APPENDIX X

NOISE IMPACT ASSESSMENT

Report

Noise Impact Assessment

Dalswinton Quarry, Dalswinton - Rosebrook Sand & Gravel Pty. Ltd.

HDB Town Planning and Design

13 October, 2020

Rev 1 (Final)

Report Details

Noise Impact Assessment - Dalswinton Quarry, Dalswinton

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Endorsements

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EXECUTIVE SUMMARY

Advitech Environmental was engaged to prepare an assessment of potential noise impacts associated with the proposed expansion of the Dalswinton Quarry at Dalswinton, NSW. The approved opening hours are 5:00am to 12:00am (midnight) Monday to Friday, and 5:00am to 1:30pm on Saturdays. The operation and use of plant machinery would mainly occur between 6:00am and 6:00pm on weekdays and between 6:00am and 1:30pm on Saturdays. The operation would have the capacity produce a up to 500,000tpa of quarried material.

Noise assessment criteria were established for adjacent sensitive receiving noise environments. Modelling indicates that unmitigated emissions may exceed the relevant criteria during the evening and night periods under some operational and meteorological conditions. In addition to general requirements around operation and maintenance of plant in a quiet and efficient manner, efforts should be made to take advantage of localised barrier effects associated with material stockpiles and heavy vehicles during truck loading. Analysis indicates that early morning truck loading and haulage has potential to approach exceedance of the PNTL at receivers immediately adjacent the internal haul road.

Following review of noise control opportunities, re-modelling of operational activities indicates that predicted $L_{Aeq,15minute}$ noise levels would likely comply with the nominated PNTL criteria at each of the receiver locations; this compliance assumes the recommended noise management commitments are implemented. Furthermore, the results of the sleep disturbance analysis indicates that the L_{Amax} noise levels would not exceed the sleep disturbance criterion at any receiver locations.

Noise emissions associated with construction activities are expected to be below the Noise Management Level (NML) for standard construction hours. Exceedances of up to 3 dB above the NML may be expected when construction and re-alignment of the internal haul road is undertaken outside of standard construction hours at the closest receiver along Bureen road to the southeast receiver , which is most exposed to construction activities and has a direct line of sight to the operation. In order to manage these potential impacts, it is recommended that construction of the internal haul road is undertaken during standard working hours (Monday to Friday 7:00am to 6:00pm, Saturday 8:00am to 1:00pm).

Modelling indicates that traffic generated by the development is likely to comply with day period $L_{Aeq,15hour}$ and night period $L_{Aeq,\ 9\ hour}$ criteria for freeway/arterial/sub-arterial roads, at all receivers adjacent to the proposed Golden Highway haulage route.

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APPENDICES

1. INTRODUCTION

Advitech Pty Limited (trading as Advitech Environmental) was engaged by HDB Town Planning and Design (HDB) to undertake an assessment of potential construction, operational and traffic noise impacts associated with the expansion of an existing quarry. The Noise Impact Assessment was conducted to supplement part of an Environmental Impact Statement (EIS), required under Section 4.12(8) of the *Environmental Planning and Assessment Act 1979* and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*

It should be noted that this report was prepared by Advitech Pty Limited for HDB Town Planning and Design ("the customer") in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing.

2. BACKGROUND AND OBJECTIVES

Approval is sought for the expansion of extraction operations at the Dalswinton Quarry, which is located approximately 7 kilometres south east of the Denman township on Lot 72 DP1199484. Presently, quarrying activities are confined to the western extent of the site, and the extraction of sand and gravel material occurs at an annual rate of 80,000 tonnes. The proposed expansion will allow access to a total of 85 hectares for extraction and will enable the reworking of previously extracted areas towards the east of the quarry. The intended objective for this quarry expansion is to provide the supply and delivery of quarry products to the mining, civil, concrete, construction and landscape industries. There is potential for 12.5 million tonnes of quarry material to be extracted over a period of 25 years at a rate of up to 500,000tpa.

2.1 Description of the Proposed Operations

The proposed expansion is estimated to allow for an annual average production rate of 250, 000 tonnes and a maximum annual extraction limit of 500, 000 tonnes to account for peak demand periods. It is predicted that the operations would generate up to 120 heavy vehicle movements per day during peak production periods. The approved opening hours are 5:00am to 12:00am (midnight) Monday to Friday, and 5:00am to 1:30pm on Saturdays. The operation and use of plant machinery is likely occur between 6:00am and 6:00pm on weekdays and between 6:00am and 1:30pm on Saturdays, however potential requirements may exist for extended work hours to service short term increases in demand for the quarried material.

The expansion of the Dalswinton Quarry would involve the realignment of the existing haulage route as well as the construction of access roads for efficient transport of material onsite. Extraction and material transport processes are to occur in a similar fashion to the existing onsite activities. A review of proposed site activities was undertaken to establish an inventory of significant noise generating plant and processes. These include:

- excavation of material and transport (within the quarry) to a processing plant;
- operation of a processing plant to size and screen the material;
- reclaim of stockpiled material for loading into trucks;
- operation of a mobile crushing plant (this will only occur on occasion annually); and
- transport of finished material from site.

Advitech Environmental understands that the following mobile plant will be used within the operation:

- Hydraulic excavator(s);
- Mobile crushing plant;
- Processing and screening plant;
- Front End Loader(s) (FEL);
- Water cart;
- Articulated dump truck(s); and
- Light service vehicles.

This mobile plant will be utilised for excavation of material from the quarry, management of the crushing plant, loading of heavy vehicles, and clearance of land (ahead of the quarry pit (as required)). While production is likely to be variable, up to 120 heavy vehicle movements (60 into site, 60 departing site) are expected at peak production.

