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Outline Planning Consultants Pty Ltd

Faheys Pit

Noise and Vibration Impact Assessment

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Rev.00	Original issue	11 Aug 2023	
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Executive Summary

Vipac Engineers and Scientists Ltd was engaged by Outline Planning Consultants Pty Ltd on behalf of Sheridan's Hard Rock Quarry to prepare a noise and vibration impact assessment to support a development consent for the continuation and expansion of a small quarry at Tyringham on the Dorrigo Plateau known as 'Faheys Pit'. The Proponent proposes to increase the capacity of Faheys Pit to extract and to process up to 150,000 tonnes per annum of quarry material within an enlarged quarry footprint totalling 4.1ha and a total resource of about 1.8 million tonnes.

The purpose of this assessment is to evaluate the potential impacts of noise and vibration generated from the increase and to provide recommendations to mitigate any potential impacts that might have an effect on any sensitive receptors.

Noise levels are predicted to comply with all applicable noise sensitive receptors. It is acknowledged NSR 5 have an agreement with the Quarry operator accepting the noise emissions at the dwelling on the property.

Traffic noise levels associated with the increase in extraction along the existing approved haul route is predicted to comply with the criteria without the need for mitigation treatment.

Vibration emissions during blasting are predicted to comply provided the MIC quantities remain consistent with previous blast results (refer to Blast report ref: Civil Blast_FR007_Post Blast Report). Vibration emissions during normal operation are predicted to comply largely due to the substantial distance between the site and the nearest receptors.

Table of Contents

1 Introduction

1.1 Overview

Vipac Engineers and Scientists Ltd (Vipac) was engaged by Outline Planning Consultants Pty Ltd on behalf of Sheridan's Hard Rock Quarry (the Proponent) to prepare noise impact assessment to support a development consent for the continuation and expansion of a small quarry at Tyringham on the Dorrigo Plateau known as 'Faheys Pit'. The Proponent proposes to increase the capacity of Faheys Pit to extract and to process up to 150,000 tonnes per annum of quarry material within an enlarged quarry footprint totalling 4.1ha and a total resource of about 1.8 million tonnes (the Project). It is also proposed to deepen the existing quarry.

The purpose of this assessment is to evaluate the potential impacts of noise and vibration generated from the Project and to provide recommendations to mitigate any potential impacts that might have an effect on nearby sensitive receptors.

1.2 Study Objectives and Requirements

The NSW Environment Protection Authority (EPA) has considered the details of the proposals as provided by the Department of Planning, Industry and Environment (DPIE) and identified the information it requires to issue its general terms of approval. The key requirements specified in relation to noise and vibration and how the requirements are addressed within this document are summarised in Table 1-1.

The purpose of this assessment is to evaluate the potential impacts of noise and vibration generated from the Project which addresses the specific EPA requirements and provide recommendations to mitigate any potential impacts that might have an effect on nearby sensitive receptors.

Table 1-1 - Summary of EAR 1722

Requirements	How Requirement is Addressed
Noise – including a quantitative assessment of potential: - construction and operational noise and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Noise Policy for Industry and NSW Road Noise Policy respectively; - reasonable and feasible mitigation measures to minimise noise emissions; and - monitoring and management measures;	Operational noise (including transport noise) assessment results are compared against the Noise Policy for Industry and NSW Road Noise Policy criteria in Section 4.2 and presented in Section 8.2. Construction noise associated with quarry and mining is not covered by the Interim Construction Noise Guideline (in accordance with Section 1.2 of the Guideline). Instead it states construction noise for quarries is assessed under the Noise Policy for Industry. Construction noise is addressed in 'Scenario 1 – Stage 1 Road and Sediment Basin Establishment' throughout the report.
Blasting & Vibration – including: - proposed hours, frequency, methods and impacts; and - an assessment of the likely blasting and vibration impacts of the development, having regard to the relevant ANZECC guidelines and paying particular attention to impacts on people, buildings, livestock, infrastructure and significant natural features;	Vibration from Quarry operation is addressed in Section 7.1. Blasting and overpressure is addressed in Section 7.2.

2 Project Description

2.1 Site Location

The quarry comprises land within a rural property in the Clarence Valley Local Government area (LGA) comprising Lot 31 in Deposited Plan (DP) 1203488, at No.9720 Armidale Road, Tyringham NSW 2453, having an area of 11.46ha (Project Site). The internal access route to the quarry connects directly with Armidale Road. To the west of the quarry is a rural property comprising Lot 32 DP 1203488, with the Hyland State Forest located to the north. Adjoining the quarry to the east is an existing sawmill and dwelling, on Lot 2 DP 1139996, and a local council quarry pit, known as 'Ellis' Pit', on Lot 1 DP 1139996. The local council quarry pit extends both into the Project Site as well as the Hyland State Forest. The Project Site location, approximate quarry footprint and access route are illustrated in Figure 2-1 and Figure 2-2.

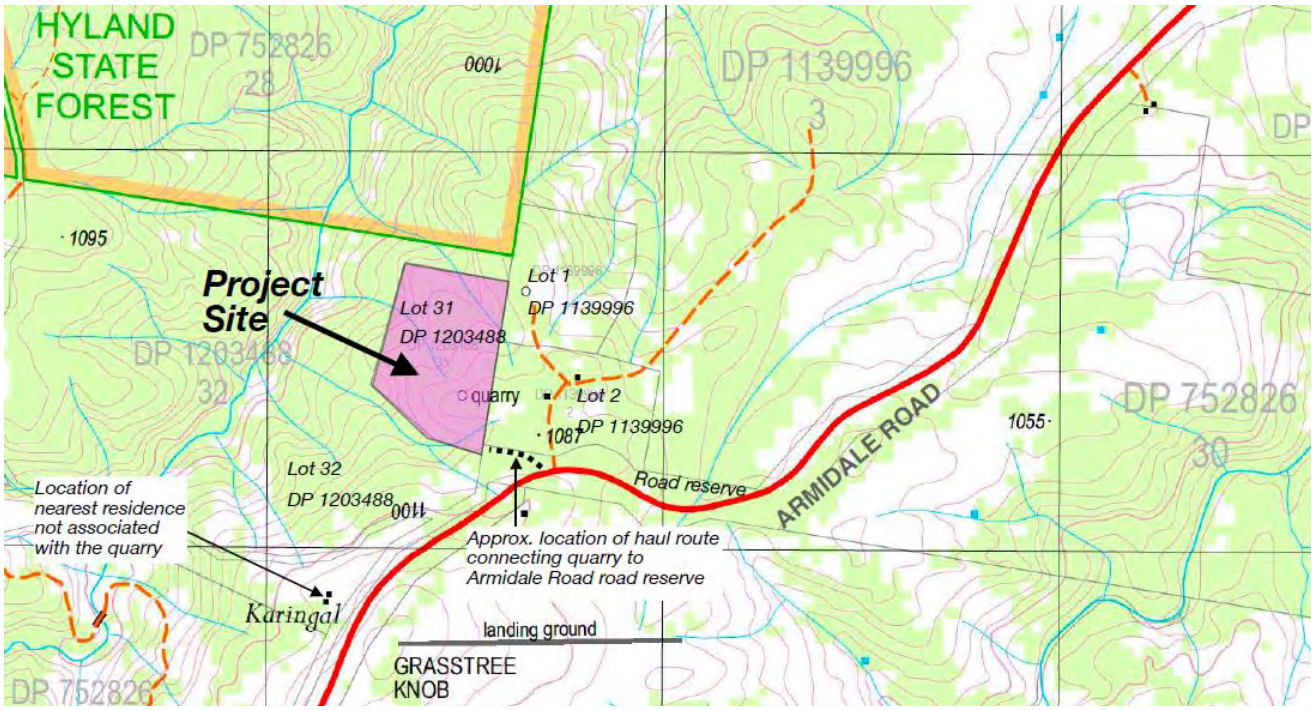

Figure 2-1: Project Site Location

Figure 2-2: Project Site Location – Aerial

2.2 Noise Sensitive Receptors

The locality is sparsely populated, with the nearest rural residences described in the following:

- NSR1 - The quarry is approximately 550m to the north-east of the nearest rural dwelling not associated with the quarry: 'Karingal', on Lot 32 DP 1203488 at No. 9722 Armidale Road, Tyringham.
- NSR2 - The quarry is approximately 1.1km to the north-east of the next nearest rural dwelling not associated with the quarry, on Lot 18 DP 752826 at No. 134 Armidale Road, Tyringham.
- NSR3 - The quarry is approximately 1.8km to the WSW of the next nearest rural dwelling not associated with the quarry, on Lot 30 DP 752826 at No. 9435 Armidale Road, Tyringham.

- NSR4 - The quarry is approximately 2km to the south-west of the next nearest rural dwelling not associated with the quarry: 'Ring Tree', on Lot 3 DP 1139996 at No. 9408 Armidale Road, Tyringham.
- NSR5 - The sawmill adjoining Faheys Pit, on Lot 2 DP 1139996 No. 9630 Armidale Road, also has a residence located about 140m from the quarry pit on Faheys Pit, however, it is a use associated with the quarry.

The locations of the nearest potentially affected noise sensitive receivers to the quarry are shown in Figure 2-3.

Figure 2-3: Sensitive Receptor Locations

2.3 Quarry Operation

2.3.1 Existing Operation

The current quarry operations at Faheys Pit may be summarised as follows:

- Clearing of land ahead of extraction.
- Ripping of weathered quarry resource and blasting of unweathered (hard) rock.
- Loose rock is then transported from the worked quarry face to the mobile (temporary) processing plant, where it is then crushed and screened, prior to being transported off-site.
- Transport of quarry product from the site via the internal haul route back onto Armidale Road i.e. product sales out the gate.

The Project Site does not contain any existing infrastructure, such as buildings or fixed plant, save for the road access back from the quarry pit to Armidale Road. All quarry processing plant is currently brought into the site on a campaign basis, as required.

It should be noted that existing operations have only recently commenced by the current operator, and the quarry has yet to conduct any blasting. As a result there is no existing blast monitoring data available from the current owners. No data has been made available by the previous owner/operator.

2.3.2 Proposed Operation

It is proposed to regularise the use of the site as a quarry at the same time as seeking approval for a lateral extension of the quarry with an increased rate of extraction of up to 150,000 tonnes per annum. The ultimate size of the resource will be determined following more detailed design; however, preliminary estimates indicate an additional resource of approximately 500,000 cubic metres-equivalent to about 1.3 million tonnes (Mt). The principal objective of the proposed development is to deepen and extend the extraction area so as to extend the life of the quarry and to maximise winning of an important and valuable resource, enabling a continuation of the extraction and production of a range of road construction and allied quarry materials. The total quarry, including the land proposed for lateral extension, will have an area of approximately 4.1ha. Table 2-1 summarises the key project components.

Table 2-1: Key Project Components

Quarry component	Summary description
Extraction Method	Bulldozer used to remove weathered rock and topsoil for rehabilitation, with drill and blast used for unweathered rock.
Resource	Weathered and unweathered siltstone, rare lithofeldspathic wacke and conglomerate, comprising Moombil Siltstone geology.
Disturbance area	A lateral expansion of existing quarry to include all cleared areas, with extraction of up to about 42 metres in depth. Total quarry area approximately 4.1ha.
Processing	Crushing and screening of unweathered and weathered siltstone material. Processing plant to be brought in to the site on a campaign basis.
Annual extraction	Up to 150,000 tonnes per annum.
Transport	Access to the quarry from Armidale Road, the existing quarry haul route. It is anticipated that the quarry may generate up to 60 loaded quarry trucks per day.
Hours of operation	Limited to 7.00am to 6.00pm Monday to Friday (i.e. 11 hours operation per day) and 7.00am to 1.00pm on Saturdays (ie. 6 hours operation). Hours of blasting are to be restricted to 9.00am to 3.00pm Monday to Friday.

