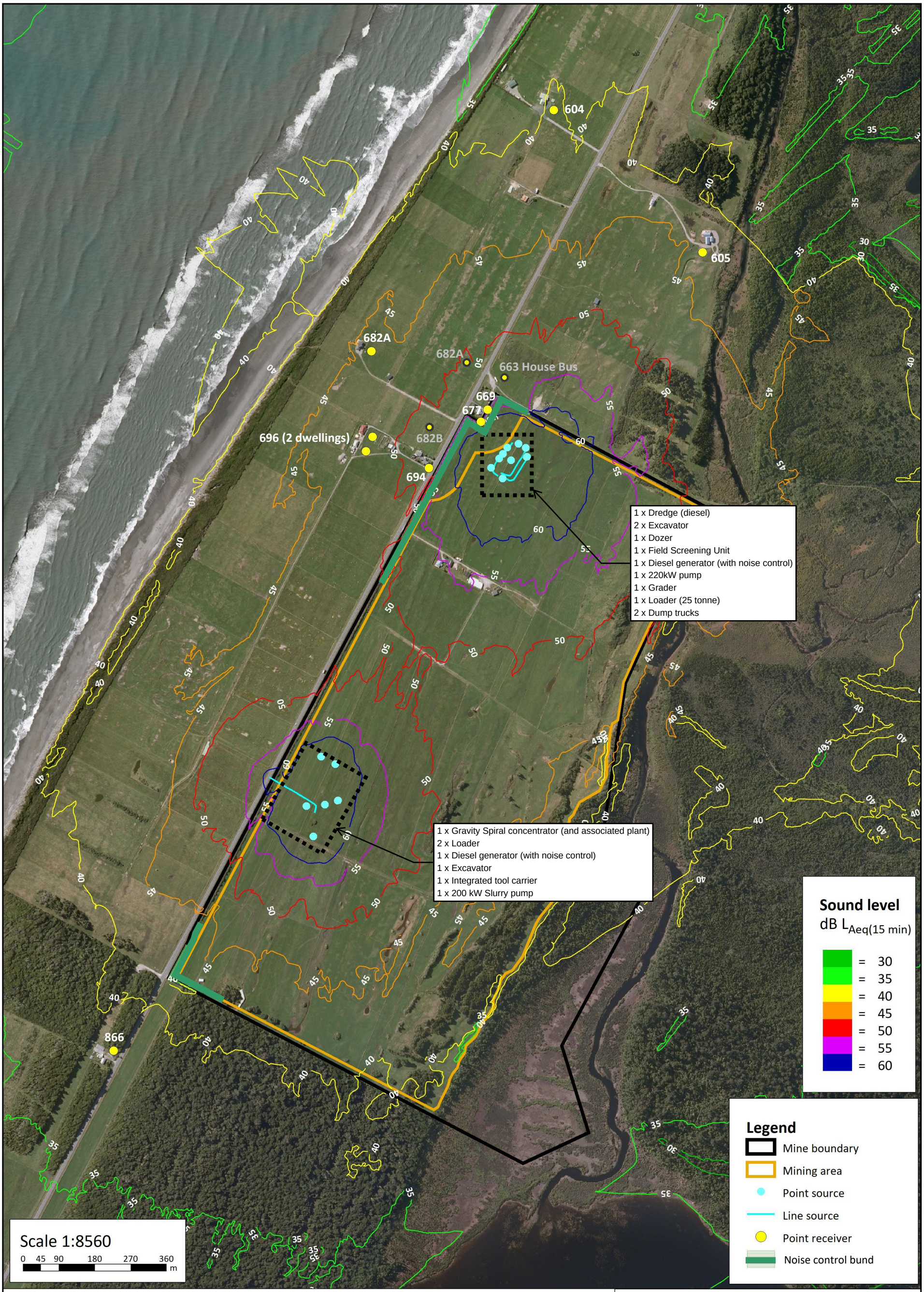
Weather: 5°C, < 10% cloud cover, calm conditions

Instrumentation: Brüel & Kjær Type 2250 analyser, serial 2488377, calibration due 02/08/2018
Brüel & Kjær Type 4231 calibrator, serial 1882775, calibration due 08/02/2019

Calibration: Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.1 dB.