Very occasionally (approximately two weeks of the year), Dalswinton Quarry may have demand to process stockpiles of larger materials (reject from 'normal' sizing activities) that requires crushing to smaller size. This permits the re-use of quarried material rather than diverting material back into the pit a waste product. As demand requires, a mobile crushing contractor will be hired to complete crushing activities onsite once or twice a year for approximately a week.

Heavy vehicle movements are assumed to be of the truck and dog type and will access the site via a 6.5 km long access road from the Golden Highway at a location approximately 8.2 km west of Edderton Road. It is assumed that the majority of heavy vehicles will access the site from the west via the Golden highway and Denman Road (55% of movements), with the remainder from the east towards Jerry's Plains and Singleton via the Golden Highway and Putty Road, linking to the New England Highway (45% of movements).

It has been indicated that the operators of Dalswinton Quarry seek to increase disturbance areas and significantly increase production rate whilst retaining current operating hours. To accommodate this modification alterations will be made to the operational activities conducted onsite. The objective of this report is to confirm that this can be achieved without exceeding noise limits. It is noted that construction activities also be undertaken to establish the initial pit footprint towards the east of the quarry and re-align the internal haul road.

3. METHODOLOGY

3.1 Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARs) (SSD 9094) establish the following requirements for:

- Noise: including a detailed assessment of the likely:
  - construction and operational noise and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Industrial Noise Policy and NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy;
  - if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities;
  - under the Interim Construction Noise Guideline; reasonable and feasible mitigation measures to minimise noise emissions; and
  - monitoring and management measures, in particular real-time and attended noise monitoring.

3.2 Assessment Methodology

The methodology adopted to address the requirements established by the SEARs includes:

- An assessment of the existing environment, including:
  - identification of potentially sensitive receivers adjacent to the operation;
  - efforts to characterise the existing noise environment, identify relevant receiver types and establish Project Noise Trigger Levels (PNTL) for the assessment of potential impacts. Site specific (long term) assessment of background noise levels will be undertaken at two separate locations to establish this existing noise environment;
  - analysis of prevailing meteorology: to identify significant meteorological conditions that may influence the way that impacts associated with the development may manifest;
- Calculation of noise levels that may be generated by the development, including:
  - identification of significant operational and meteorological scenarios that may have potential to generate different levels of noise;
  - development of a noise model: (ISO9613 calculation methodology) to derive predicted noise levels associated with the development at adjacent sensitive receivers;
  - determination of premises-based contributions from the development, using descriptors established by the relevant guidelines;
- Assessment of results, including:
  - recommendations for noise criteria that may be written into a development consent;
  - comparison of noise predictions against these criteria, and evaluation of potential impacts; and
  - recommendations for management of potentially adverse or residual impacts.

Assessment requirements for vibration impacts associated with the development have not been referenced in the SEARs and therefore will not be assessed in this report.

3.3 Guidelines and Standards Referenced by this Assessment

The assessment was performed with reference to the following guidelines, policies and standards:

- AS1055:2018 Acoustics – Description and measurement of environmental noise;
- AS2436:2010 Guide to noise and vibration control on construction, demolition and maintenance sites;
- Noise Policy for Industry (NPfI). EPA, 2017;
- NSW Industrial Noise Policy (NPI). EPA, 2000;
- Interim Construction Noise Guideline (ICNG). EPA, 2008;
- Voluntary Land Acquisition and Mitigation Policy (VLAMP). NSW Government, 2014; and
- Road Noise Policy (RNP). EPA, 2011.

4. THE EXISTING ENVIRONMENT

4.1 Sensitive Receivers

Identification of potentially sensitive receivers was initially undertaken via cross referencing of:

- Aerial imagery;
- The Geocoded National Address File (G-NAF) (an open source national database of address points), maintained by the Federal Department of Industry, Innovation and Science;
- Limited ground truthing during field inspection.

Two distinct receiving environments were identified within the study area, including:

- isolated receivers located in rural areas adjacent quarry haulage road; and
- receivers located adjacent to Bureen Road;

A combination of unattended background monitoring and short-term operator attended noise monitoring was undertaken in each of these receiving environments to characterise existing noise levels. This data was used to derive PNTLs for the development. All receiving environments were characterised as representative of the Rural Residential receiver type established in the NPfI, while rural receivers near the Golden Highway were flagged as potentially affected by road traffic noise.

4.1.1 Noise Environments Adjacent to Quarry Operations

Assessment indicates that the nearest sensitive receivers are located approximately 300 metres from the internal haul road. The nearest sensitive receiver to quarrying operations is located approximately 750 metres south east along Bureen Road. A further eight residential receivers were identified within approximately 3 kilometres of the proposal site. Sensitive receivers adjacent to quarry operations are shown in **Table 1** and **Figure 1.**

Table 1: Details of Sensitive Noise Receivers adjacent quarry operations

Receiver ID	Address	Approximate Distance from Site (metres)	Direction
R1	4245 Jerrys Plains Road (on Haul Road)	400	E
R2	4483 Jerrys Plains Road (on Haul Road)	300	W
R3	463 Dalswinton Road	2000	NNW
R4	530 Dalswinton Road	2000	NW
R5	602 Dalswinton Road	900	W
R6	478 Bureen Road	1500	S
R7	570 Bureen Road	1000	SSE
R8	660/701 Bureen Road (nearest to quarry)	750	SE
R9	810 Bureen Road	1500	SE
R10	910-914 Bureen Road	2500	ESE
R11	974 Bureen Road	2700	ESE

4.1.2 Noise Environments Adjacent to the Haul Route

Further analysis was undertaken to identify receivers within 600m of the proposed haulage route, in line with guidance established in the RNP. Sensitive receivers adjacent to quarry operations are shown in **Table 2** and **Figure 1.**

Table 2: Details of Sensitive Noise Receivers adjacent haulage route

Receiver ID	Address	Estimated Setback (metres)
R12	4063 Jerrys Plains Road	520
R13	4372 Jerrys Plains Road	350
R14	4883 Jerrys Plains Road	450
R15	4931 Jerrys Plains Road	230
R16	DP1243140 Jerrys Plains Road	50
R17	4954 Jerrys Plains Road	510
R18	4931 Jerrys Plains Road	150

4.2 Assessment of Existing Noise Levels

Short term operator attended noise monitoring was undertaken during site inspections on 19 October and 9 November, 2018. The purpose of this monitoring was to identify and document predominant sources of noise, and thus characterise the noise environment at the development site and adjacent to the proposed haulage route. A summary of the results is presented in **Table 3**.

