MARSHALL DAY Acoustics

STAFFORD GOLD MINE EXPANSION MP52365
ASSESSMENT OF NOISE EFFECTS

Rp 001 2016654C | 27 October 2016

MARSHALL DAY Acoustics

Level 3 69 Cambridge Terrace
PO Box 4071
Christchurch 8140 New Zealand
T: +64 3 365 8455 F: +64 3 365 8477
www.marshallday.com

Project: **STAFFORD GOLD MINE EXPANSION MP52365**

Prepared for: **Phoenix Mining Ltd**
c/- Gold and Green Resources Ltd
PO Box 11
Hokitika 7842

Attention: **John Wood**

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EXECUTIVE SUMMARY

This report sets out our assessment of the noise-related effects from a proposed expansion to the existing Stafford Gold Mine as part of Mining Permit MP52365 near Stafford, West Coast.

The mining activity proposes to utilise up to three dump trucks, four excavators, two mobile gold processing plants and up to two associated dewatering pumps. The mining is proposed to occur between 0700 and 1800 hours, Monday to Friday and 0700 to 1300 hours on Saturdays throughout the anticipated 5 year life of the mine.

We predict that noise levels from the activity will comply with the District Plan daytime noise limit (55 dB L_{A10} at all surrounding dwellings where written approval has not been provided. Noise from the proposed mine expansion will also generally be below our recommended 50 dB L_{A10} noise limit at nearby dwellings where written approval has not been provided. However, noise levels may be marginally above this recommendation by 1-3 dB at some dwellings at times.

To ensure that noise from the activity is adequately controlled throughout the life of the consent, we recommend that noise-related conditions consistent with the following suggested wording are included in the consent, should it be granted:

1. With the exception of those properties for which affected party approval has been obtained, mining activities must be conducted such that noise emissions do not exceed 55 dB $L_{A10(15\ min)}$ within the notional boundary of any dwelling.

   "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 legal boundary is within 20 metres of the building.

2. Noise shall be measured and assessed in accordance with New Zealand Standards NZS 6801:1991 *"Measurement of Sound"* and NZS 6802:1991 *"Assessment of Environmental Sound"*, respectively.

3. Mining activities must only take place between 0700-1800 hours, Monday to Friday, and 0700-1300 hours on Saturdays. No mining shall take place on public holidays.

4. Construction activities, such as the formation of access roads, must be planned and managed in accordance with New Zealand Standard NZS 6803:1999 *"Acoustics - Construction Noise"*.

5. Mining operations must utilise the best practical option to minimise noise at all times. This includes replacement of worn parts, maintenance of mufflers, lubrication of moving machinery to avoid squeaks and squeals, and appropriate operation of all equipment.

6. Any vehicles or equipment must not be fitted with tonal or beeper reversing alarms.

Based on the above, we consider the potential noise effects from the proposed activity to be acceptable at all dwellings where written approval has not been obtained.

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1.0 INTRODUCTION

Marshall Day Acoustics has been appointed to assess the noise-related effects from a proposed expansion to the existing Stafford Gold Mine as part of Mining Permit MP52365 near Stafford, West Coast.

This report provides:

- An overview of the proposed mine expansion and activity;
- A summary of the existing ambient noise environment;
- A review of appropriate noise assessment criteria;
- Details of our recent noise survey of the current mining activity;
- Predicted noise levels for the proposed mine expansion; and
- An assessment of the potential noise effects at nearby dwellings as a result of the proposed expansion.

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

2.0 SITE & ACTIVITY DESCRIPTION

2.1 Proposed Mine Area Expansion

The proposed mine area expansion is indicated in Figure 1. The locations of the nearest dwellings are labelled A-Q in the figure and the addresses of these dwellings are provided in Appendix B.

We understand that the owners of dwellings B, H, I and J have provided written approval for the proposed mining expansion and we have therefore excluded these dwellings from our assessment of noise effects.

2.2 Proposed Activity

The proposed activity will essentially be the same as that currently occurring on the existing mine site. This involves the following mining equipment, which could all potentially operate simultaneously:

- 2x mobile gold processing plants;
- 3x hydraulic excavators (30-50 tonne), two of which are used to service the gold processing plants;
- 1x large hydraulic excavator (50-90 tonne);
- 3x dump trucks (30-40 tonne tare weight); and
- 2x diesel powered dewatering pumps.

The hours of mining will be 0700 to 1800 hours Monday to Friday, and 0700 to 1300 hours on Saturdays. No mining will take place on public holidays. We understand that the life of the mine is anticipated to be 5 years.