3 Existing Noise Environment

3.1 Noise Monitoring

Environmental noise monitoring took place at the most exposed sensitive receptor between May 26th and June 6th, 2022 using a Rion NL-22 environmental noise logger. The monitoring location is shown in Figure 3-1 and was chosen to avoid extraneous noise from the sawmill as much as possible. The noise logger was configured to measure instantaneous noise levels with a 'Fast' time weighting and 'A' frequency weighting over 15 minute intervals. A field calibration check was conducted for the microphone immediately before and after the measurement sequence, with no significant drift from the reference signal. The microphone was appropriately fitted with a windshield.

Table 3-1: Equipment List

Instrument	Serial Number	Next Calibration Date
Rion NL-22 Class 2 Sound Level Meter/Logger	001273564	02/06/2023
Ono Sokki SC-2120 Acoustic Calibrator	35100926	8/02/2023

Noise level data which has been affected by adverse weather conditions (i.e. winds > 5m/s and/or rainfall) is considered invalid and is excluded from analysis. During the monitoring period, wind speeds were greater than 5m/s were observed semi-regularly. As a result, Table 3-2 outlines the date and period which have been excluded due to higher wind speeds.

Table 3-2 - Adverse Weather Affected Monitoring Periods Excluded from Results

Date	Excluded Periods		
	Day	Evening	Night
26th May	N/A[1]		
27th May			
28th May			
29th May	Excluded	Excluded	
30th May	Excluded	Excluded	Excluded
31st May	Excluded	Excluded	Excluded
1st June	Excluded	Excluded	
2nd June			
3rd June		Excluded	Excluded
4th June	Excluded		
5th June			Excluded
6th June	Excluded	N/A[2]	N/A[2]

[1]Logger installed toward the end of the day period.

[2]Logger picked up during the day period – evening and night periods not recorded.

30 minute interval weather data was obtained from the nearest Bureau of Meteorology 30 minute data site at Armidale Airport AWS (station ID: 056238). Graphical representation of the monitoring results is available in Appendix E.

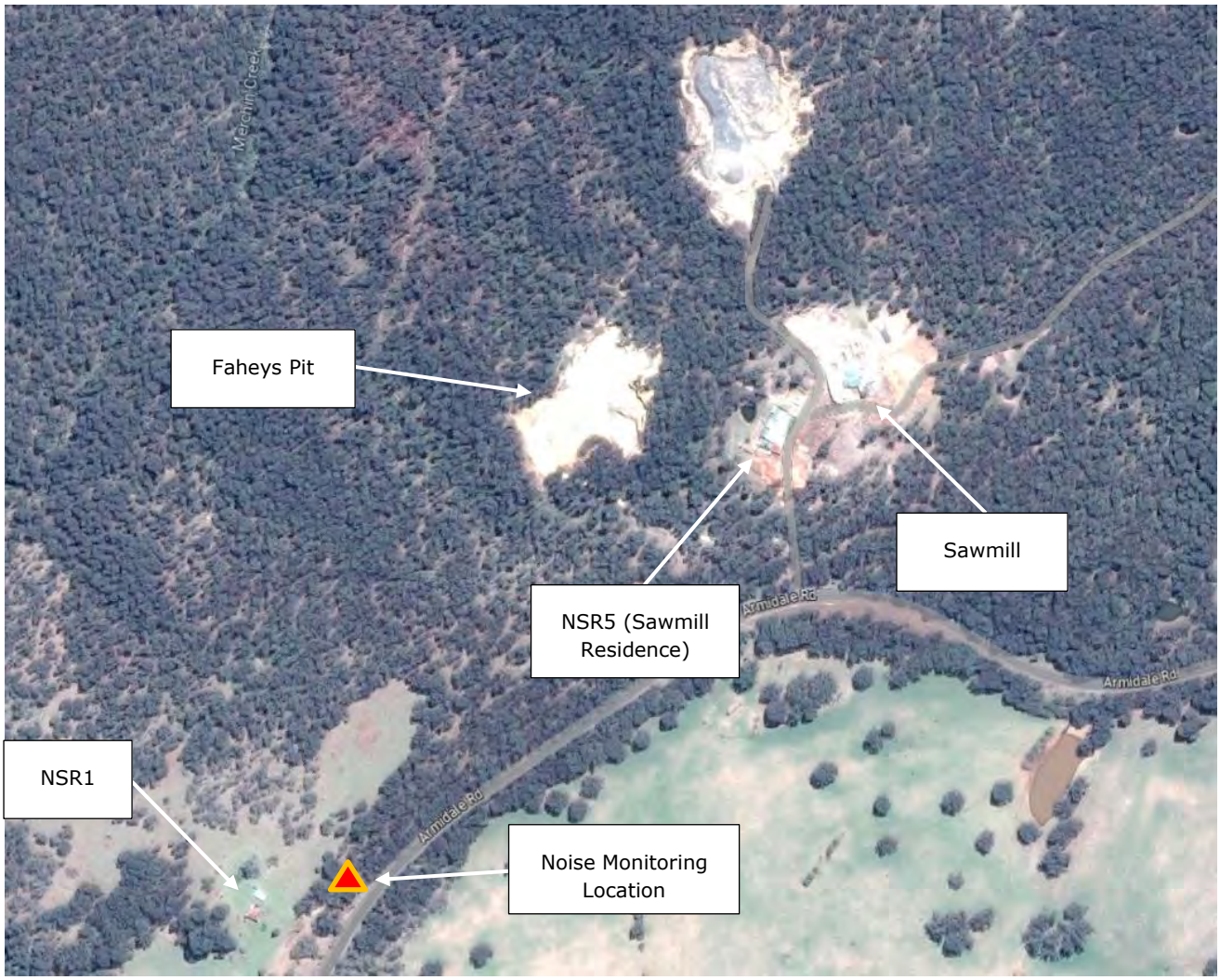

Figure 3-1 - Noise Monitoring Location

Table 3-3 presents a summary of the current noise monitoring levels at the monitoring location during the day, evening and night periods.

Table 3-3 - Noise Monitoring Results

Monitoring Location	Period	L_{Aeq}	L_{A90}	RBL
NSR1	Day	49	28	26
	Evening	43	34	26
	Night	42	33	26

4 Noise Criteria

The noise criteria are determined in accordance with the NSW Noise Policy for Industry (NPI, 2017), the NSW Road Noise Policy (RNP, 2011) and the NSW Interim Construction Noise Guideline (ICNG, 2009). Vibration criteria are determined in accordance with the NSW Assessing Vibration: A Technical Guideline (2006).

4.1 NSW EPA Noise Policy for Industry (NPI)

The project specific noise criterion limits the noise that a development can make in accordance with the *NSW Noise Policy for Industry 2017* (NPI) in order to limit the effects of the development on the existing noise sensitive receptors.

4.1.1 Project Specific Noise Criterion

The project specific noise criterion limits the noise that a development can make in accordance with the NSW Noise Policy for Industry (NPI) (2017) in order to limit the impact of the development on the existing noise sensitive receptors.

The NPI sets limits on the noise that may be generated by a wide array of facilities and includes guidance that is applicable for the assessment of potential noise impacts from the operational stages of developments. These limits are dependent upon the existing noise levels at the site and are designed to ensure changes to the existing noise environment are minimised and deal with the intrusiveness of the noise and the amenity of the environment. The most stringent of the limits is taken as the Project Specific Noise Level which is the most stringent of the amenity criteria or the intrusiveness criteria for the location.

The amenity criteria for this project are recommended acceptable $L_{Aeq,T}$ noise levels for residences in rural areas as provided in Table 2.2 of the NPI. Amenity criteria are formulated to protect against cumulative impacts.

The intrusiveness noise criterion requires that the $L_{Aeq,15minutes}$ for the noise source, measured at the most sensitive receiver under worst-case conditions, should not exceed the Rated Background Level (RBL) by more than 5dB, represented as follows:

- $L_{Aeq,15minutes}$ < RBL+ 5dB

Noise levels associated with the quarry at nearby noise sensitive receptors (located in the surrounding area) should not exceed the Project Specific Noise Levels detailed in Table 4-2 which have been determined from the lower of the amenity and intrusiveness criteria.

4.1.2 Amenity Noise Criterion

The amenity criterion is specific to land use and associated activities. It aims to limit continuing increases in noise levels. The maximum ambient noise level within an area should not exceed the acceptable noise levels specified in Table 4-1.

Table 4-1: Amenity Noise Levels

Receiver	Noise Amenity Area	Time of Day	L_{Aeq}, dB(A)
Residential	Rural	Day (7am-6pm)	50
		Evening* (6pm-10pm)	45
		Night* (10pm-7am)	40

*The Quarry proposes to operate under the existing operating hours (7am-6pm). Therefore, only the day period has been considered for assessment.

4.1.3 Intrusiveness Noise Criteria

The intrusiveness criterion states that the equivalent continuous noise level of the source should not be more than 5 decibels above the rated background level when measured over a 15 minute period. It aims to control intrusive noise impacts in the short term for residences.

$$L_{Aeq,\ 15\ minute} \leq \text{rating background level} + 5\ dB$$

4.1.4 Project Specific Noise Levels

The project specific noise criterion was determined in accordance with the NPI using background data logged at the most exposed noise sensitive receptor.

Table 4-2: Project Specific Noise Levels (dB (A))

Receptor	Time of Day	Rating Background Level (RBL)	Intrusiveness Criterion	Amenity Criterion	Project Specific Noise Level
All	Day	35*	40	50	**40**

*NSW NPI states that where the rating background noise level is found to be less than 35dB(A) for the daytime periods, then it is set to 35dB(A).

4.2 NSW Road Noise Policy (RNP)

The requirements of the *NSW Road Noise Policy 2011* (RNP) are applicable to this assessment. Table 4-3 summarises the road category to establish the noise assessment criteria based on the type of roads proposed for use. The proposed expansion will generate additional traffic on nearby public roads. The addition of quarry trucks on the existing haul route could potentially impact on the nearby noise sensitive receivers.

Therefore, the criteria for the applicable categories of the roads surrounding the project site are detailed in Table 4-3 and Table 4-4.

Table 4-3 - Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of project / land use	Assessment Criteria/ Target Noise Level, dB(A)	
		Day (7am-10pm)	Night** (10pm-7am)
Local Roads*	Existing residences affected by additional traffic on existing local roads generated by land use developments.	**$L_{Aeq,\ (1\ hour)}$ 55 (external)**	*$L_{Aeq,\ (1\ hour)}$ 50 (external)*
Freeway/arterial/sub-arterial Road (Armidale Road)	Existing residences affected by additional traffic on existing local roads generated by land use developments.	**$L_{Aeq,\ (15\ hour)}$ 60 (external)**	$L_{Aeq,\ (9\ hour)}$ 50 (external)

Note: These criteria are for assessment against façade- corrected noise levels when measured in front of a building façade. Hence, a correction factor of 2.5 dB is added to the predicted noise levels
**The quarry only operates during the daytime period only; night-time criteria is therefore not applicable.
*Principal haulage routes are to be assessed against the criteria for arteria/sub-arterial roads in accordance with Section 2.2.2 of the RNP.

In addition to the criteria detailed in the table above, the magnitude of increase in the total traffic noise level at a location due to a proposed project or traffic-generating development must be considered. Residences experiencing increases in total traffic noise level above the relative increase criteria in Table 4-4 should also be considered for mitigation.