APPENDIX C NOISE CONTOURS MAPS

(following pages)

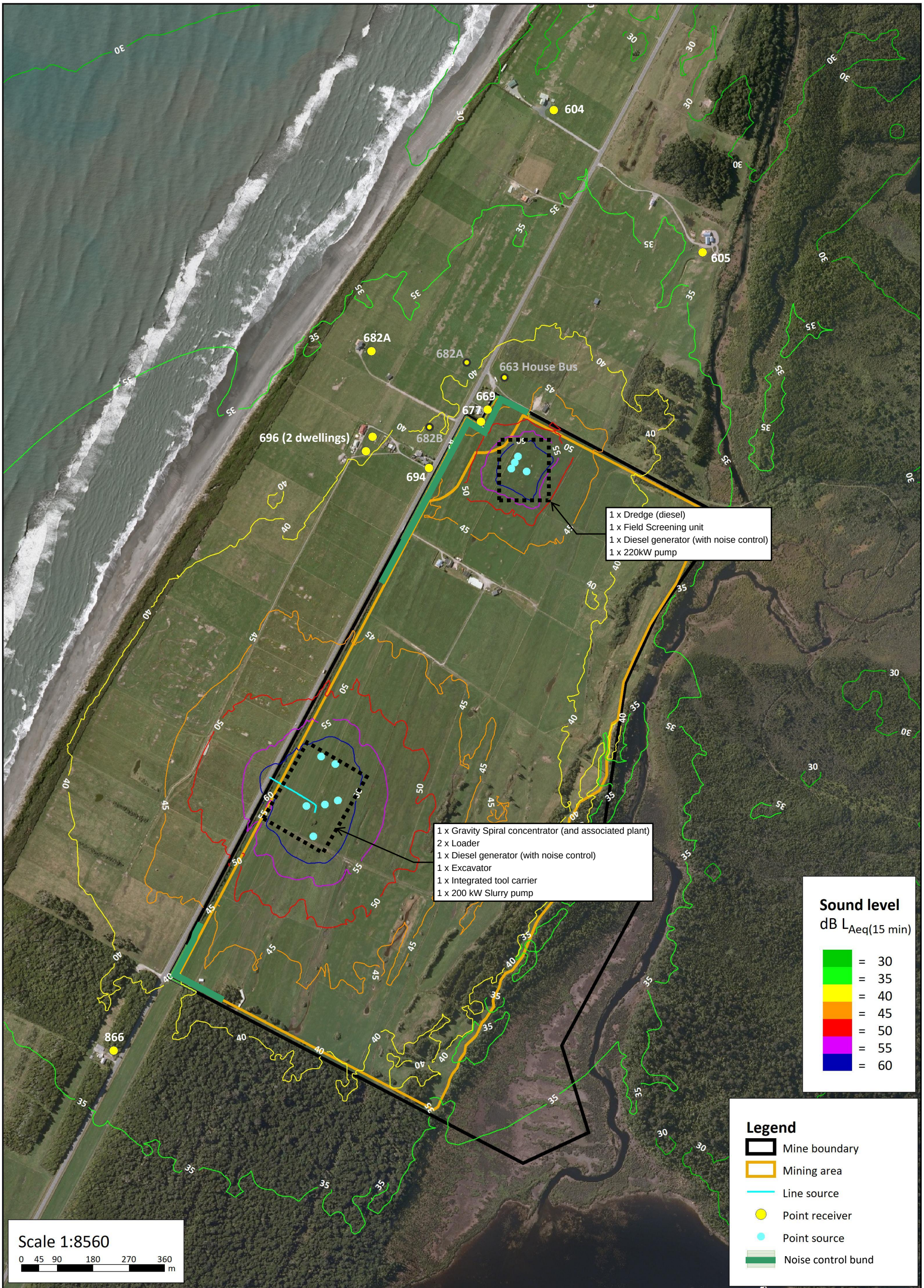


MARSHALL DAY Acoustics

Scenario 1 - DAYTIME Northwest

Dredging, mobile plant and processing

Project: Ruatapu Mine
Project no: 20230381 Run no: 24
Filename: Sh 013 20230381 Dredging + processing NW DT
Prepared by: JG Date: 4/09/2023