Figure 1: Proposed mine area expansion, nearby dwellings and ambient noise survey locations

3.0 AMBIENT NOISE ENVIRONMENT

Marshall Day Acoustics has undertaken multiple noise surveys of the existing ambient noise environment in the vicinity of the proposed mine area expansion. The results of our most recent noise surveys, undertaken in October 2016 and August and November 2013 indicate relatively low ambient noise levels in the area. Daytime ambient noise levels during fine, calm conditions have been measured to range from 33 dB L_{A10} to 45 dB L_{A10}, with background noise levels typically around 30-35 dB L_{A90}. Details of our ambient noise surveys are provided in Appendix C.

It is important to note that ambient noise levels will be significantly higher than these values during wet or windy conditions.

4.0 NOISE PERFORMANCE STANDARDS

4.1 District Plan Noise Standards

The proposed mine site expansion and surrounding properties are zoned *Rural* under the Westland District Plan. The District Plan noise standards applicable to the operation of the gold mining activity 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 gold mining is only proposed to occur during daytime hours Monday to Saturday, the critical noise limit is 55 dB L_{A10} at the notional boundary of any dwelling.

The Westland District Plan does not provide any L_{AFmax} noise limits for the *Rural* zone, nor does it reference any construction noise standards.

We understand the status of the proposed activity is 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 World Health Organisation Guidance

World Health Organisation (WHO) Guideline Values for Community Noise (Berglund and Lindvall, 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 1: 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)
Outdoor living area	Serious annoyance, daytime & evening	55	16
	Moderate annoyance, daytime & evening	50	16

4.3 NZS 6802:2008 Guidance

The 2008 version of NZS 6802:2008 *"Acoustics - Environmental Noise"* (the District Plan refers to the 1991 version) makes reference to a desirable upper limit of 55 dB $L_{Aeq(15min)}$ at or within the notional boundary of any rural dwelling during daytime hours.

4.4 NZS 6803:1999 Construction Noise Standard

New Zealand Standard NZS 6803:1999 *"Acoustics - Construction Noise"* sets out the following noise limits for dwellings in rural areas:

Table 2: NZS 6803:1999 recommended upper limits

Time of week	Time period	Duration of work					
		Typical duration		Short-term duration		Long-term duration	
		dB L_{Aeq}	dB L_{Amax}	dB L_{eq}	dB L_{Amax}	dB L_{eq}	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

NZS 6803:1999 defines the durations as follows:

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

4.5 Discussion of Noise Assessment Criteria

The District Plan daytime noise rule of 55 dB L_{A10} is consistent with the desirable upper noise limit provided in the latest version of NZS 6802, and the WHO Guideline Value to minimise the onset of 'serious annoyance'.

However, in our experience a noise level of this magnitude in a low ambient noise environment such as Stafford may result in adverse noise effects. We therefore recommend that the proposal aims to achieve a noise level 5 dB below the District Plan daytime limit (50 dB L_{A10}) at neighbouring dwellings. A noise limit of 50 dB L_{A10} is broadly consistent with the World Health Organisation guidelines to minimise the onset of 'moderate annoyance' and in our opinion would ensure that noise effects at neighbouring dwellings would be acceptable.

In addition, we recommend that any construction activities, such as the formation of access roads for example, be planned and managed in accordance with NZS 6803:1999 *"Acoustics - Construction Noise"*.

5.0 NOISE SURVEY OF CURRENT MINING ACTIVITY

On 7 October 2016, Marshall Day Acoustics performed a noise survey of the existing mining activity. Conditions during our noise survey were fine with light winds. Refer to Appendix C for further details of our noise survey such as equipment and calibration information.

The results of our measured noise levels are summarised in Table 3 below.

Table 3: Summary of measured noise levels from existing mining activity

Equipment	Measured noise level at 10 m*	Comments
Gold processing plant 1 (larger)	87 dB L_{A10}	Includes Hitachi Zaxis 350H excavator loading plant
Gold processing plant 2 (smaller)	85 dB L_{A10}	Includes Hitachi Zaxis 210K excavator loading plant
Komatsu HM400 dump truck	89 dB L_{AE}	Average of six drive-bys
Hitachi Zaxis 870LC excavator	83 dB L_{A10}	Excavating overburden
Hitachi Zaxis 870LC excavator	83 dB L_{A10}	Loading dump truck
Hitachi Zaxis 350H	81 dB L_{A10}	Excavating pit

* Measured noise levels at distances other than 10 m have been adjusted for distance accordingly.

The measured noise levels summarised in Table 3 are generally consistent with our measurements of similar mining activities. Notable differences are that the gold processing plants appear to be 1-3 dB quieter than previous measurements of similar plants. However, the Hitachi Zaxis 350H excavator is around 6 dB greater than our measurements of other excavators of similar size.