Table 4-4 Relative Increase Criteria for Residential Land Uses

Road Category	Type of project / land use	Total traffic noise level increase, dB(A)	
		Day (7am-10pm)	Night (10pm-7am)
Freeway/arterial/sub-arterial Road	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	**Existing traffic $L_{Aeq,\ (15\ hour)}$ + 12 dB (external)**	*Existing traffic $L_{Aeq,\ (9\ hour)}$ + 12 dB (external)*

A relative increase of 12 dB represents slightly more than an approximate doubling of perceived loudness (AS2659.1–1988) and is likely to trigger community reaction, particularly in environments where there is a low existing level of traffic noise.

4.3 Vibration Criteria

The NSW DEC guideline *Assessing Vibration: A Technical Guideline* (2006) is based on guidelines contained in British Standard BS 6472-2008 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

The guideline provides preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. At vibration values below the preferred values, there is a low probability of adverse comment or disturbance to building occupants. Where all feasible and reasonable mitigation measures have been applied and vibration levels are still beyond the maximum level, it is recommended the operator negotiate directly with the affected community.

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria. Table 2.1 of the DEC guideline provides examples of the three vibration types and are summarised as continuous vibration, impulsive vibration and intermittent vibration. The relevant type of vibration for this project is intermittent vibration. Intermittent vibration (as defined in the DEC guideline) is assessed using the vibration dose concept which relates to vibration magnitude and exposure time. Intermittent vibration is representative of activities such as impact hammering, rolling or general excavation work (such as an excavator tracking). Section 2.4 of the guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted root mean square (rms) acceleration levels over the frequency range 1 Hz to 80 Hz; the criteria are presented in Table 4-5.

Table 4-5: Acceptable Vibration Dose Values (VDV) for Intermittent Vibration ($m/s^{1.75}$).

Location	Daytime (7am-10pm), VDV		Night time (10pm-7am), VDV	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60
Critical areas (e.g. hospital operating theatres)	0.10	0.20	0.10	0.20

Structural vibration criteria for building damage due to blasting is considered the same as that induced by transient groundborne vibration due to general construction activities. Vibration levels for potential building damage contained in *British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* are referenced in *British Standard BS 5228-2:2009* and *Australian Standard AS 2187.2:2006*. The vibration levels in BS 7385-2:1993 are adopted as building damage criteria from construction activities and are shown as follows:

TABLE J4.4.2.1

TRANSIENT VIBRATION GUIDE VALUES FOR COSMETIC DAMAGE (BS 7385-2)

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structure. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

NOTES:

1 Values referred to are at the base of the building.

2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

5 Noise Modelling

Noise modelling has been undertaken using the SoundPLAN 8.2 computational noise modelling software package. The use of the SoundPLAN software and referenced modelling methodology is accepted for use in the State of NSW by the EPA for environmental noise modelling purposes. Vipac have undertaken numerous noise modelling and impact assessments previously using SoundPLAN for a range of projects, including infrastructure development and industrial projects.

5.1 Noise Modelling Scenarios

Noise modelling has been conducted of the following scenarios to determine noise impacts at various stages of the project:

- Scenario 1: Stage 1 – Road and Sediment Basin Establishment.
- Scenario 2: Stage 1 - Quarry Operation.
- Scenario 3: Stage 2 'Final Stage' – Quarry Operation.

5.2 Geographical Data

Outline Planning Consultants supplied topographical details of the current pit to Vipac. Table 5-1 below lists the drawings received and used in the noise prediction model.

Table 5-1 – Terrain Data Used

Drawing Title	Description	Date	Scenario
'Plan Showing Existing Quarry Lot 31 DP1203488 at 9720 Armidale Road Tyringham'	1m Contours	08/04/2022	1
'Faheys Pit Conceptual Design – Stage 1'	Stage 1 Design Levels	01/05/2023	2
'Faheys Pit Conceptual Design – Final Stage'	Final Stage Design Levels	22/06/2023	3

Terrain data of the surrounding areas extending to the nearest receptors was obtained from Google Earth and was spliced with the data from Table 5-1 to create a complete model of the pit and surrounding area.

5.3 Noise Sources

Details of the plant and equipment that will be used during the operation of the Quarry has been provided by the Quarry operator and is detailed in Table 5-2. Sound Power Levels (SWL) have been taken from measurements previously conducted by Vipac of similar Quarry machinery.

Table 5-2 - Sound Power Levels of Site Machinery Items (Lw).

Description	Sound Power levels, L_w (dB(A))	Sound Power Reference Source Measurement	Scenarios Utilised
Current Machinery at Quarry			
J50 McCloskey Jaw Crusher	114	Terex Finlay I1312 Impact Crusher*	2,3
Cone/Screen	121	Terex Finlay 683 Supertrak 12x5 Screen*	2,3
20 tonne Wheeled Loader (Cat 962M)	99	Caterpillar IT6T2H Wheeled Loader*	2,3
30 tonne Excavator	103	BS5228-1:2009, Table C2	1,2,3
Caterpillar D6 Dozer	115**	Caterpillar D8T Dozer*	2,3
Haul Truck	91	Kenworth Rigid Tipper***	1,2,3

*Measured by Vipac at a regional NSW Quarry on 7th June 2022.

**a positive 5dB(A) correction has been applied to the D6 dozer source to account for potential impulsivity commonly observed from the metal tracks as the dozer moves forward and reverse. It should be noted impulsivity caused by the tracks was observed during the measurement of the D8T dozer.

***Measurement conducted by Vipac from previous noise surveys involving a Kenworth Rigid Tipper driving at low speeds.

All noise sources have been modelled as operating simultaneously for 100% of the time over the 15 minute assessment period.

Predicted octave band results (shown in Appendix C) show no tonality at any receptor. Additionally, no intermittency characteristics were observed when conducting the attended measurements of the Quarry plant and equipment on site. As a result, noise from the Quarry:

- Does not exhibit any prominent (tonal) sound frequency that would have the potential to result in greater annoyance;
- Does not exhibit any notable, intermittent fluctuations (i.e. does not increase rapidly by 5-10dB, depending on time of day, on at least two occasions during a 30 minute period, then maintaining that noise level for at least 60 seconds) that would have the potential to result in greater annoyance; and
- Does not exhibit any impulsive characteristics that would have the potential to result in greater annoyance, with the exception of the Dozer.

5.3.1 Noise Source Locations

Locations of quarry equipment are shown in Figure 5-1 to Figure 5-3 for each modelled scenario. Note – Road and Sediment Basin Establishment has been shown on the Stage 1 plans to provide context of the source location in relation to the road and sediment base location.

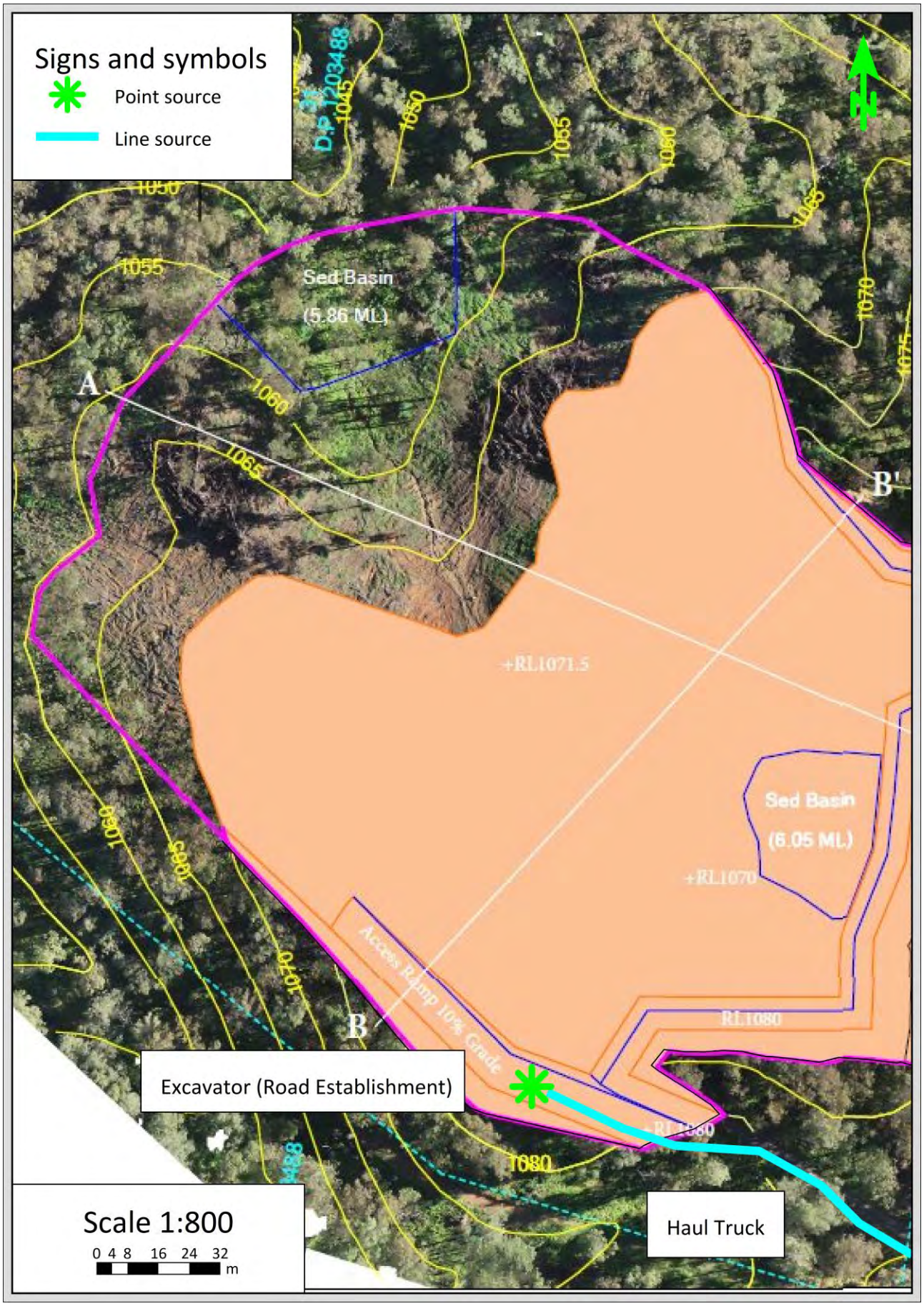

Figure 5-1 - Source Location – Scenario 1 'Stage 1 – Road and Sediment Basin Establishment'