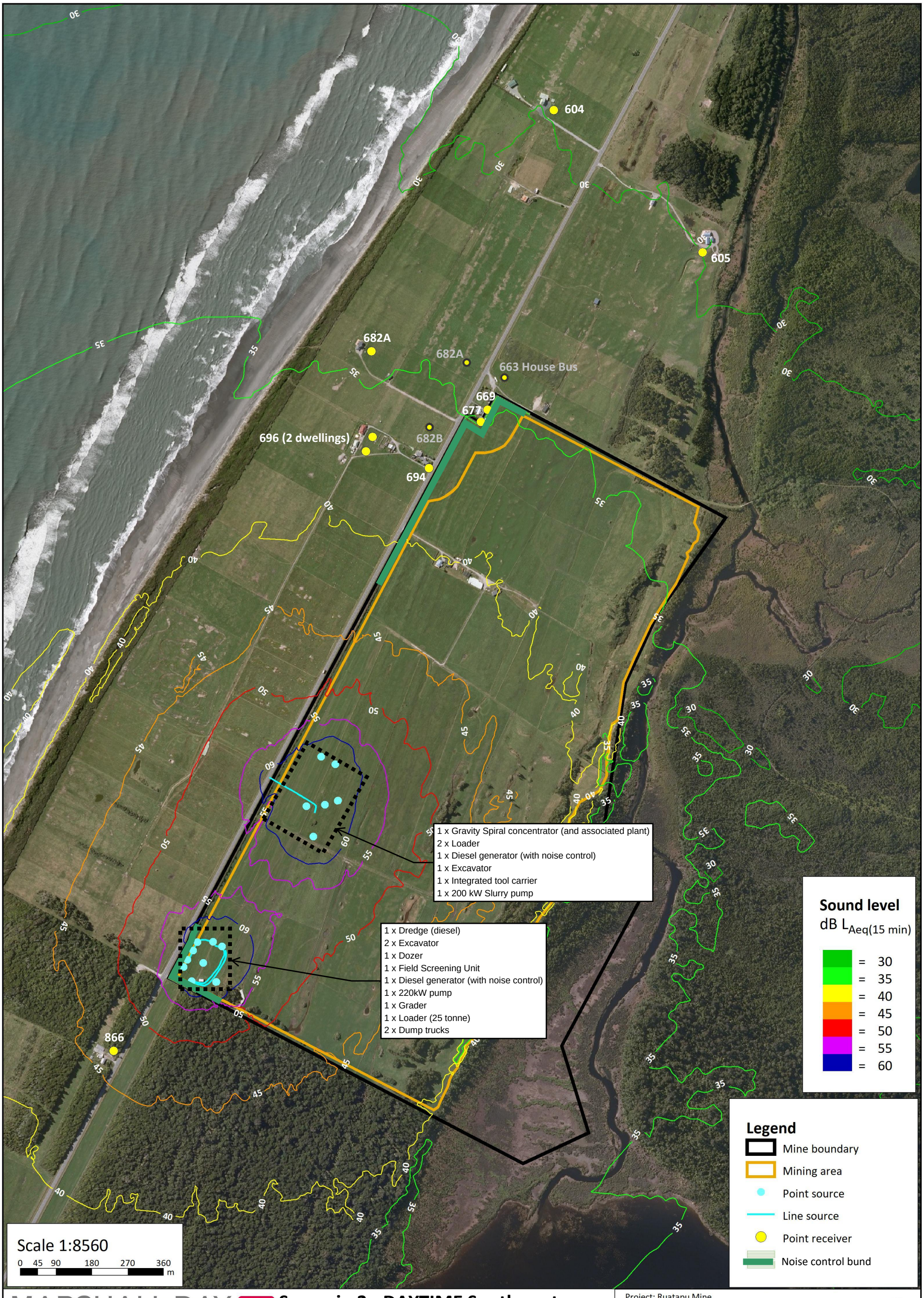


MARSHALL DAY Acoustics

Scenario 2 - NIGHT-TIME Northwest

Dredging and processing

Project: Ruatapu Mine
Project no: 20230381 Run no: 25
Filename: Sh 013 20230381 Dredging + processing NW NT
Prepared by: JG Date: 4/09/2023