During our survey we observed that the dump trucks were fitted with tonal reversing alarms. Although not especially loud, these alarms were still noticeable at times at our distant measurement positions. We therefore recommend that these alarms be replaced with non-audible alarms, such as flashing lights, or broadband reversing alarms (sometimes referred to as 'quackers'). Suggested suppliers for these types of alarms are provided in Section 8.0.

6.0 PREDICTED NOISE LEVELS

6.1 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 take into account 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.

6.2 Input Noise Data

The noise data used in our model is based on our measurements of the actual equipment that would be operating under the expansion, as summarised in Table 3.

None of the dewatering pumps were operational during our noise survey of the existing mining activity so we have used data from previous measurements of diesel powered dewatering pumps in our model. A sound power level of 103 dB L_{AW} has been used for each pump.

6.3 Modelling Scenarios & Predicted Noise Levels

The challenge in predicting noise levels from a mining operation such as this, is that the activity only occurs in small areas of the site at any one time. Noise levels at neighbouring properties will therefore vary, depending on the separation distance at the time. To account for this, we have predicted noise levels for a range of scenarios:

- **Year 0:** Equipment operating at existing ground level near mine start location, one gold processing plant and associated equipment located within existing mine pit.
- **Year 1:** Equipment operating near mine start location, 10 m deep pit, one gold processing plant and associated equipment located within existing mine pit.
- **Year X:** Equipment operating near west corner of proposed mining area, 10 m deep pit.
- **Year Y:** Equipment operating at existing ground level near north corner of proposed mining area.
- **Year Z:** Equipment operating near east corner of proposed mining area. Large excavator, dump trucks and one gold processing plant and associated equipment operating at existing ground level, with the other gold processing plant and associated equipment operating within a 10 m deep pit.

Our predicted noise levels for the above scenarios are summarised in Table 4. Noise contour maps for each of these scenarios are provided in figures 2-6 on the following pages.

Table 4: Predicted noise levels at nearest dwellings

Dwelling	Predicted noise level at notional boundary (dB L_{A10})				
	Year 0	Year 1	Year X	Year Y	Year Z
A	48	45	48	42	41
B [1]	49	46	49	43	43
C	**51**	50	**53**	45	45
D	47	45	**52**	44	42
E	44	43	**51**	44	40
F	41	41	47	42	38
G	40	40	45	41	37
H [1]	47	46	**59**	50	42
I [1]	46	45	**54**	**51**	43
J [1]	44	42	46	**59**	44
K	39	36	39	48	42
L	41	38	40	46	49
M	36	35	36	42	**51**
N	36	35	35	42	**51**
O	38	36	36	41	47
P	38	36	36	41	47
Q	37	36	36	41	49

[1] Dwelling owners have provided written approval for proposed activity.

*** Above 50 dB L_{A10} but complies with 55 dB L_{A10} District Plan limit.**

*** Exceeds 55 dB L_{A10} District Plan limit.**

Our results show that non-compliances with the 55 dB L_{A10} District Plan noise limit will only occur at two dwellings, H and J, both of which the owners have provided written approval for the proposed mine expansion.

Our suggested noise criteria of 50 dB L_{A10} is generally achieved throughout the life of the mine at all surrounding dwellings where written approval has not been provided. Notable exceptions to this are at dwellings C, D, E, M and N which could, at times, be exposed to noise levels of 51-53 dB L_{A10} at certain stages of mining. The noise-related effects that could arise from this level of noise at these properties is discussed in the following section.