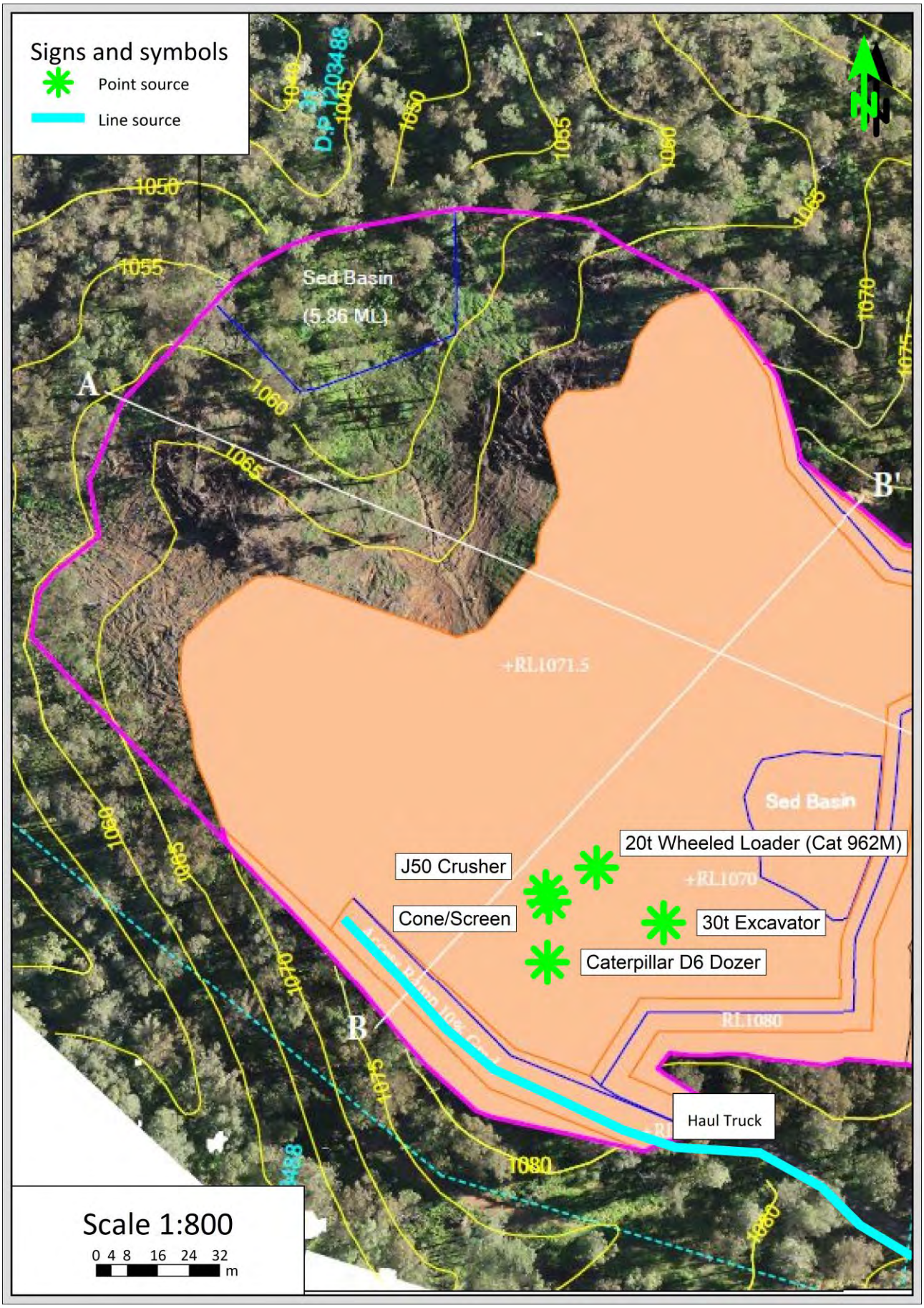

Figure 5-2 - Source Locations - Scenario 2 'Stage 1 Quarry Operation'

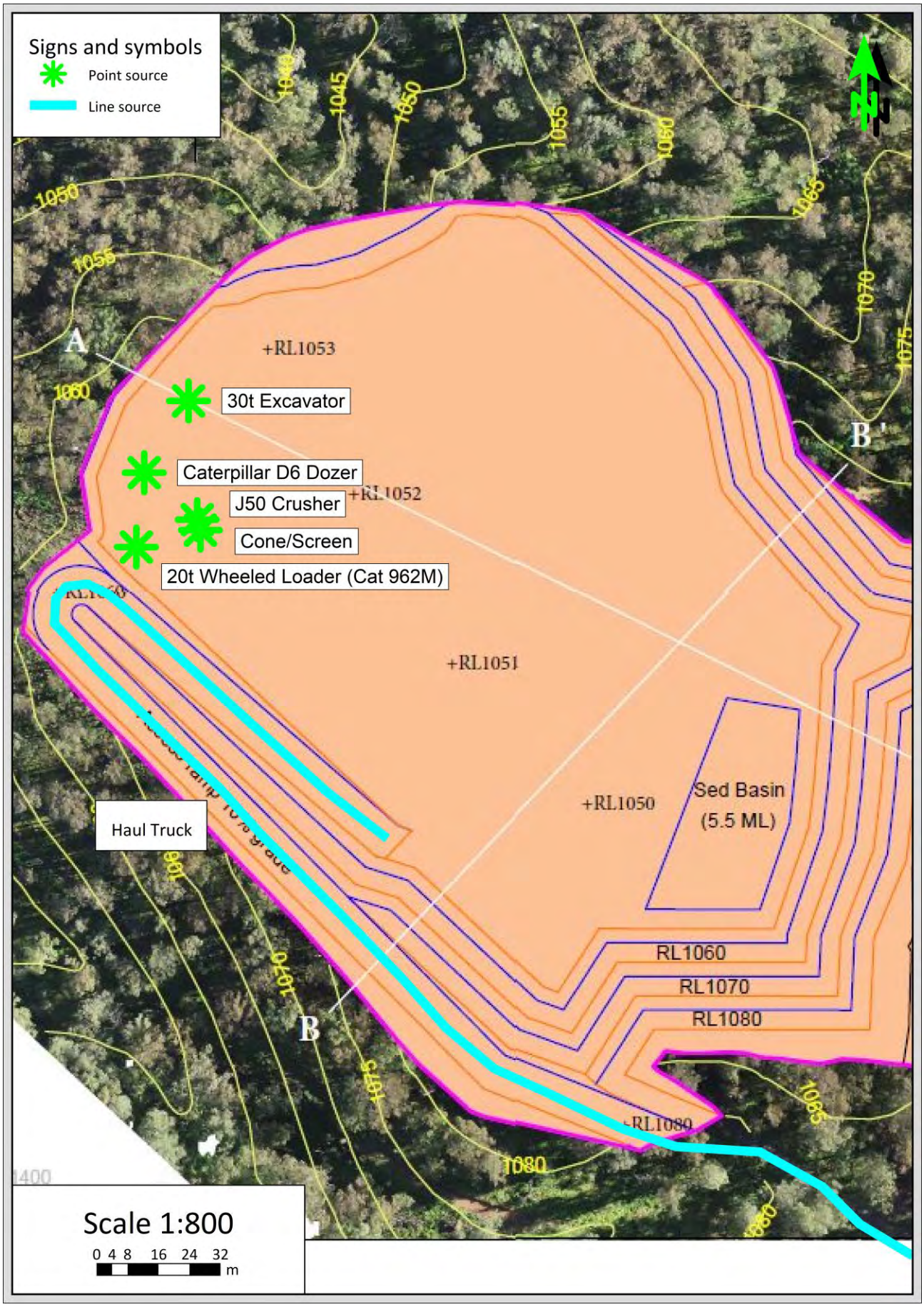

Figure 5-3 - Source Locations - Scenario 3 'Stage 2 Final'

5.4 Weather Conditions

Noise propagation over long distances can be significantly affected by the weather conditions, mainly source-to-receiver winds and temperature inversions, as both these conditions can increase noise levels at sensitive receptors.

The CONCAWE methodology can predict to one of six meteorological categories (CAT). To determine which category is modelled, the Pasquill Stability Classes need to be determined for the Quarry. For this assessment the weather conditions, including stability class frequencies at the Quarry have been obtained from The Air Pollution Model (TAPM). TAPM is a three-dimensional prognostic model developed and verified by Commonwealth Scientific and Industrial Research Organisation (CSIRO). TAPM data was generated for the air quality assessment has been used for uniformity. The wind parameters were compared for the Bureau of Meteorology (BOM) and TAPM data and were found to be very similar.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance the motion of noise. The Pasquill-Gifford Stability Classes define the amount of turbulence in the air, of which the most widely used categories are Classes A-F. The TAPM generated meteorology determined the stability class for each hour of the year. The frequency of each stability class occurrence is shown in Table 5-3. Temperature inversions are defined as Class F. These conditions only occur with clear and calm conditions during the evening and night time periods. During temperature inversions noise emissions from distant sources can be amplified.

Table 5-3: Annual Stability Class Distribution Predicted [TAPM, 2019]

Stability Class	Description	Frequency of Occurrence (%)	Average Wind Speed (m/s)
A	Very unstable low wind, clear skies, hot daytime conditions	2.5	1.8
B	Unstable clear skies, daytime conditions	19.6	2.4
C	Moderately unstable moderate wind, slightly overcast daytime	17	2.5
D	Neutral high winds or cloudy days and nights	14.5	4
E	Stable moderate wind, slightly overcast night-time conditions	10.9	3.5
F	Very stable low winds, clear skies, cold night-time conditions	35.5	1.8

The long term wind roses recorded daily at the Dorrigo station at 9am and 3pm are provided in Figure 5-4. Winds are shown to be primarily from the south and north at 9am and from the south and southeast directions at 3pm. Stronger winds (>40km/hr or >11.1m/s) are extremely rare.

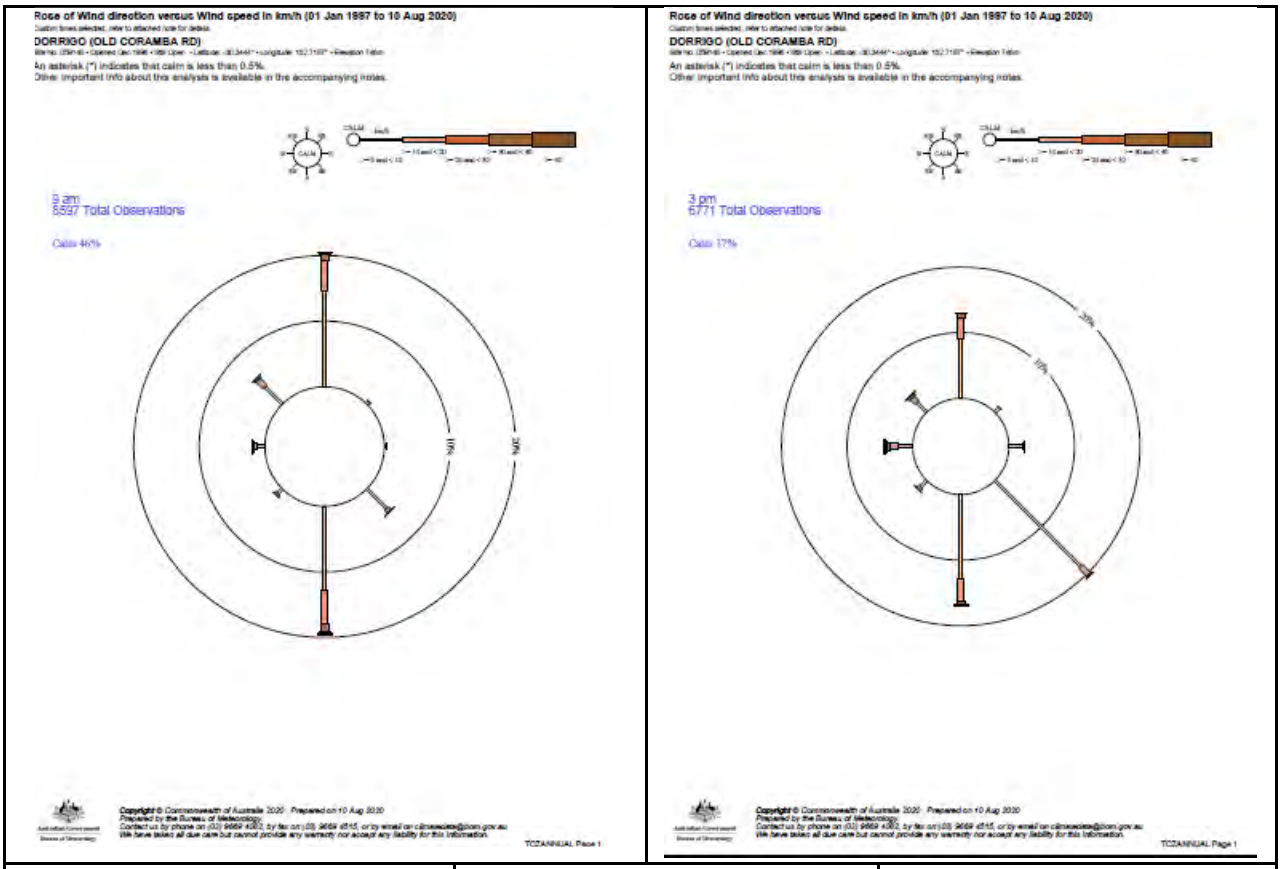

Figure 5-4: Annual wind roses for Dorrigo Weather Station (1997 to 2020)

5.4.1 Modelled Weather Scenarios

For the purposes of providing a worst case assessment, source to receptor winds have been applied to all receivers surrounding the Quarry.