Table 3: Details of operator attended monitoring

Location	Date	Measured noise level dB(A)			Observations
		L_{A90}	L_{A10}	L_{Aeq}	
Bureen Road (R8)	9/11/2018 6:25	41	53	50	Road noise (pass-by events along Bureen Rd), cattle, birds,
Rural receivers adjacent Haul Road (R1)	19/10/2018 14:52	31	44	44	Insects, gusting wind, distant car pass by

The operator attended monitoring results indicate that higher noise levels are expected at receivers close to Bureen Road, due to public road noise generated by vehicle pass by events. In contrast, receiving environments adjacent to the haul road (to the north of the quarry site) are subject to relatively lower levels of noise and may be considered representative of the rural receiver type identified by the NPfI. Background noise monitoring was conducted to confirm any long term differences in these noise environments and was used to establish the project noise trigger level (PNTL) in **Section 5.**

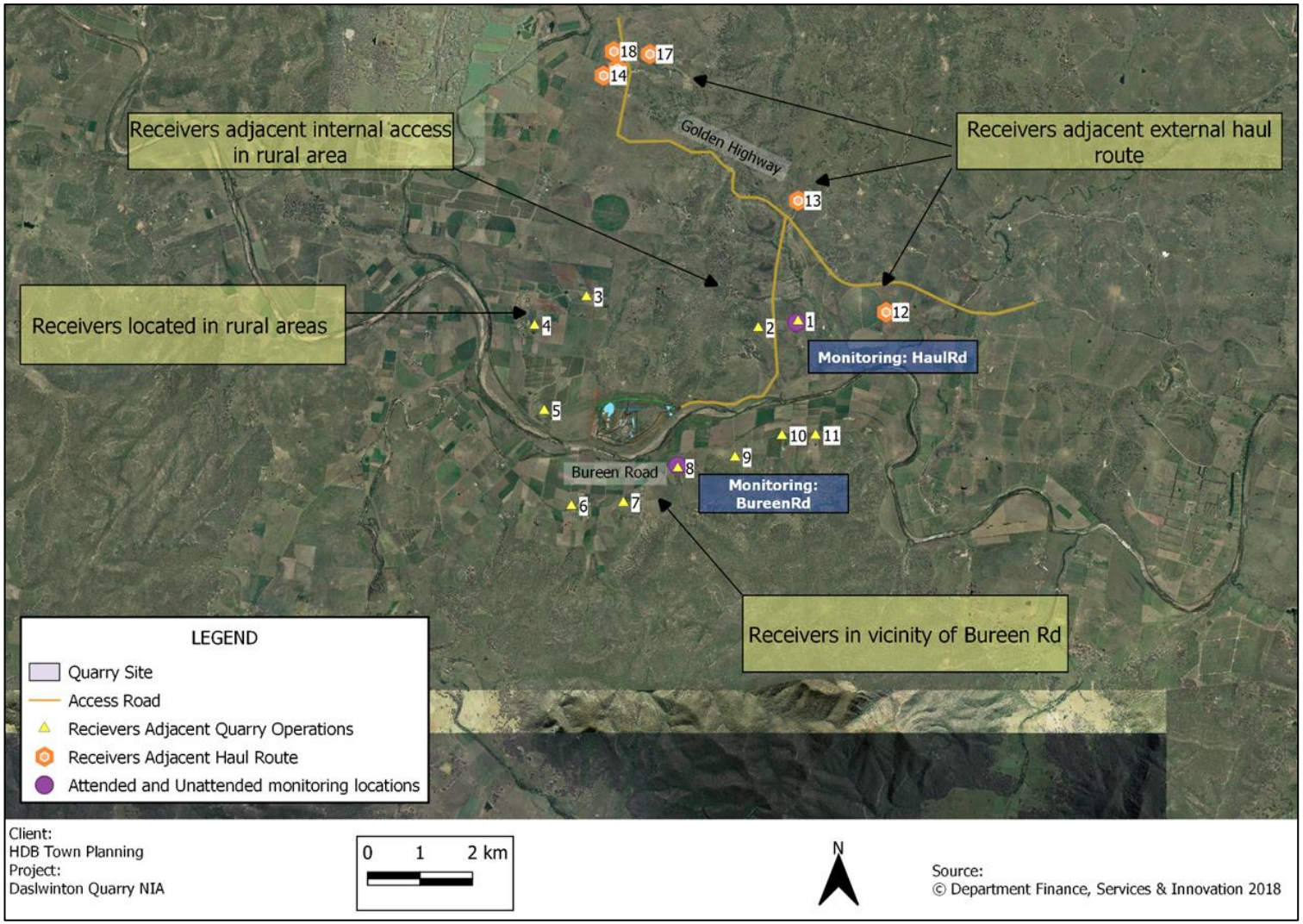

Figure 1: General project arrangement and location of sensitive receivers adjacent quarry operations

4.3 Assessment of Prevailing meteorology

4.3.1 Prevailing winds

The NPfI identifies that meteorological conditions such as wind gradients and temperature inversions may enhance noise propagation from industrial sites to distant sensitive receivers. The guide provides two options for the assessment of these impacts:

- a simple method, which adopts worst case noise enhancing conditions;
- a more detailed analysis of prevailing meteorology, to identify whether enhancing conditions occur with sufficient frequency to be considered a feature of the local environment:
  - where enhancing conditions occur with sufficient frequency, noise enhancing meteorological parameters should be adopted by the noise modelling; and
  - where enhancing conditions are not a feature of the environment, modelling should adopt the standard meteorological parameters.