Figure 2: Stafford Gold Mine Expansion - Year 0

Figure 3: Stafford Gold Mine Expansion - Year 1

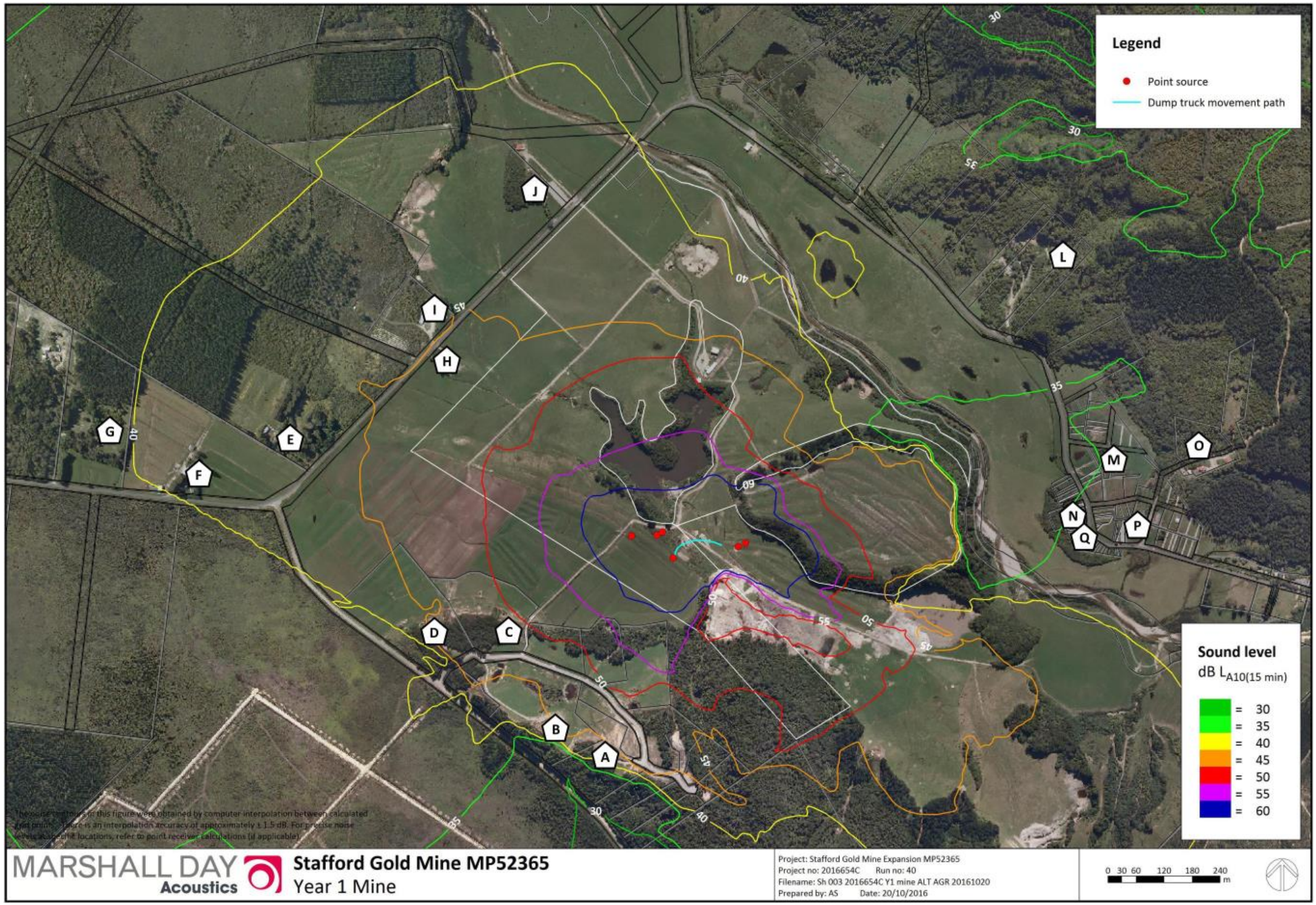