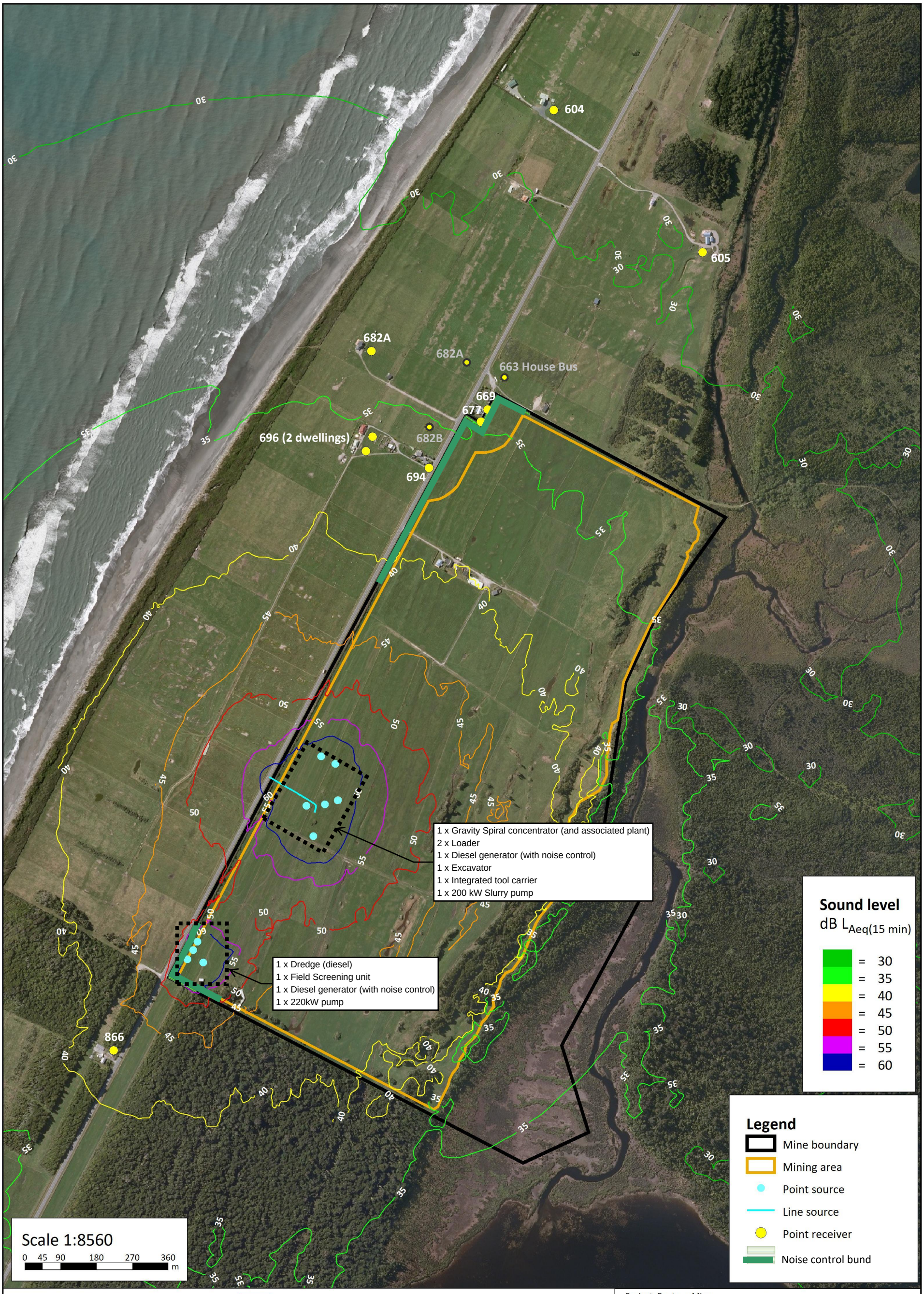


MARSHALL DAY Acoustics

Scenario 3 - DAYTIME Southwest

Dredging, mobile plant and processing

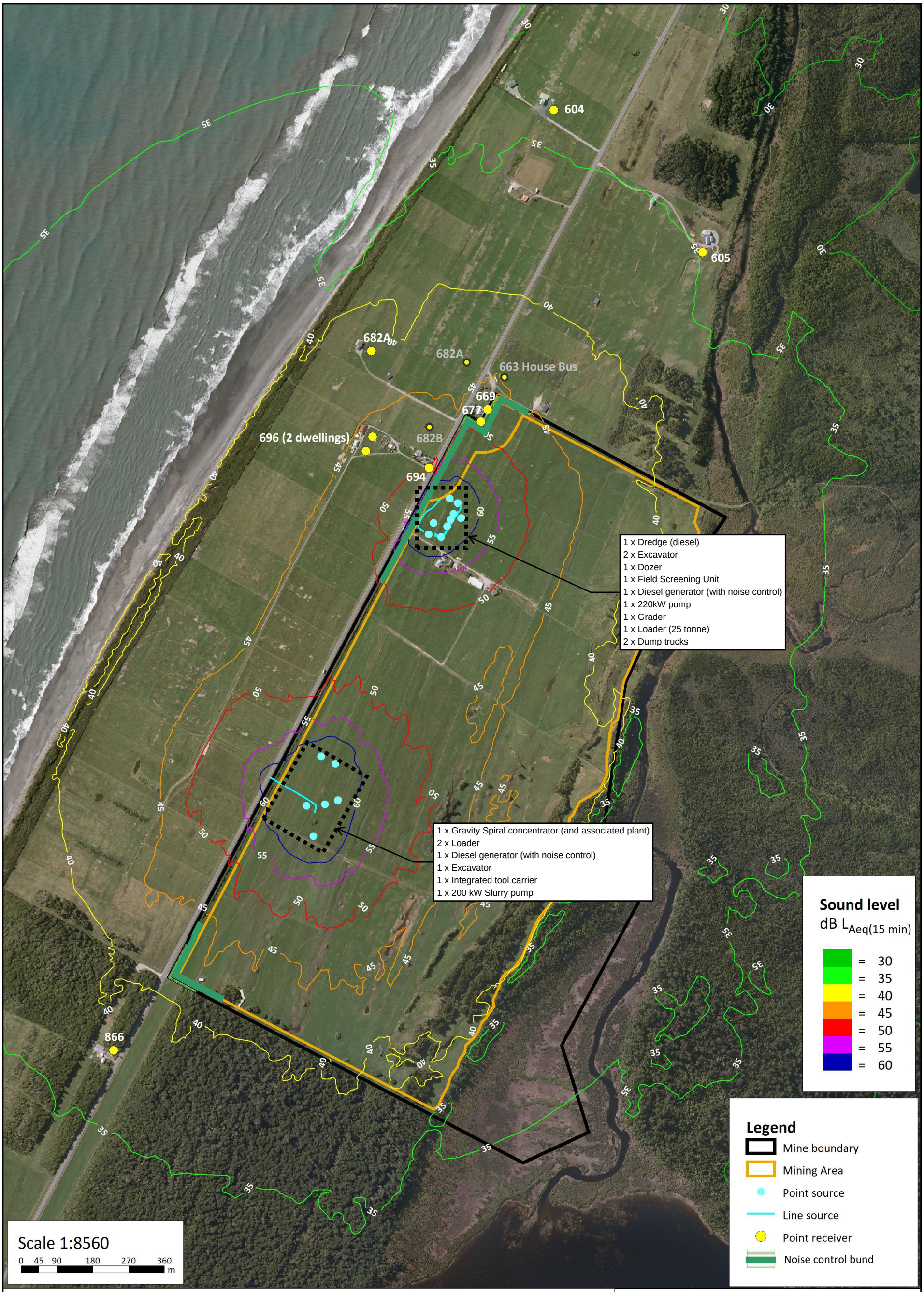
Project: Ruatapu Mine
Project no: 20230381 Run no: 26
Filename: Sh 013 20230381 Dredging + processing SW DT
Prepared by: JG Date: 4/09/2023



MARSHALL DAY Acoustics

Scenario 4 - NIGHT-TIME Southwest
Dredging and processing

Project: Ruatapu Mine
Project no: 20230381 Run no: 27
Filename: Sh 013 20230381 Dredging + processing SW NT
Prepared by: JG Date: 4/09/2023