Stability classes A, B, and C are associated with an unstable atmosphere and are generally unfavourable for noise propagation. Condition D is a neutral condition for noise propagation while conditions E and F are unfavourable as stable conditions further facilitate noise propagation.

Taking into consideration the time of day the Quarry currently operates and is proposing to operate, the following weather scenarios have been assessed:

Average/Neutral Climatic Conditions:

- Class D (average/neutral) conditions occur for more than 38% of the time. Class D has been modelled for the average climatic condition scenarios for day, with 0m/s wind speeds.

Worst Case Climatic Conditions:

- Worst case climatic conditions during the day period have been assessed as per Class D, but with 3m/s wind speeds.

6 Traffic Noise Impact Assessment

6.1 Traffic Noise Impact Methodology

The Calculation of Road Traffic Noise (CoRTN) method of traffic noise prediction has been used, which is a method approved by the EPA. The traffic data presented in the Traffic Impact Assessment (by StreetWise Road Safety & Traffic Services) demonstrates the quarry will generate an additional 60 laden truck movements per day on the surrounding road network

The assessment considers two worst-case scenarios:

- All (i.e. existing and proposed increase = 120 laden trucks) quarry truck movements on the existing haul route.
- The proposed increase (i.e. additional 60 laden trucks) on the existing approved haul route.

Existing and future traffic volumes are currently below the minimum threshold for CoRTN to predict road traffic noise levels reliably. Section 2, paragraph 30 of CoRTN stipulates that a minimum of 1,000 vehicles in an 18-hour period are required to predict noise levels (inclusive of a low traffic flow correction). Calculations using traffic flow data that is below 1,000 vehicles in an 18-hour period are considered unreliable, and CoRTN recommends noise measurements be conducted when evaluating such cases.

Noise measurements of the surrounding road network have not been undertaken, however, as a proof of concept, the low traffic flow correction that results from calculating noise impacts from a road with a minimum AADT of 1,100 (18 hour volume of 1,034) has been applied to the predicted results for this assessment.

It is noted that this correction is conservative, as a low traffic flow correction decreases as traffic flow numbers increase. For example:

- The low traffic flow correction is applicable to roads with 1000 to 4000 vehicles in an 18-hour period.
- The low traffic flow correction for 1,034 vehicles (mentioned above) equates to a -2dB(A) correction.
- As the traffic flow increases, the correction reduces i.e. 4,000 vehicles equates to no correction required.
- As the existing and future numbers are below 1,000, it is expected that should a correction be applied for these numbers, it would be greater than a -2dB(A) correction, and therefore a -2dB(A) correction applied to these values is considered conservative.

The increased number of quarry trucks utilising the road (as per Table 4.11 of the Streetwise report) compared with the existing traffic volumes on the surrounding road network (as per Section 3.1 of the StreetWise report) has been reproduced below in Table 6-1**.**

Table 6-1 – Current Traffic Volumes Alongside Additional Quarry Truck Movements Per Day from the Quarry.

Haul Route	Road	Existing 2022 Daily Traffic Volumes	Additional Total Quarry Truck Movements per day	Future Daily Traffic Volumes (Existing + Additional + 2034 adjustment*)
Existing Haul Route	Armidale Road	470	120	610

*As per section 4.6 of the Streetwise Traffic Report.

6.1.1 Traffic Noise Impact Calculation Parameters

The worst-case scenario of a maximum of 120 additional truck (i.e. laden and unladen) movements has been assessed under two scenarios:

- All trucks enter from, and exit to the north; and
- All trucks enter from and exit to the south.

Assessing these two scenarios accounts for a worst case scenario where 100% of the truck movements pass by any given sensitive receptor, whether they be north or south of the quarry, where in reality, the movements in and out of the quarry will be split heading north and south (it is noted the Traffic Report assumes at 90% south, 10% north split). It is more likely that the quarry truck movements would be dictated by supply location, effectively dispersing the movements more evenly. This displacement is likely to reduce potential noise impacts on the nearest sensitive receptors, when compared to the worst-case predictions.

Vipac has conducted initial noise calculations for the two worst-case scenarios detailed above. The traffic noise assessment has also taken into account the following assumptions:

- L_{Aeq} values were calculated from the L_{A10} values predicted by the CoRTN algorithms using the well-validated approximation of $L_{Aeq} = L_{A10} -3$.
- Previous research in Australia has established a negative correction to the CoRTN predictions of -1.7dB for façade-corrected levels. This correction for Australian conditions has been included in this assessment.
- A low traffic flow correction (mentioned previously) of -2dB(A) to the existing and predicted results.
- A conservative assumption of 94% of the AADT values to occur within the 15-hour daytime period.
- Calculated speed limits of the following:
    - Armidale Road – 100km/hr posted speed limit.
- A heavy vehicle percentage of approximately 20%.
- Distance attenuation to the nearest sensitive receptors to each road:
    - NSR1 - approx. 170m from the nearest road edge.
    - NSR2 - approx. 76m from the nearest road edge.
    - NSR3 - approx. 94m from the nearest road edge.
    - NSR4 - approx. 71m from the nearest road edge.
    - NSR5 - approx. 81m from the nearest road edge.
- An angle of view of 160 degrees.
- A conservative assumption of 50% soft ground absorption.
- No correction of grade or road surface.
- Sensitive Receptors have direct, unobstructed line of sight to the roads, with no shielding from intervening structures applicable.
- Receptor heights modelled at 1.8m above ground, 1m from the façade (i.e. façade-corrected).

Potential vibration levels from quarry truck movements are likely to be less than 0.5 mm/s PPV (Peak Particle Velocity) for receptors along the adjacent public roads, which is well below all accepted criteria for structural damage and human comfort from ground borne vibration.

7 Vibration Impact Assessment

7.1 Operational Vibration (Non-Blasting)

Both continuous/quasi-continuous and intermittent vibration has been considered. Most machinery items are likely to generate some continuous or quasi-continuous vibration during their operation, and some intermittent or transient vibration could be caused by machinery during start-up compaction (and possibly during loading of trucks).

Ground-borne vibration resulting from activities on site are compared against the applicable criteria relating to human comfort and potential structural damage (usually in terms of Peak Particle Velocity, PPV). The recommended limits or guide values (refer Section 4.3) for transient vibration to ensure minimal risk of cosmetic damage to residential buildings (and community buildings) are in the range 15 to 20 mm/s PPV (depending on the frequency), with higher limits of 50 mms/ for industrial buildings. The stipulated human comfort criterion (lower limit) for vibration is typically 1 mm/s PPV (to an upper limit of 2 mm/s).

The ground vibration predictions for machinery were based on previously measured data by Vipac or sourced data for mobile plant from various vibration databases and literature references (Ref: *Ground Vibration Engineering* (Srbulov, 2010), *Construction Vibrations* (Dowding, 2000), CALTRANS *Construction Vibration Manual* (US CALTRANS, 2013), US FTA *Transit Noise & Vibration Manual* (2018)).

The calculation formulae used for ground vibration predictions (in terms of Peak Particle Velocity, V_{PPV} in mm/s) for vibratory compaction rollers (as a worst case example) are given as follows (Ref: BS 5228-2; Hiller & Crabb, 2000):

Table 7-1 :Ground Vibration Prediction Formulae

Normal compaction passes:	$V_{PPV} = ks * n^{0.5} * (A/(x+w))^{1.5}$	[mm/s]	ks	75	50% exceedance probability
			ks	143	33% exceedance probability
			ks	276	5% exceedance probability
Transient startup/shutdown:	$V_{PPV} = kt * n^{0.5} * (A^{1.5}/(x+w)^{1.3})$	[mm/s]	kt	65	50% exceedance probability
			kt	106	33% exceedance probability
			kt	177	5% exceedance probability
	x	distance along ground from roller to receiver (m)			
	n	number of vibrating drums in roller			
	A	nominal amplitude of vibrating roller (mm)			
	w	width of vibrating drum (m)			

** Note: The exceedance probability represents the level of conservatism in the predictions, where a 5% predicted level would be the most conservative or worst case situation (higher prediction) to represent the maximum level predicted for 95% of possible cases and therefore only 5% of cases likely to exceed the predicted level.*

A conservative prediction of the potential ground-borne vibration impacts associated with the proposed equipment on site has been made (primarily quasi-continuous vibration). Ground vibration levels (in mm/s PPV) from machinery items (e.g. excavator, crusher) are typically in the range of 0.1 to 1 mm/s at distances of 25 to 50 m. Truck traffic (over rough/irregular road surfaces) will typically generate ground vibration levels of 0.1 to 0.5 mm/s (or less) at distances of 25 to 50 m. Considering the nearest sensitive receptors are at far greater distances (>200m) away, predicted vibration levels would meet the human comfort criteria and are well below structural damage criteria for all nearby buildings.

7.2 Blasting Vibration and Airblast Overpressure

Ground vibration and airblast overpressure are two common environmental effects of blasting that can cause human discomfort and damage to buildings and other structures. The quarry is proposing to operate between 7am and 6pm Monday to Friday and 7am and 1pm on Saturdays, however blasting is only proposed between 9am and 3pm Monday to Friday.

Table 7-2 below details the results of the most recent blasting at Faheys Pit on the 31st of July 2023. A copy of the blast report is available in Appendix D. Vibration and overpressure monitoring of blasting operations with a Maximum Instantaneous Charge (MIC) of 55kg was undertaken in the locations detailed in Figure 7-1.

Figure 7-1 - Blast Monitoring Locations

Table 7-2 - Previous Measured Blasting Results for Faheys Pit

Criteria	**Blast 31st July 2023** **MIC 55kg**
Airblast Overpressure 115dB Linear Peak (Maximum of 120dB Linear Peak)	114.6 dB Linear Peak measured adjacent Sawmill at Monitor Location 1
	120.4 dB Linear Peak measured approx. 90m to the north at Monitor Location 2
Ground Vibration 5mm/second (Maximum 10mm/second)	4.22mm/s measured adjacent Sawmill at Monitor Location 1
	12.61mm/s approx. 90m to the north at Monitor Location 2

As the previous monitoring results demonstrate compliance can be achieved at the nearest sensitive receptor (i.e. the Sawmill Residence R1), it is expected that future blasting operations are expected to comply providing blasting parameters remain in line with previous blast conditions.

It is recommended for monitoring to occur with all future blasting operations to ensure compliance is achieved at the closest receptors.

8 Noise Modelling Results

8.1 Predicted Quarry Noise Levels

Noise prediction modelling has been carried out to assess the potential impact associated with the Quarry operations at the nearest noise sensitive receptors for the proposed operational scenarios.

The predicted noise levels representative of each scenario for both neutral conditions and worst-case conditions during the day period are presented in Table 8-1. These results been reproduced graphically as Noise Contour Maps and are shown in Appendix A.

Table 8-1 – Predicted Noise Levels: Daytime (dB $L_{Aeq\ 15min}$)

Scenario	Criteria	Scenario 1 Stage 1- Road and Sediment Basin Establishment		Scenario 2 Stage 1 – Quarry Operation		Scenario 3 Stage 2 'Final Stage – Quarry Operation	
Rec #		Neutral	Worst Case	Neutral	Worst Case	Neutral	Worst Case
NSR1	40	23	27	31	36	33	38
NSR2		<10	<10	18	23	12	17
NSR3		<10	<10	<10	15	<10	15
NSR4		<10	<10	<10	14	<10	13
NSR5		41	44	41	44	40	44

Noise levels are predicted to comply at the majority of receptors, with the exception of NSR5 (sawmill dwelling). It is acknowledged there is a current agreement between the Quarry operator and the owners of NSR5, acknowledging the predicted noise impacts. Therefore, the noise impacts on this receptor is accepted and not discussed further. Management measures are recommended in Section 9 for best practice noise management.