Figure 4: Stafford Gold Mine Expansion - Year X

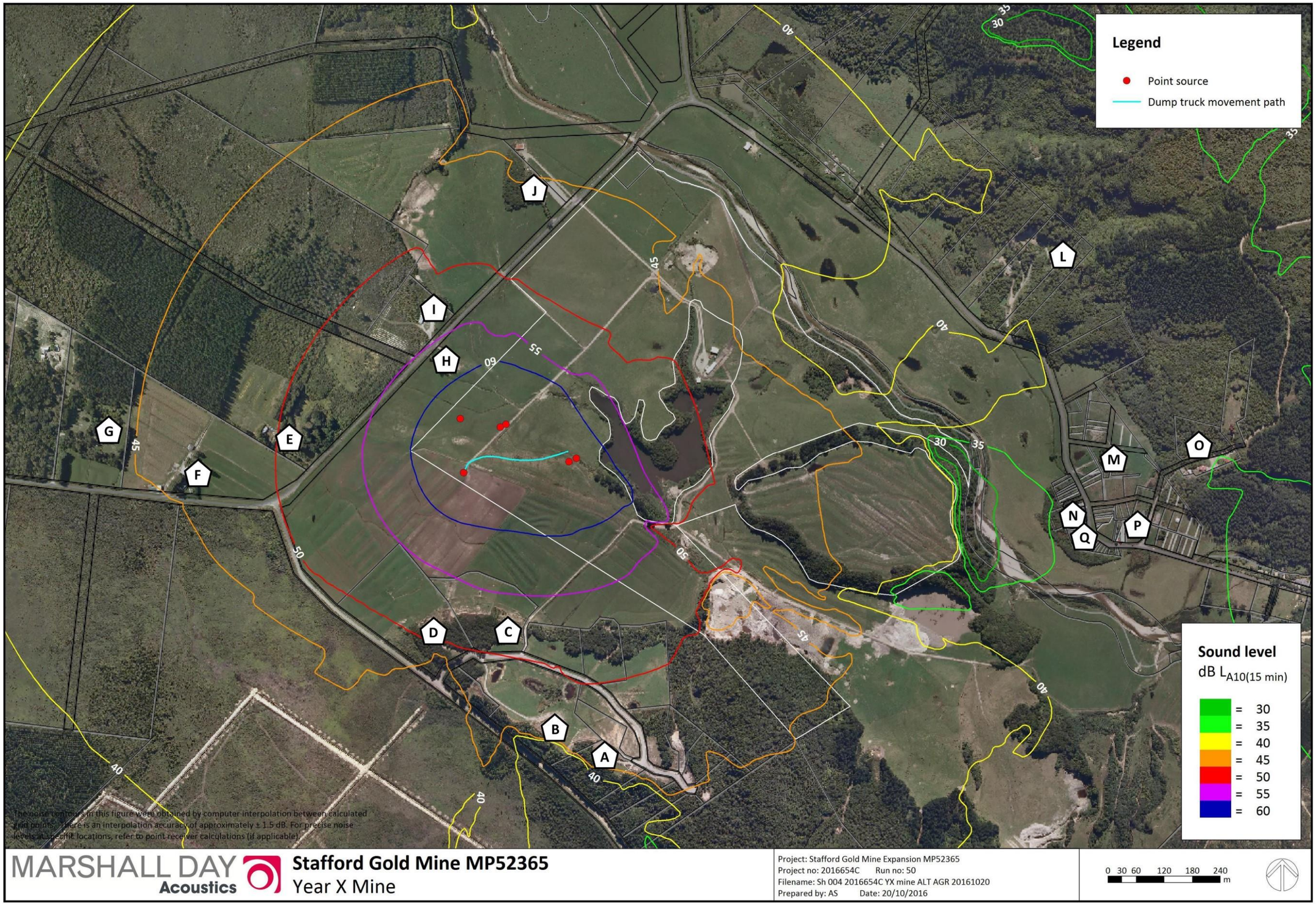