The NPfI sets the threshold of significance at 30% of the time during any assessment period, assessed seasonally. Definitions of the standard and enhancing conditions established by the NPfI are reproduced in **Table 4**.

Table 4: Standard and noise-enhancing meteorological conditions

Meteorological Condition	Meteorological Parameters
Standard conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m AGL.
Noise-enhancing conditions	Daytime/evening: stability categories A-D with light winds (up to 3 m/s at 10 m AGL) Night-time: stability categories A-D with light winds (up to 3 m/s at 10 m AGL) and/or stability category F with winds up to 2 m/s at 10 m AGL.

Meteorological monitoring records were adopted from the Noise Impact Assessment conducted on the state significant development at Drayton South Mine, which is located approximately 23 kilometres north east of the subject site (Bridges Acoustics, 2015). Monitoring of weather conditions from the station located on the Drayton South site was used to identify whether any prevailing wind patterns may be considered a feature of this environment. It was found that prevailing winds observed for more than 30% of the time:

- were not identified during any periods over summer and spring;
- were not identified during day periods during autumn and winter; and
- were identified:
  - about the south-south east during evening and night periods over autumn;
  - and north west during the night period only over winter.

4.3.2 Temperature Inversions

The NPfI default inversion strength of 3°C/100m, represents a reasonably strong but not worst-case inversion strength. In the absence of data clearly indicating the typical strength of temperature inversions a scenario incorporating F class stability was adopted for assessment of conservative conditions during the night period over winter.

4.3.3 Adopted Weather conditions

Table 5 displays adopted atmospheric parameters used in this assessment for Dalswinton Quarry. The adopted weather conditions represent both calm and prevailing conditions for the project.

Table 5: Adopted Weather Conditions

Atmospheric Parameter	Day	Evening / Night		
	Neutral	SSE Wind	Inversion (NW wind)	Inversion (calm)
Temperature, °C	20	10	10	10
Relative Humidity, %	70	90	90	90
Wind Speed, m/s	Calm	3	2	Calm
Wind Direction	Calm	155	315	Calm

4.4 Assessment of Existing Road Traffic

Data relating to heavy vehicle percentages was adopted from a traffic impact assessment conducted by Intersect Traffic (Intersect Traffic, 2018). To determine the proportion of heavy vehicle movements on the road network, a traffic classifier count was conducted on the Golden Highway in the vicinity of the Quarry access over a seven-day period in 2018. The existing percentage of heavy vehicles within the traffic flows on the Golden Highway was found to be approximately 15%.

Data relating to existing traffic volumes in the study area was obtained through query of the NSW Roads and Maritime Services (RMS) Traffic Volume Viewer (TVV)(RMS, 2019). This interactive tool allows users to browse historical traffic count data in NSW. A summary of available traffic volume and heavy vehicle data relevant to the study area (the Golden Highway) is presented below.

Table 6: Traffic count data from GoldenHighway (StnID:05485, Year: 2012, approximately 9km east of Dalswinton Quarry access road)

Hour of Day	Total Vehicles	Heavy Vehicle Count
0:00 to 1:00	6	1
1:00 to 2:00	5	1
2:00 to 3:00	4	1
3:00 to 4:00	5	1
4:00 to 5:00	8	1
5:00 to 6:00	47	7
6:00 to 7:00	57	9
7:00 to 8:00	48	7
8:00 to 9:00	50	8
9:00 to 10:00	72	11
10:00 to 11:00	87	13
11:00 to 12:00	111	17
12:00 to 13:00	131	20
13:00 to 14:00	116	17
14:00 to 15:00	114	17
15:00 to 16:00	104	16
16:00 to 17:00	77	12
17:00 to 18:00	75	11
18:00 to 19:00	69	10
19:00 to 20:00	37	6
20:00 to 21:00	34	5
21:00 to 22:00	14	2
22:00 to 23:00	13	2
23:00 to 0:00	8	1

5. ASSESSMENT CRITERIA

5.1 Project Trigger Noise Levels

Environmental noise monitoring was undertaken at two locations to measure ambient and background noise levels in receiving environments adjacent to the proposed development site. The monitoring locations were selected such as to be representative of typical receiver locations in these receiving environments. Details relevant to the background noise monitoring are provided in **Table 7**.

Table 7: Details of background monitoring

Location	Rural (RecEnv1)	Bureen Road (RecEnv2)
Logger Serial Number	ARL316 (s/n:16-203-513)	ARL316 (s/n:16-299-450)
Measurement Title	Haul Rd	Bureen Rd
Run Started	20/10/2018 7:00	10/11/2018 7:00
Run Stopped	31/10/2018 6:45	22/11/2018 6:45
Frequency Weighting	A	A
Time Response	Fast	Fast
Engineering Units	dB SPL	dB SPL

Supplementary local meteorological monitoring (rain, wind speed and direction) was undertaken at the Bureen Road monitoring location. This data is used to validate noise monitoring results in accordance with provisions established in Section A4 of the NPfI. Noise monitoring equipment observed the following metrics at 15-minute intervals:

- date, time and temperature;
- maximum and minimum noise levels measured during the interval;
- the equivalent continuous noise level (L_{Aeq}) for the interval; and
- statistical noise levels representative of the noise environment.