For reference, the individual contribution of each noise source at each NSR is shown in Appendix B for Stage 2

8.2 Traffic Noise Assessment Results

Calculations were conducted to assess the potential noise impacts associated with the additional quarry truck movements on the existing haul route.

Road traffic noise monitoring was not conducted as part of this traffic noise assessment, therefore validation of a traffic noise model used to predict noise levels at the nearest receivers cannot be undertaken, however, it is anticipated that existing traffic noise levels for all other receptors are below the current criteria for both local roads and principal haulage routes.

Table 8-2 below presents the traffic noise predictions for existing traffic, alongside future predicted traffic volumes at the nearest residential receptors.

Note that because noise levels of the existing traffic are unknown, the results are intended to provide a conservative indication based on a worst-case scenario of the sole use of heavy vehicles travelling to and from the site.

Table 8-2 – Cumulative Traffic Noise Impact Predicted Results

Noise Levels, $L_{Aeq,\ 15\ hour}$ dB(A)– façade corrected					
Receptor	Predicted Existing Traffic	Predicted Future Traffic	Criteria	Predicted Compliance?	*Maximum Difference* (Existing v Future) ≤2dB(A)*
NSR1	42	43.1	60	✓	*1.1*
NSR2	46.3	47.4		✓	*1.1*
NSR3	45.1	46.2		✓	*1.1*
NSR4	46.6	47.7		✓	*1.1*
NSR5	45.9	47		✓	*1.1*

*Only applicable for receptors where it is anticipated existing traffic noise levels already exceed the criteria.

8.3 Traffic Noise Summary

As stated in Section 3.4 of the Road Noise Policy, with regard to existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use development, any increase in total traffic noise level should be limited to 2dB above that of the corresponding existing noise level at any residential property. Considering the predicted existing traffic noise levels for each of the closest receptors on each road is below the criteria, this assessment is not applicable, although the increase has been included for transparency.

It can be seen in Table 8-2 that existing and future traffic noise levels at existing residential receptors are predicted to comply with the criteria without the need for acoustic mitigation.

Predicted noise levels at receptors along the existing haul route are also predicted to comply with the criteria, with minor increases in noise level of 1.1dB(A) at each location.

Given the increase in noise levels between existing and future traffic flow are also well below the relative increase criteria detailed in Table 4-4 (existing traffic + 12dB), the increased traffic from the proposed development is predicted to comply with the relevant road traffic noise criteria.

Therefore, traffic noise associated with the additional quarry truck movements on the proposed and existing haul routes associated with the quarry are predicted to comply with the criteria without the need for acoustic mitigation measures.

9 Mitigation Recommendations

Noise levels for the proposed operations have been predicted in neutral and worst case weather conditions and some exceedances are expected at NSR5. However, considering the owner of this property acknowledges these predicted exceedances in the form of an agreement with the quarry operators, no further acoustic mitigation is required for predicted compliance, as all other receptors in the vicinity of the quarry are predicted to comply during all scenarios and weather conditions.

Vipac offer the below management measures to be considered for best practice noise management strategies.

9.1 Operational Management Measures

General noise management measures that can be implemented into daily noise management plans can include:

- Monitoring of weather conditions and stop noisy plant when wind direction and speeds are conducive to exceeding the noise limits at NSR1.
- Constant community engagement and consultation to inform the nearest receptors of anticipated adverse impacts (i.e. community consultation days, monthly meetings, letter box drops, door knocking, information bulletins, etc.)
- Consideration of reduction in operation frequency of the crushing equipment;
- Installation of permanent noise monitoring devices on site to monitor noise impacts in real time, with the inclusion of alert exceedances in the form of email/SMS alerts to be received by the Quarry operators;
- Temporary noise monitoring at the nearest receptors in response to valid, unresolved complaints.

10 Conclusion

A noise impact assessment has been undertaken to support a development consent for the continuation and expansion of a small quarry at Tyringham on the Dorrigo Plateau known as 'Faheys Pit'. The Proponent proposes to increase the capacity of Faheys Pit to extract and to process up to 150,000 tonnes per annum of quarry material within an enlarged quarry footprint totalling 4.1ha and a total resource of about 1.8 million tonnes.

Future noise levels were predicted using SoundPLAN modelling software for the scenarios where crushing and ancillary equipment would operate during existing hours of operation during the day periods.

Noise levels are generally predicted to comply during all conditions with the exception of exceedances predicted at NSR5 in both neutral and worst case weather conditions. Agreements have been reached between the quarry operator and the owner of this property acknowledging the predicted noise impacts.

Noise from additional trucks entering and exiting the site and on the approved haul route were predicted and shown to be compliant with the appropriate criteria without the need for mitigation measures.

It is expected that noise emissions from the Quarry during operation can be adequately managed at the nearest noise sensitive receptors.

Appendix A Noise Contour Maps

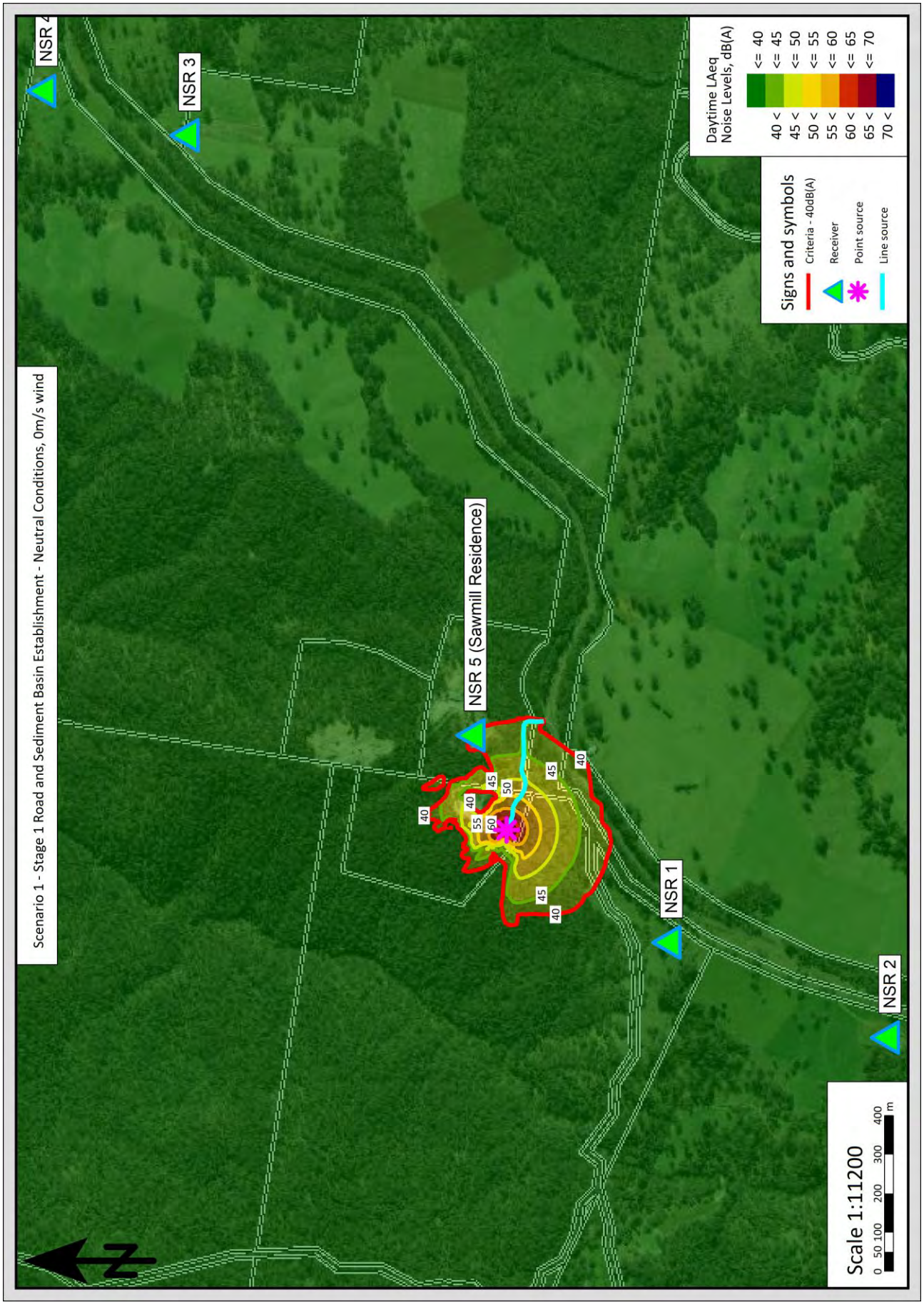

Figure A 1 – Scenario 1 – Stage 1 Road and Sediment Basin Establishment – Neutral Conditions

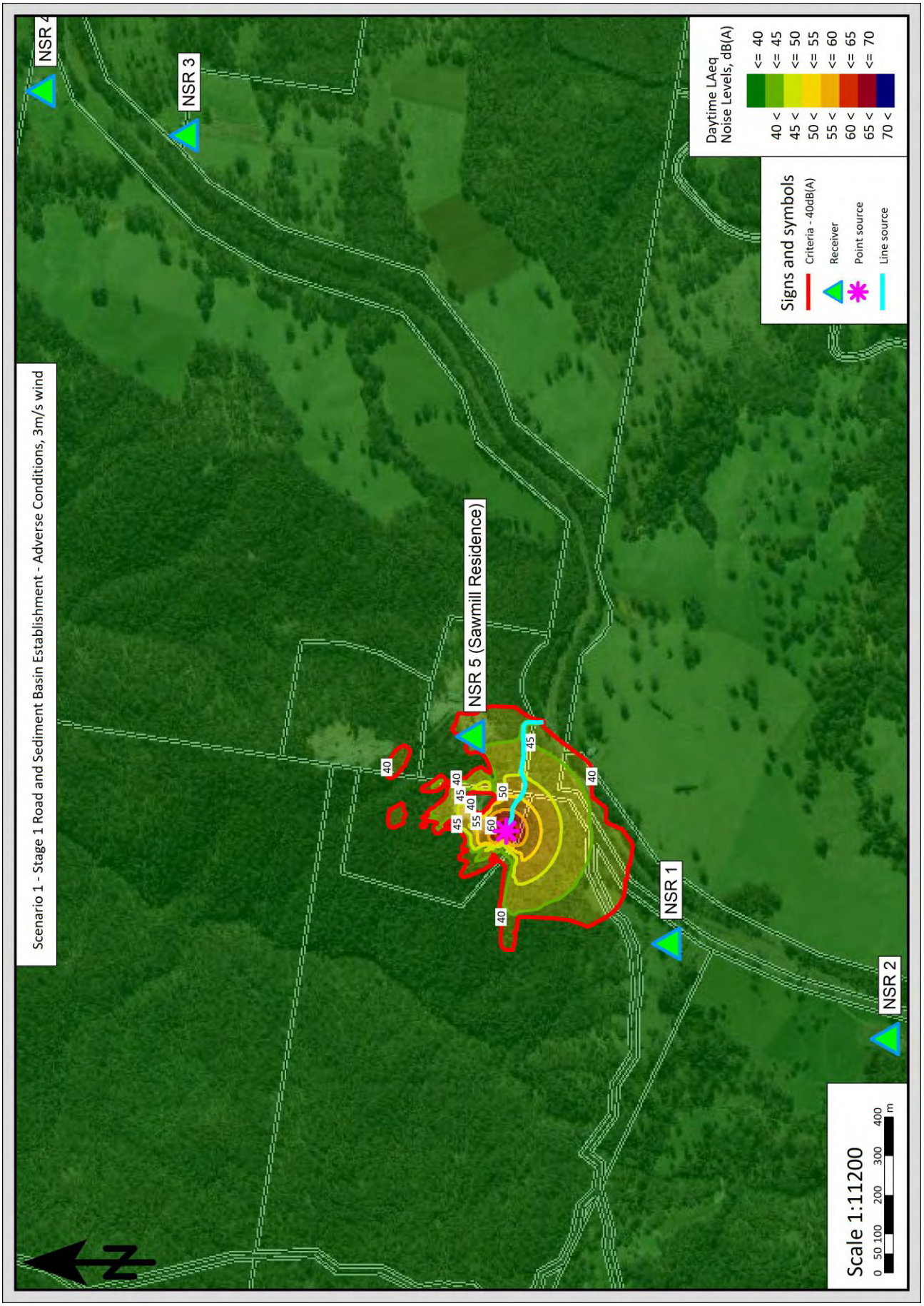

Figure A 2 - Scenario 1 – Stage 1 Road and Sediment Basin Establishment – Adverse Conditions