Figure 5: Stafford Gold Mine Expansion - Year Y

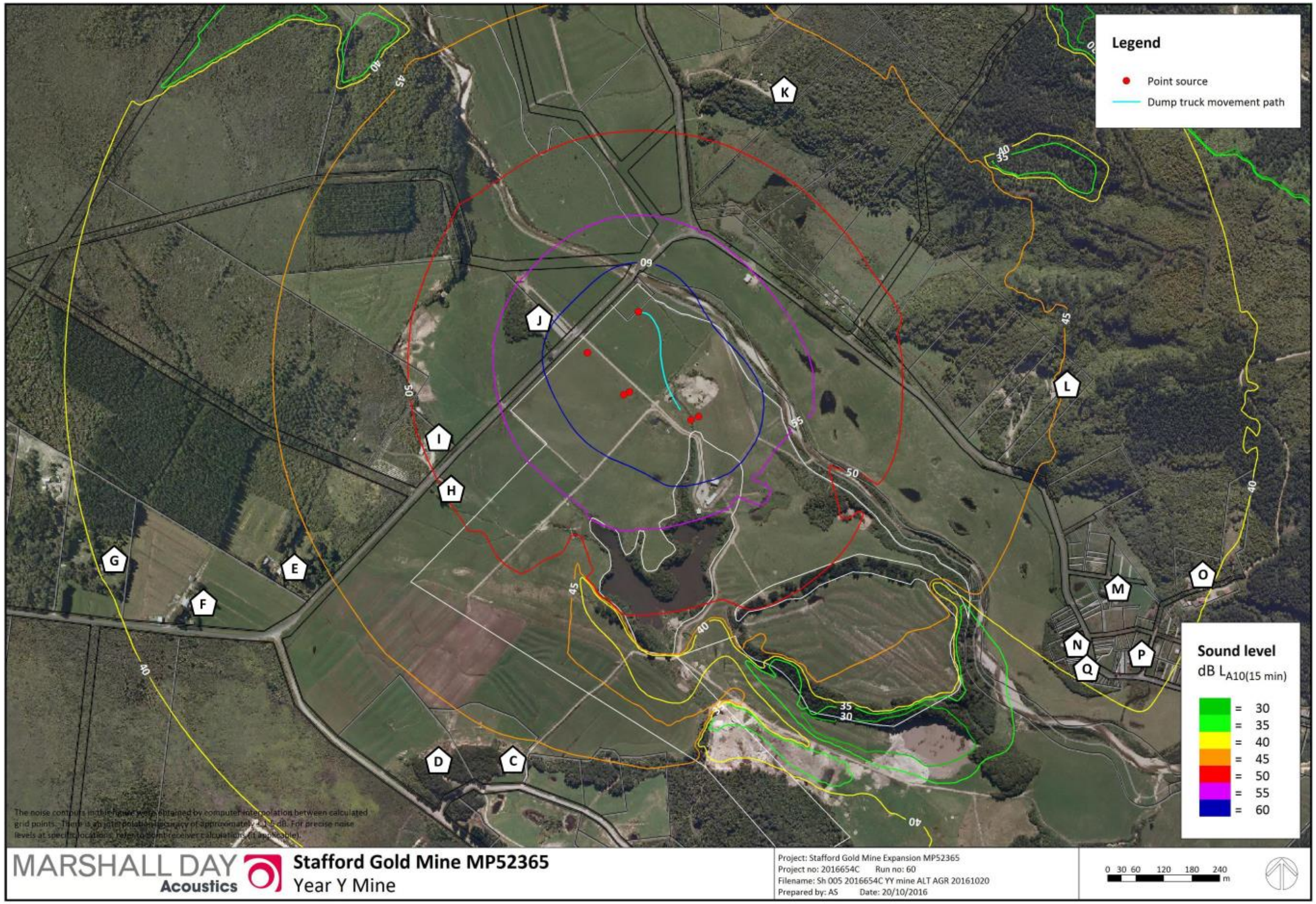
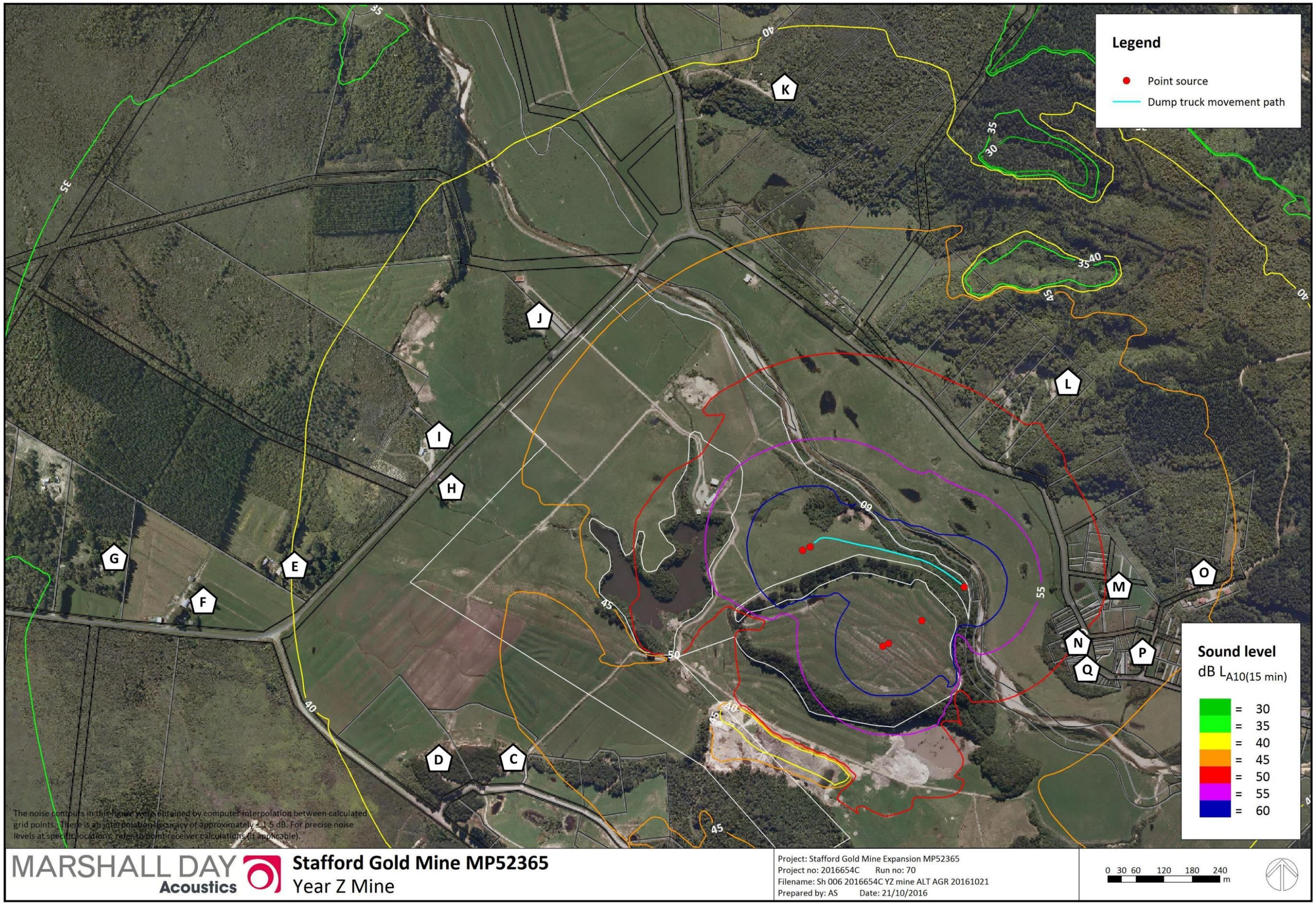