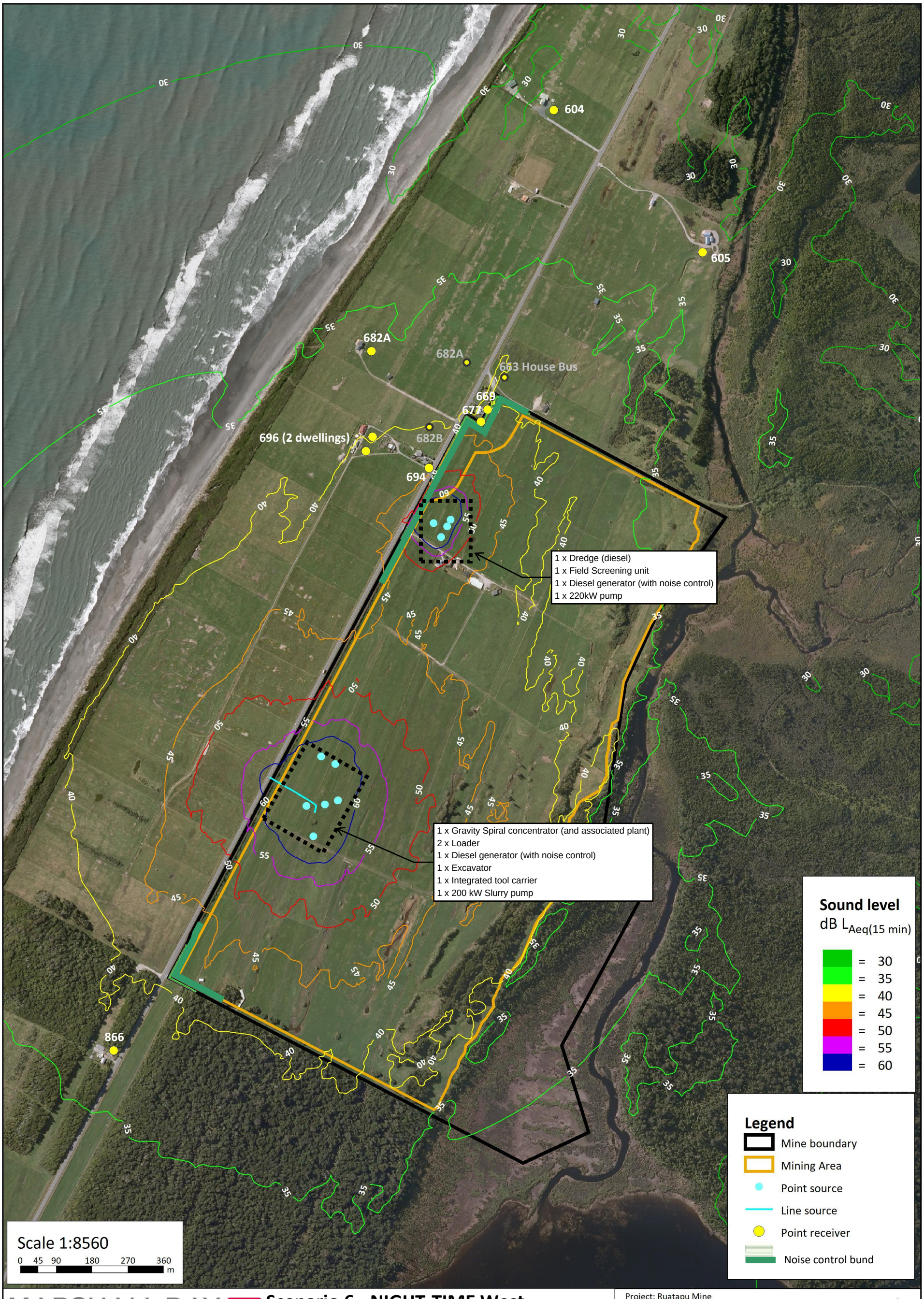


MARSHALL DAY Acoustics

Scenario 5 - DAYTIME West

Dredging, mobile plant and processing

Project: Ruatapu Mine
Project no: 20230381 Run no: 29
Filename: Sh 013 20230381 Dredging + processing western DT
Prepared by: JG Date: 4/09/2023



MARSHALL DAY Acoustics

Scenario 6 - NIGHT-TIME West

Dredging and processing

Project: Ruatapu Mine
Project no: 20230381 Run no: 31
Filename: Sh 013 20230381 Dredging + processing western NT
Prepared by: JG Date: 4/09/2023