A summary of results from the continuous noise loggers is presented graphically in **Appendix I**.

5.1.1 Noise Monitoring Results and Evaluation of PNTL

The Rating Background Level (RBL) and associated Intrusiveness Criteria were determined for the receiving environments adjacent to the proposed development in accordance with provisions established in the NPfI. The results of this analysis are presented in **Table 8.**

Table 8: Assessment background levels (ABLs) (Day period 7:00 to 18:00, Evening period 18:00 to 22:00 and Night period 22:00 to 7:00)

Rural (RecEnv1)				Bureen Road (RecEnv2)			
Date	Day	Evening	Night	Date	Day	Evening	Night
20/10/2018	28	30	28	10/11/2018	32	36	25
21/10/2018	28	30	27	11/11/2018	31	32	26
22/10/2018	27	29	28	12/11/2018	35	34	26
23/10/2018	29	30	27	13/11/2018	32	33	27
24/10/2018	35	34	27	14/11/2018	30	28	26
25/10/2018	30	30	26	15/11/2018	30	30	26
26/10/2018	28	33	27	16/11/2018	33	30	25
27/10/2018	27	29	27	17/11/2018	31	34	27
28/10/2018	31	28	26	18/11/2018	35	38	27
29/10/2018	33	35	26	19/11/2018	33	31	25
-	-	-	-	20/11/2018	29	30	27
-	-	-	-	21/11/2018	33	29	25
Rating Background Level (RBL)	**30**	**30**	**30**		**32**	**32**	**30**
Mean L_{Aeq}	53	45	34		51	51	37

Table 9 provides an analysis of both the Intrusiveness and Amenity noise levels for the purposes of establishing a PNTL for the proposed development. Section 2 of the NPfI establishes that the lower of the Amenity and Intrusiveness noise levels should be adopted as the PNTL for the development.

Table 9: Assessment of PNTL in the adjacent receiving environment

	Rural (RecEnv1)			Bureen Road (RecEnv2)		
Date	Day	Evening	Night	Day	Evening	Night
Rating Background Level	35[1]	30[1]	30[1]	35[1]	32	30[1]
Project Intrusiveness Criteria	40	35	35	40	37	35
Recommended Amenity Level	50	45	40	50	45	40
Project Amenity Criteria	48[2]	42[2]	38[2]	48[2]	43[2]	38[2]
Project Trigger Noise Level	**40**	**35**	**35**	**40**	**37**	**35**

Note 1: Minimum RBL adopted from table 2.1 of NPfI as measured RBL is below criteria threshold.

Note 2: Project amenity level established as level equal to the Recommended Amenity Noise Levels for Rural receivers minus 5dB(A) plus 3dB(A) to convert from a period level to a 15-minute level, in accordance with guidance established in Fact Sheet F of the NPfI.

The Project Intrusiveness Criterion is the more stringent of the two criteria for both receiving environments and is thus adopted as the PTNL for the development. As the PNTL has been assessed at two different locations, **Table 10** presents the allocated criteria for each receiver based on the representative noise environment.

Table 10: Allocated PNTL criteria for receivers in vicinity of Quarry

Receiver ID	Receiving Environment	PNTL Criteria dB(A) Day/ Evening / Night
R1 - R4	Rural	40 / 35 / 35
R5 - R11	In vicinity of Bureen Rd	40 / 37 / 35

5.1.2 Shoulder periods

The NPfI indicates that in circumstances where early morning operations are proposed, it may be unreasonable to expect such operations to be assessed against the night-time project noise trigger levels – especially if existing background noise levels are steadily rising in these early morning hours. In these situations, it may be appropriate to assign a shoulder period rating background noise level based on the L_{AF90}(shoulder period) dB value (that is, the lowest 10th percentile value of aggregate data for the equivalent of one week's worth of valid data taken over the shoulder period). **Figure 2** and **Figure 3** below outline the 1-hour RBLs at both the receivers in vicinity of Bureen Road and the rural receivers to the north of the site over the period of a week.