Figure 6: Stafford Gold Mine Expansion - Year Z



7.0 ASSESSMENT OF NOISE EFFECTS

Noise emissions from the proposed mine expansion will comply with the District Plan daytime noise limit at all dwellings where written approval has not been provided.

The proposed expansion will also generally achieve our recommended noise limit of 50 dB L_{A10} at nearby dwellings where written approval has not been provided. However, we predict that there could be times when our recommended noise limit of 50 dB L_{A10} would be marginally exceeded by 1-3 dB at dwellings C, D, E, M and N. Slight exceedances of this magnitude (1-3 dB) will generally be imperceptible or just perceptible to the human ear, and would still be below the recommended upper noise limits provided in NZS 6802:2008 and the WHO guidance values to minimise the onset of serious annoyance in outdoor living areas.

In addition, the hours of mining will be restricted to 0700-1800 hours, Monday to Friday and 0700-1300 hours on Saturdays which will reduce the potential noise effects of the activity. Furthermore, mining is anticipated to be completed within five years.

While the results of our ambient noise surveys indicate that the mining activity is likely to be audible at the surrounding dwellings during fine, calm conditions, based on the factors outlined above we consider the potential noise effects from the proposed mine expansion to be acceptable at all dwellings where written approval has not been provided.

8.0 RECOMMENDED CONSENT CONDITIONS

To ensure that noise from the activity is adequately controlled throughout the life of the consent, we recommend that noise-related conditions consistent with the following suggested wording are included in the consent, should it be granted:

1. With the exception of those properties for which affected party approval has been obtained, mining activities must be conducted such that noise emissions do not exceed 55 dB $L_{A10(15\ min)}$ within the notional boundary of any dwelling.

   "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 legal boundary is within 20 metres of the building.

2. Noise shall be measured and assessed in accordance with New Zealand Standards NZS 6801:1991 *"Measurement of Sound"* and NZS 6802:1991 *"Assessment of Environmental Sound"*, respectively.

3. Mining activities must only take place between 0700-1800 hours, Monday to Friday, and 0700-1300 hours on Saturdays. No mining shall take place on public holidays.

4. Construction activities, such as the formation of access roads, must be planned and managed in accordance with New Zealand Standard NZS 6803:1999 *"Acoustics - Construction Noise"*.

5. Mining operations must utilise the best practical option to minimise noise at all times. This includes replacement of worn parts, maintenance of mufflers, lubrication of moving machinery to avoid squeaks and squeals, and appropriate operation of all equipment.

6. Any vehicles or equipment must not be fitted with tonal or beeper reversing alarms.

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:

- Capital Civic Auto Electrical Parts. (03) 366 4593, http://www.capitalcivic.co.nz/contact_part_no.php
- Rearsense Warning Systems. Ph (07) 575 6273, http://www.rearsense.co.nz/Contact+Us.html
- Airdraulic Birco Group, Australia. Ph +61 2 9882 3444, http://www.abgpl.com.au/messages/new (also supply 'BACKBLITZ' strobe light devices)

9.0 CONCLUSIONS

Marshall Day Acoustics has assessed the potential noise effects arising from a proposed gold mine expansion near Stafford, West Coast and reaches the following conclusions:

- Noise emissions from the proposed activity will comply with the District Plan daytime noise limit at all dwellings where written approval has not been provided;
- Noise from the proposed mine expansion will generally be below our recommended 50 dB L_{A10} noise limit at nearby dwellings where written approval has not been provided. Marginal exceedances of up to 1-3 dB are predicted to occur at some dwellings at certain stages of mining;
- Noise from the activity is likely to be audible at the nearest dwellings during fine, calm conditions;
- We have provided conditions which we recommend are incorporated into the consent to ensure noise form the activity is adequately controlled throughout the life of the consent; and
- Based on the above, we consider the potential noise effects from the proposed activity to be acceptable at surrounding dwellings where written approval has not been provided.