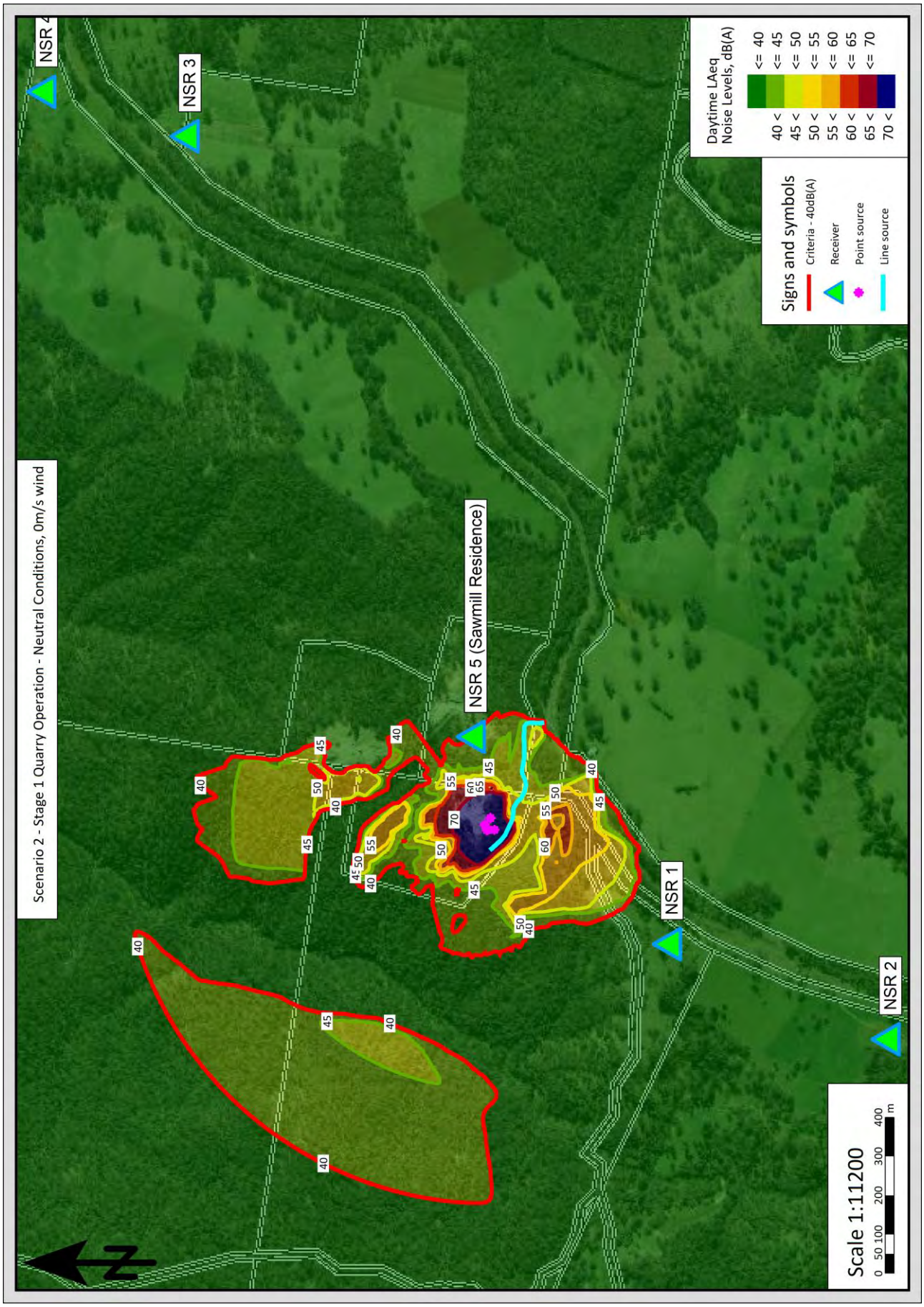

Figure A 3 - Scenario 2 - Stage 1 Quarry Operation - Neutral Conditions

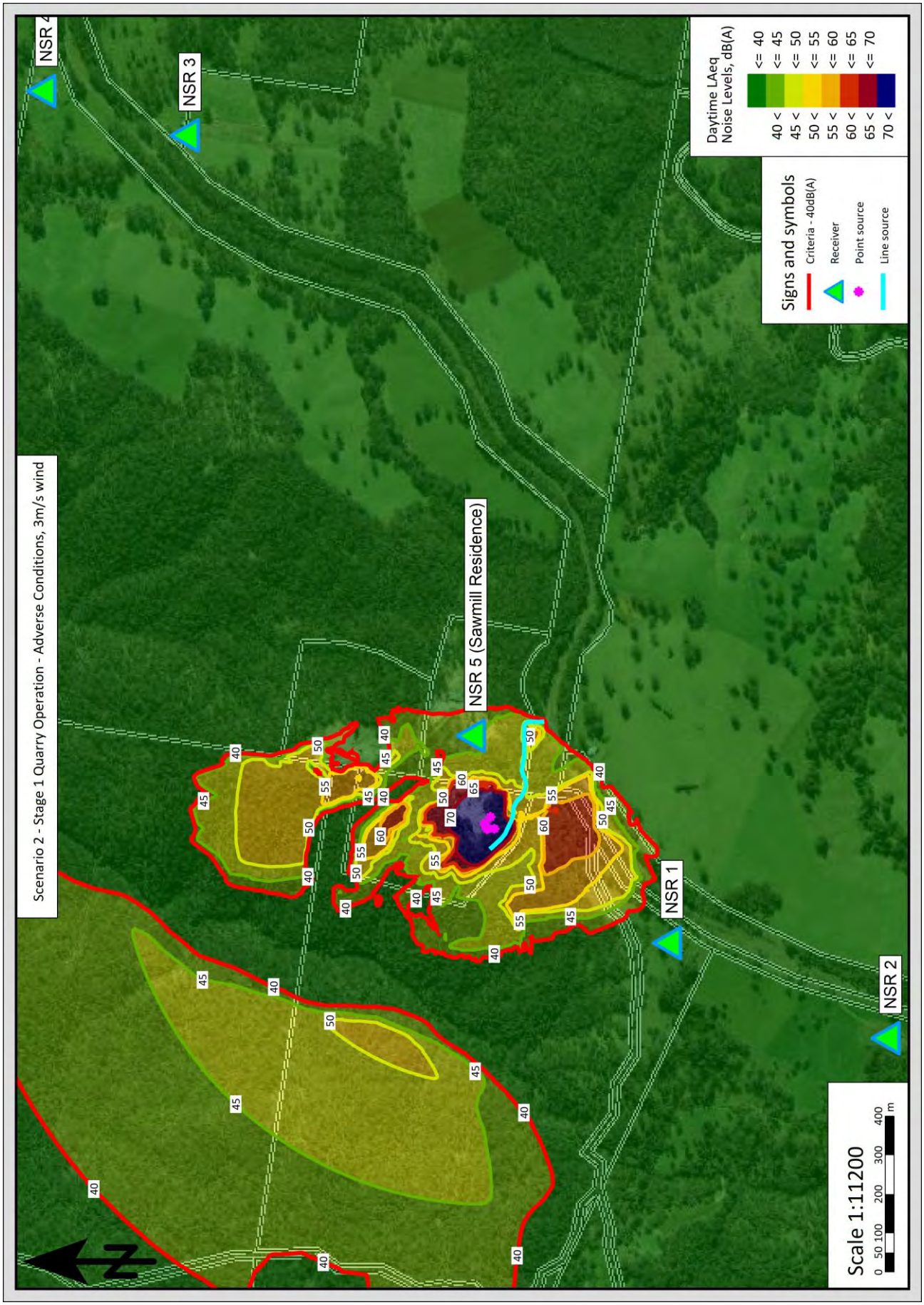

Figure A 4 - Scenario 2 - Stage 1 Quarry Operation - Adverse Conditions

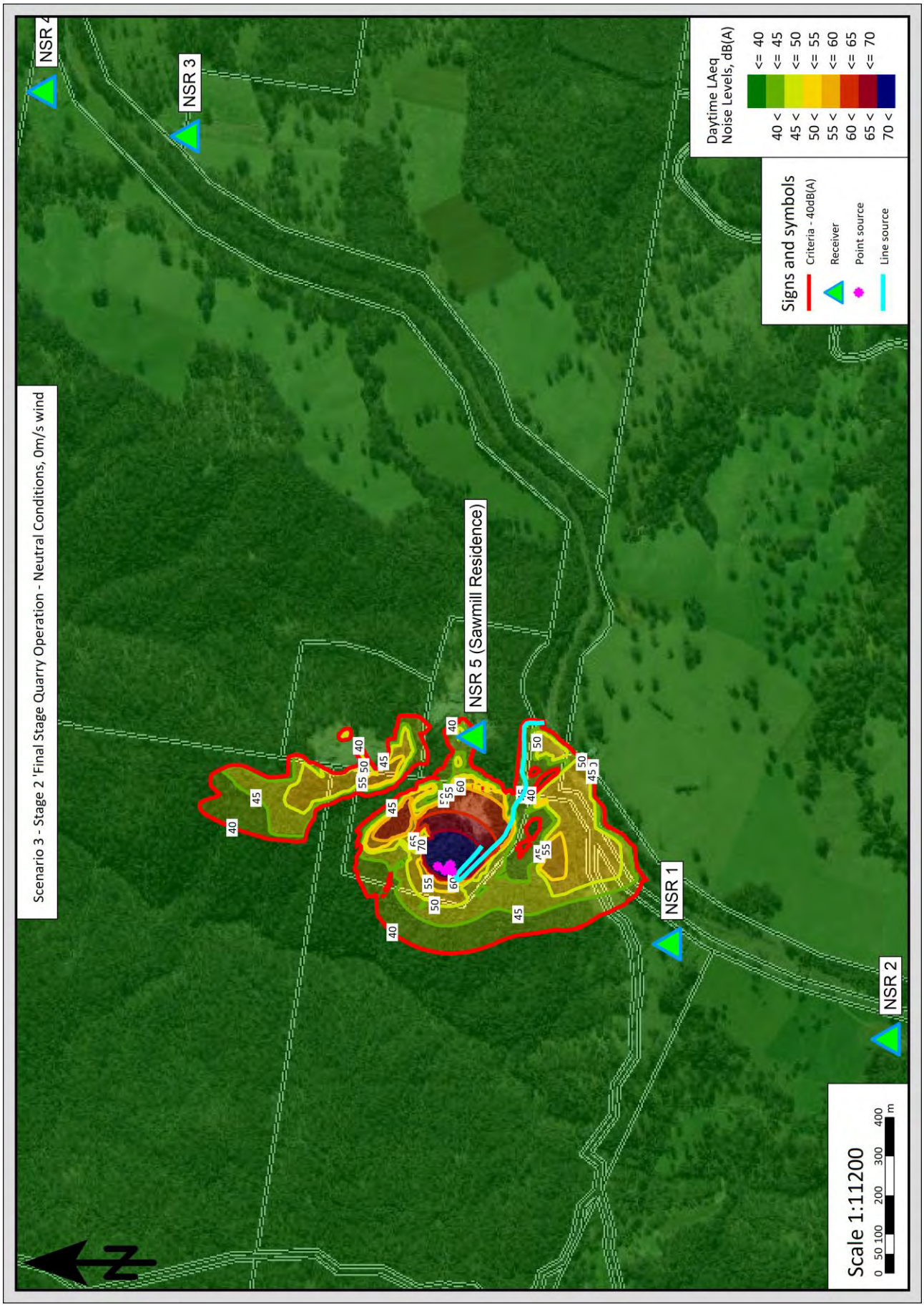

Figure A 5 - Scenario 3 - Stage 2 'Final Stage' Quarry Operation - Neutral Conditions