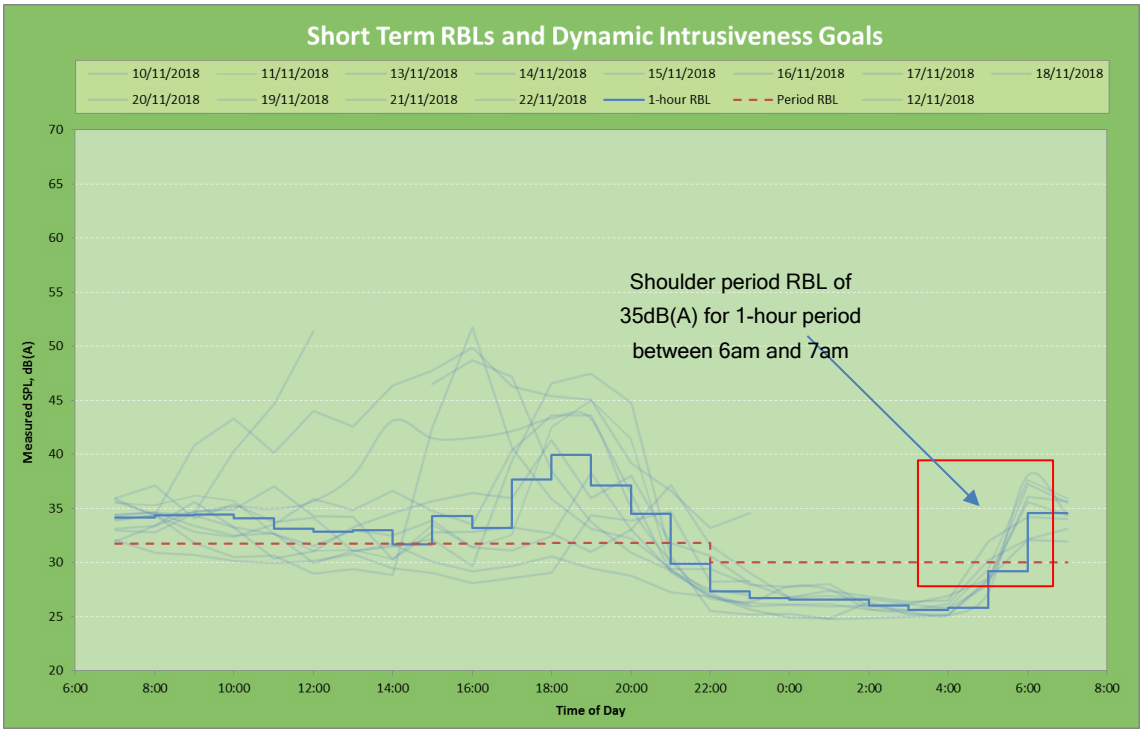

Figure 2: Hourly RBLs – receivers in vicinity of Bureen Rd

Figure 2 indicates that there is a diurnal cycle in which RBLs are strongly influenced by traffic movements along Bureen Road. There is a distinct early morning peak at 6am (approximately 35dB(A)) and evening peak at approximately 6pm (approximately 40dB(A)). This noise environment varies as much as 15dB(A) over a 24hr period.

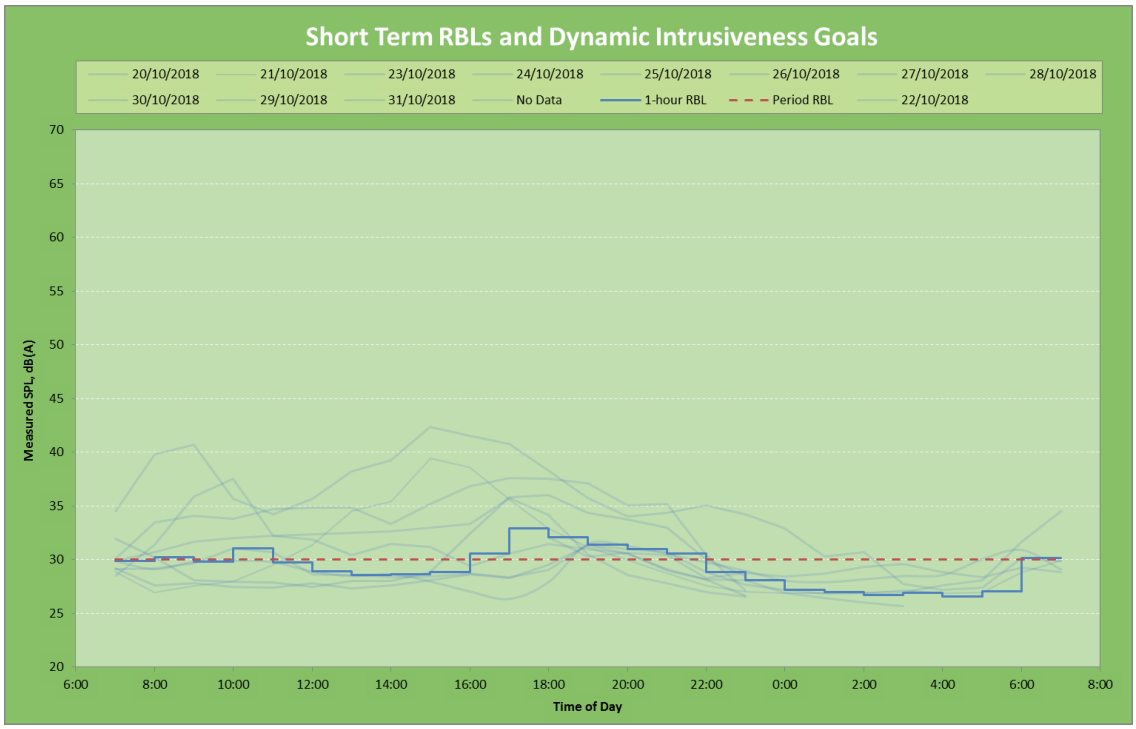

Figure 3: Hourly RBLs – rural receivers north of quarry

Figure 3 shows a weaker diurnal cycle with less deviation in the rural noise environment over a 24hr period (approximately 5dB(A)), indicating less influence from traffic movements. Considering this information, shoulder period PNTLs were established from the 1-hour RBLs between 6 and 7am for the two distinct receiving environments.

Table 11: Shoulder period PNTL $L_{Aeq,15\ minute}$ dB(A)

Receiver ID	Receiving Environment	RBL (6am to 7am)	PTNL (RBL+5dB)
R1 - R4	Rural	30	35
R5 - R11	In vicinity of Bureen Rd	35	40

Table 12 presents the revised PNTL criteria for each receiver based on the representative noise environment.

Table 12: PNTL criteria for receiving environments

Receiver ID	Receiving Environment	PNTL Criteria dB(A) Day/ Evening / Night / Shoulder
R1 - R4	Rural	40 / 35 / 35 / 35
R5 - R11	In vicinity of Bureen Rd	40 / 37 / 35 / 40

5.2 Maximum Noise Level Triggers

The NPfI provides updated guidance relating to the assessment of maximum noise level events that carry potential to cause sleep disturbance, aligning the NSW policy position with that established in the Road Noise Policy. In this context, potential for sleep disturbance is considered in terms of events that may induce awakenings, or cause disturbance to sleep stages. The guide establishes the following requirements:

> *Where the subject development night-time noise levels at a residential location exceed:*
>
> - $L_{Aeq,15min}$ *40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or*
> - L_{AFmax} *52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,*
>
> *… a detailed maximum noise level event assessment should be undertaken.*

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. While the development is not intending to operate plant equipment during the night period, assessment of potential maximum noise levels associated with haul truck during the early morning is presented.