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
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.
$L_{A10\ (t)}$	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. 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_{AFmax}	The A-weighted maximum noise level measured using fast time response (hence 'F'). 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 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 DWELLING KEY

Dwelling Reference	Address
A	60 Ballarat Rise
B [1]	183 Gillams Gully Road
C	12 Ballarat Rise
D	9 Ballarat Rise
E	221 Stafford Loop Road
F	185 Stafford Loop Road
G	161 Stafford Loop Road
H [1]	259 Stafford Loop Road (farm workers accommodation)
I [1]	259 Stafford Loop Road
J [1]	293 Stafford Loop Road
K	259 Stafford Road
L	419 Stafford Loop Road
M	453 Stafford Loop Road
N	464 Stafford Loop Road
O	Scandinavian Street (dwelling number unknown)
P	473 Stafford Loop Road
Q	Stafford Loop Road (dwelling number unknown)

[1] Dwelling owners have provided written approval for proposed activity.

APPENDIX C NOISE SURVEY DETAILS

The key details of our noise surveys are as follows.

C1 Noise Survey of Existing Mining Activity

Date: 7 October 2016, 1015 - 1210 hours

Personnel: Aaron Staples, Marshall Day Acoustics

Weather: 12-20°C, initially largely overcast, then clearing to <10% cloud cover, initially light south-westerly wind estimated to be 0-2 m/s, before changing to a very light north-easterly wind estimated to be < 1 m/s.

Instrumentation: Brüel & Kjær Type 2250 analyser,
serial 3010261, calibration due 19/07/2018
Brüel & Kjær Type 4231 calibrator,
serial 1882775, calibration due 16/02/2017

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

C2 October 2016 Ambient Noise Survey

Date: 7 October 2016, 1225 - 1330 hours

Personnel: Aaron Staples, Marshall Day Acoustics

Weather: 20°C, <5% cloud cover, light west to north-westerly wind estimated to be 0-2 m/s.

Instrumentation: Brüel & Kjær Type 2250 analyser,
serial 3010261, calibration due 19/07/2018
Brüel & Kjær Type 4231 calibrator,
serial 1882775, calibration due 16/02/2017

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

Table 5: Summary of ambient noise survey results, 7 October 2016

Position	Start time*	Measured noise level			Comments
		dB L_{A10}	dB L_{A90}	dB L_{AFmax}	
2	1310 hrs	38	35	59	Bird song and nearby stream equally dominant; sea audible and contributes at times; sheep audible at times.
3	1250 hrs	43	35	57	Bird song dominant; distant chainsaw contributes at times; mining activity audible at times; dump truck reversing alarms audible at times. Traffic on Stafford Loop Road excluded from measurement due to close proximity of road.
6	1225 hrs	45	32	72	Bird song dominant; distant stream contributes; 4 vehicle passes on Stafford Loop Road during measurement.

*The duration of each measurement was ten minutes.

Refer to Figure 1 on page 5 for measurement positions.

C3 November 2013 Ambient Noise Survey

Date: 7 November 2013, 1040 - 1055 hours

Personnel: Aaron Staples, Marshall Day Acoustics

Weather: 20°C, <10% cloud cover, calm conditions

Instrumentation: Brüel & Kjær Type 2250 analyser,
serial 2683036, calibration due 25/09/2014
Brüel & Kjær Type 4231 calibrator,
serial 1882775, calibration due 21/02/2014

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

Table 6: Summary of ambient noise survey results, 7 November 2013

Position	Start time*	Measured noise level			Comments
		dB L_{A10}	dB L_{A90}	dB L_{AFmax}	
1	1043 hrs	33	31	48	Bird song and insects dominant; occasional vehicle on Stafford Loop Road just audible; surf just audible.

* Ten minute measurement duration.

C4 August 2013 Ambient Noise Survey

Date: 29 August 2013, 1600 - 1710 hours

Personnel: Aaron Staples, Marshall Day Acoustics

Weather: 15°C, clear skies, variable southerly wind ranging from 0-2 m/s

Instrumentation: Brüel & Kjær Type 2250 analyser,
serial 2683036, calibration due 7/11/13
Brüel & Kjær Type 4231 calibrator,
serial 1882775, calibration due 21/02/14

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

Table 7: Summary of ambient noise survey results, 29 August 2013

Position	Start time*	Measured noise level			Comments
		dB L_{A10}	dB L_{A90}	dB L_{AFmax}	
4	1600 hrs	38	30	56	Bird song dominant; nearby stream contributes; distant farm bike and tractor audible at times; Traffic on Stafford Loop Road excluded from measurement due to close proximity of road.
5	1655 hrs	41	31	64	Bird song generally dominant; occasional vehicle on Stafford Loop Road clearly audible; sea noise just audible at times.

*The duration of each measurement was ten minutes.