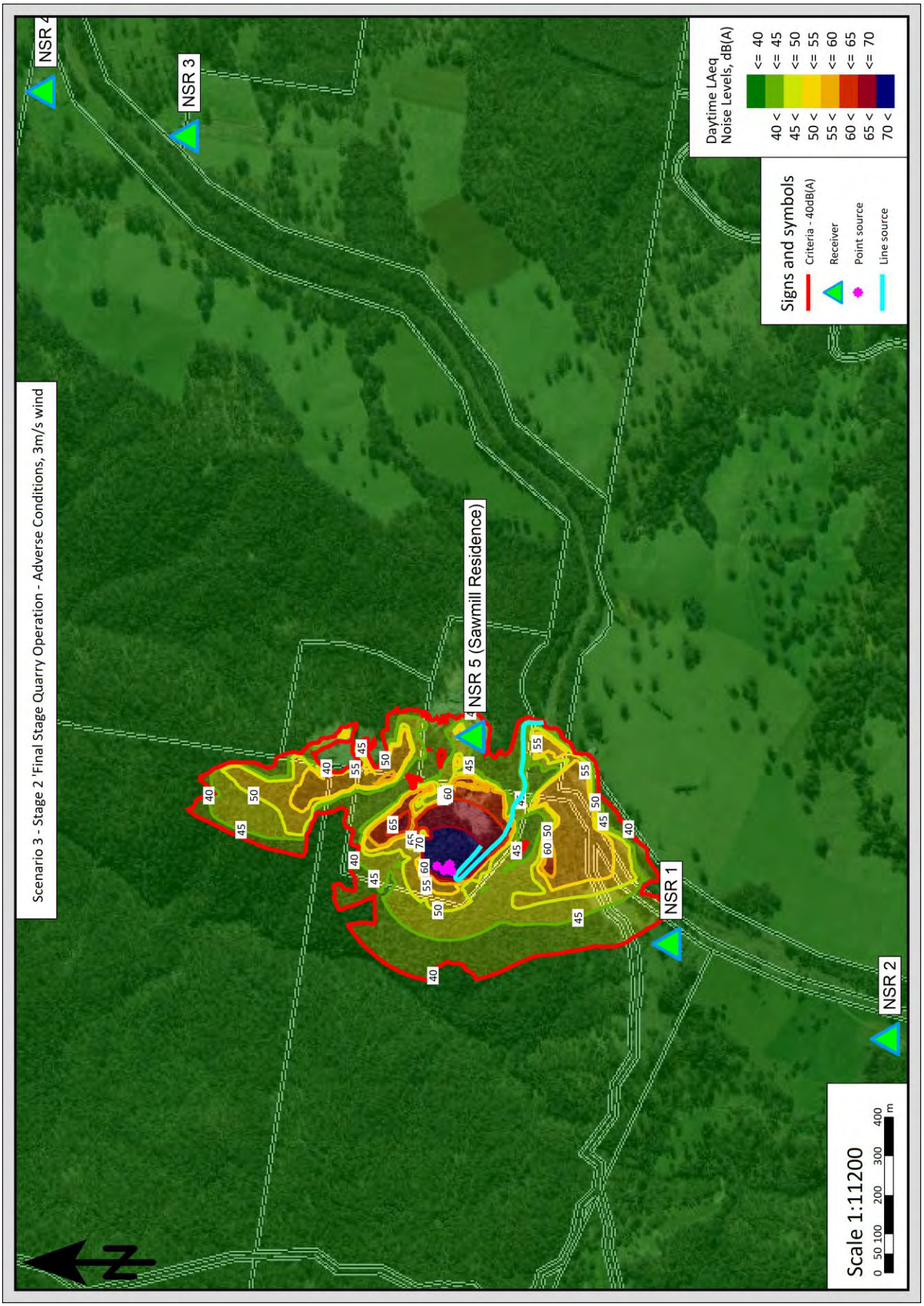

Figure A 6 - Scenario 3 - Stage 2 'Final Stage' Quarry Operation - Neutral Conditions

Appendix B Source Contribution at NSR 1 – Stage 2 'Final Stage'

Faheys Pit Quarry
Contribution level - Stage 2 Adverse - August 2023 **9**

Source	Source ty	LrD dB(A)
Receiver NSR 1 LrD 37.9 dB(A)		
Caterpillar D6 Dozer	Point	33.8
30t Excavator	Point	32.9
J50 Crusher	Point	31.3
Cone/Screen	Point	27.1
20t Wheeled Loader (Cat 962M)	Point	10.1
Haul Truck Stage 2	Line	-0.2
Receiver NSR 2 LrD 16.9 dB(A)		
Caterpillar D6 Dozer	Point	15.3
J50 Crusher	Point	9.6
Cone/Screen	Point	6.3
30t Excavator	Point	2.1
20t Wheeled Loader (Cat 962M)	Point	-5.7
Haul Truck Stage 2	Line	-14.6
Receiver NSR 3 LrD 14.8 dB(A)		
Caterpillar D6 Dozer	Point	13.1
J50 Crusher	Point	7.7
Cone/Screen	Point	4.3
30t Excavator	Point	-0.4
20t Wheeled Loader (Cat 962M)	Point	-6.6
Haul Truck Stage 2	Line	-10.5
Receiver NSR 4 LrD 13.1 dB(A)		
Caterpillar D6 Dozer	Point	11.4
J50 Crusher	Point	6.2
Cone/Screen	Point	2.7
30t Excavator	Point	-1.4
20t Wheeled Loader (Cat 962M)	Point	-8.0
Haul Truck Stage 2	Line	-12.3
Receiver NSR 5 (Sawmill Residence) LrD 44.1 dB(A)		
Caterpillar D6 Dozer	Point	42.5
J50 Crusher	Point	36.7
Cone/Screen	Point	32.9
30t Excavator	Point	30.1
20t Wheeled Loader (Cat 962M)	Point	21.8
Haul Truck Stage 2	Line	17.8

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SoundPLAN 8.2

Faheys Pit Quarry
Assessed receiver spectra in dB(A) - Stage 2 Adverse - August 2023

7

Time slice	25Hz dB (A)	31.5Hz dB (A)	40Hz dB (A)	50Hz dB (A)	63Hz dB (A)	80Hz dB (A)	100Hz dB (A)	125Hz dB (A)	160Hz dB (A)	200Hz dB (A)	250Hz dB (A)	315Hz dB (A)	400Hz dB (A)	500Hz dB (A)	630Hz dB (A)	800Hz dB (A)	1kHz dB (A)	1.25kHz dB (A)	1.6kHz dB (A)	2kHz dB (A)	2.5kHz dB (A)	3.15kHz dB (A)	4kHz dB (A)	5kHz dB (A)	6.3kHz dB (A)	8kHz dB (A)	
Receiver NSR 1 LrD 37.9 dB(A)																											
LrD	-2.1	-6.8	0.4	8.3	12.7	14.0	16.5	16.8	16.1	20.1	22.2	21.5	26.1	30.0	26.6	27.2	30.9	29.3	27.2	27.1	16.7	12.9	17.0	-3.4	-16.4	-10.3	
Receiver NSR 2 LrD 16.9 dB(A)																											
LrD	-19.0	-23.6	-16.8	-9.6	-6.3	-5.4	-3.8	-4.2	-6.0	-2.7	-2.2	-2.2	5.8	6.6	8.2	8.1	7.6	10.9	6.6	1.2	-6.7	-13.7	-24.8	-38.7	-60.9	-74.4	
Receiver NSR 3 LrD 14.8 dB(A)																											
LrD	-22.3	-26.9	-20.0	-12.7	-9.7	-8.0	-5.0	-5.7	-6.3	-2.6	-3.0	-2.0	6.4	5.8	7.1	6.1	5.0	7.2	0.6	-6.8	-18.1	-30.4	-43.1	-67.8	-101.9	-113.0	
Receiver NSR 4 LrD 13.1 dB(A)																											
LrD	-23.7	-28.2	-21.4	-14.1	-10.9	-9.3	-5.9	-6.5	-7.2	-3.6	-4.0	-3.0	5.6	4.9	5.4	4.2	2.9	4.8	-2.5	-10.5	-22.9	-37.1	-50.0	-78.5	-116.5		
Receiver NSR 5 (Sawmill Residence) LrD 44.1 dB(A)																											
LrD	3.4	-0.6	6.7	14.5	18.4	20.5	23.7	23.9	23.6	27.1	27.9	29.1	31.3	32.1	33.0	34.4	34.0	37.7	36.1	32.2	26.7	24.0	18.9	12.0	3.3	-5.1	

Appendix D Faheys Pit Blast Report

CIVIL BLAST PTY LTD

POST BLAST REPORT

CUSTOMER:	Sheridans Hardrock Quarry – Fayes Pit
DATE & TIME:	31/07/2023 3:00pm
SHOT TYPE:	Production Blast
SHOT NUMBER:	23-01
SHOTFIRER:	Chris Browning

BURDEN	3.0 m	BENCH HEIGHT	5.62
SPACING	3.5 m	DRILL MTS Av.	1,628.35
STEMMING	3.0 m	SUB-DRILL	.7m
HOLE DIAMETER	102mm	ROCK DENSITY	2.2
HOLE ANGLE	5 degrees	TOTAL TONNES	
NUMBER HOLES	290	TOTAL BCM	17,097.68
POWDER FACTOR	0.55	MIC	55kg

EXPLOSIVES PRODUCT USED		
PRODUCT	TYPE	QUANTITY
ANFO		
BULK WET	Maxam Rioflex	9,550kg
BOTTOM PRIMER	400g Booster	0
TOP PRIMER	150g Booster	290
BOTTOM DOWNLINE	450ms, 10m	290
TOP DOWNLINE	450ms (7m)	0
SURFACE DELAY	17ms , 42ms, 65ms	267,23
SURFACE DELAY		
L.I.L / ELEC I.E	Lead In Line	500m
Explosive reconciliation	All explosives products accounted for, all remaining explosives removed from site	
COMMENTS		

ENVIRONMENTAL CONDITIONS			
TEMPERATURE	25 degrees		
WIND DIRECTION	SE		
CLOUD COVER	Light		
MONITOR LOCATION	MONITOR #	VIBRATION (mm/s)	OVER PRESSURE (dB/L)
As per attached map and report	001	4.22	114.60
	002	12.61	120.40

Appendix E Graphed Noise Monitoring Results