5.3 Construction Noise Criteria

The NSW *Interim Construction Noise Guideline* (ICNG) (2009) provides guidance on managing construction works to minimise noise. Equipment and site activities during construction are likely to be similar to those occurring during operation of the quarry. However, it's likely that equipment will be operating at (or close to) natural surface levels during initial excavation of the quarry workings and associated stockpile areas. This means that higher noise levels may be expected relative to operational noise levels, which may benefit from attenuation by the quarry pit.

The Noise Management Levels (NMLs) relevant to construction noise are typically slightly higher than for operations noise, as the construction activity typically represents a shorter-term impact. **Table 13** summarises the NMLs relevant to the proposed development. It is noted that the NML are not statutory criteria above which impacts are deemed to be non-compliant, but the level at which reasonable and feasible management measures would be required.

Table 13: Construction Noise Management Levels, $L_{Aeq,15\ minute}$ dB(A)

Receiver Type	Construction Hours	Management Level ($L_{Aeq,\ (15\ min)}$)	
Residential Receivers	Monday to Friday: 7am to 6pm Saturday: 8am to 1pm (Standard hours)	Noise Affected NML (RBL + 10 dB)	45 dB(A)
		Highly Noise Affected NML	75 dB(A)
	Outside recommended standard hours (OOHW)	Noise Affected NML (RBL + 5 dB)	40 dB(A)

5.4 Road Traffic Noise Criteria

The NSW RNP (2011) provides a framework for the management of noise issues associated with road traffic from existing roads, new road projects, road redevelopment projects and new traffic-generating developments. The primary aim of the RNP is to provide assessment criteria for road traffic noise based on protecting amenity and wellbeing.

The criterion adopted for this assessment is provided in **Table 14**. This is based on review of existing receiving environments, and description of road types established in the RNP. Calculated contributions from road traffic generated by the proposed development may be compared against management levels (or existing traffic noise levels) to assist with evaluation of potential project related impacts.

Table 14: Road traffic noise assessment criteria for residential land uses

Road Category	Type of Project / Land Use	Assessment Criteria – dB(A)	
		Day 7am – 10pm	Night 10pm – 7am
Freeways/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)

6. ASSESSMENT OF OPERATIONAL NOISE LEVELS

6.1 Operating Scenarios

The proposed development involves extraction of sand and gravel from the eastern part of the site and material recovery from previously backfilled areas. There will be two working areas within the site, namely Work Area 1 and Work Area 2. Approximately 50 ha of land in the currently approved extraction footprint will constitute Work Area 1 and approximately 39 ha of unmined land to the east will form Work Area 2. This is displayed below in **Figure 4**.

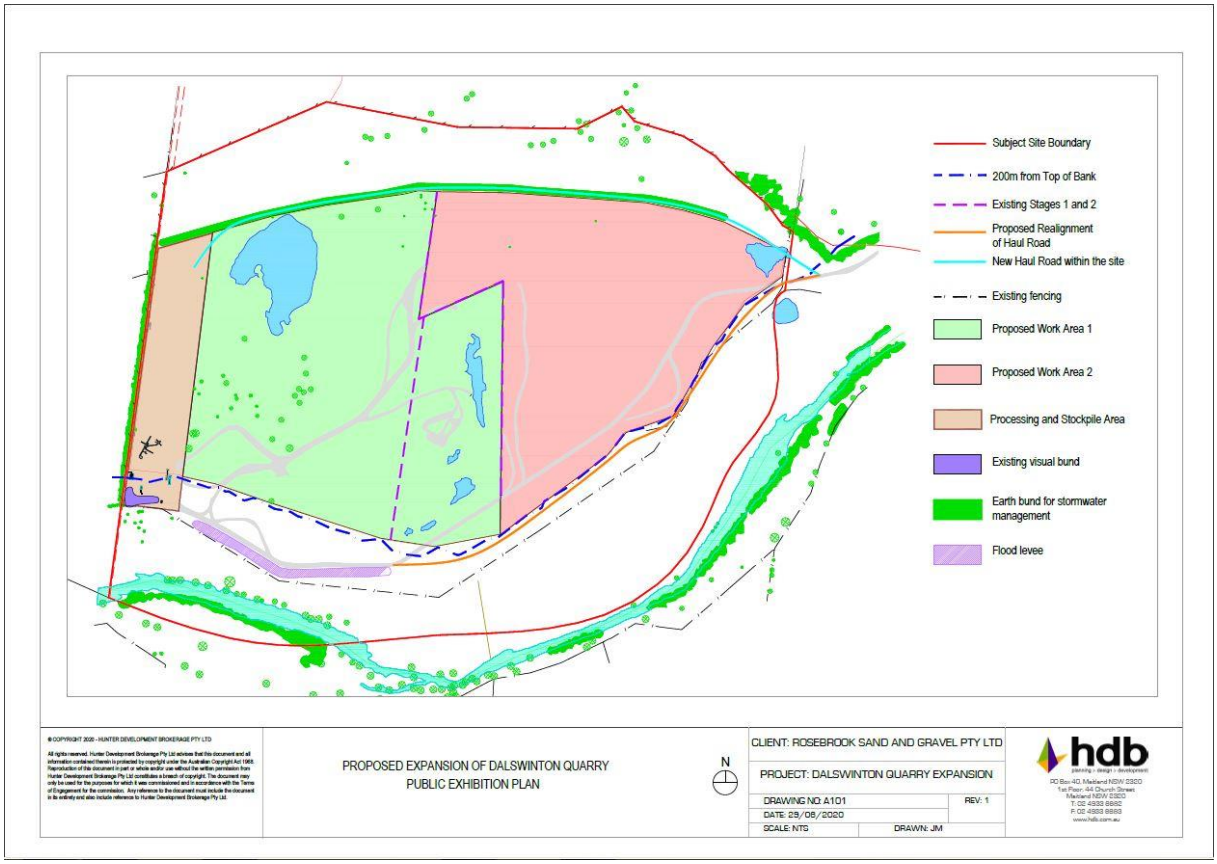

Figure 4: Proposed expansion of Dalswinton quarry

Table 15 outlines plant utilisation sound power levels (Lw) for quarrying operations for both Work Area 1 and Work Area 2. Assessment assumes that plant equipment will be in operation between 6:00am and 6:00pm on weekdays and between 6:00am and 1:30pm on Saturdays. It is noted that crushing is not proposed to occur onsite regularly, and daily processing will involve the screening and sizing of quarried material. As demand requires, a contractor will be engaged to complete onsite processing with a mobile crusher. This activity is proposed to occur once or twice a year for approximately a week. Operational scenarios at both Work Area 1 and Work Area 2 were constructed to evaluate impacts including:

- standard quarry operations : These are standard operational conditions that will occur most of the time at Dalswinton quarry. This scenario involves the simultaneous operation of all plant excluding mobile crushing plant;
- crushing & quarrying operations: This scenario is predicted to occur approximately two weeks per year depending on product demands. This involves the simultaneous operation of all plant (including mobile crushing plant); and
- haulage and loading: This activity involves the passage of haulage trucks and operation of front-end loader onsite.

A more detailed breakdown of plant utilised in each of these operational scenarios is included in **Appendix III**.

Table 15: Operational stage noise sources (Lw, dB(A))

Plant Description	Description of Utilisation	A-wt Level
Screening and Processing Plant	sizing of excavated quarry material	112 dB
Washery	Washing and sizing of excavated quarry material	110 dB
Mobile Crushing Plant	Crushing of excavated quarry material	115 dB
Articulated Dump Truck	Transport of quarry material from extraction area to stockpile	107 dB
Front End Loader	Reclaiming material from stockpile and loading heavy vehicles	107 dB
Water Cart	Road and stockpile maintenance	113 dB
Excavator	Quarrying of material and feeding crushing plant	108 dB
Truck & Dog	Transport of finished material from site	107 dB
Truck Loading (L_{AMax})	Loading truck with FEL (as L_{AMax})	113 dB

6.2 Meteorological Scenarios

This operational configuration was modelled using standard meteorological parameters, following analysis of prevailing meteorology presented in **Section 4.3**.

6.3 Noise Level Predictions

A summary of predicted $L_{Aeq,15minute}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios associated in Work Area 1 and Work Area 2 under standard meteorological conditions and worst case meteorological conditions is provided in **Table 16**. A detailed analysis of operational noise impacts under each specified meteorological condition is provided in **Appendix IV.**

Table 16: Noise impact predictions ($L_{Aeq,15minute}$ dB(A))

ID	Predictions under Standard / Worst Case Meteorological conditions			PNTL (Day / Evening / Night / Shoulder) $L_{Aeq,15minute}$
	Haulage & truck loading	Standard quarry operation	Quarry operation with Crusher	
R1	28 / 31	29 / 32	29 / 32	40 / 35 / 35 / 35
R2	33 / 36	33 / 36	33 / 36	40 / 35 / 35 / 35
R3	<25 / 26	28 / 32	30 / 34	40 / 35 / 35 / 35
R4	<25 / 26	29 / 32	30 / 34	40 / 35 / 35 / 35
R5	29 / 32	36 / 40	38 / 42	40 / 37 / 35 / 40
R6	25 / 28	33 / 37	34 / 38	40 / 37 / 35 / 40
R7	27 /30	36 / 40	37 / 41	40 / 37 / 35 / 40
R8	33 / 36	39 / 42	39 / 43	40 / 37 / 35 / 40
R9	30 / 33	34 /37	34 / 37	40 / 37 / 35 / 40
R10	29 / 32	32 / 35	33 / 36	40 / 37 / 35 / 40
R11	28 / 31	31 / 34	32 / 34	40 / 37 / 35 / 40

The results of noise modelling indicate that:

- exceedance of the day and shoulder period PTNL is not expected at any receiver under any operating scenario under standard meteorological conditions;
- standard quarrying operations may:
  - exceed criteria at one receiver during the day period under worst case meteorological conditions;
  - exceed criteria at four receivers during the evening period under worst case meteorological conditions;
  - exceed criteria six receivers during the night period under worst case meteorological conditions; and
  - exceed criteria at two receivers during the shoulder period under worst case meteorological conditions;
- quarrying and crushing operations may:
  - exceed criteria at three receivers during the day period under worst case meteorological conditions;
  - exceed criteria at five receivers during the evening period under worst case meteorological conditions;
  - exceed criteria at seven receivers during the night period under worst case meteorological conditions; and
- haulage at truck operations may exceed the criteria at two receivers during the evening, night and shoulder period under worst case meteorological scenarios.

6.4 Operational Mitigation Measures

Based on review of these preliminary results, it is recommended that standard quarrying activities be conducted during the shoulder and day period (6am to 6pm) to ameliorate adverse impacts at several receivers during the evening and night periods. It is recommended that more intensive activities such as crushing are also conducted during the shoulder and day periods. To reduce impacts expected for these operations under worst case meteorological conditions, the following mitigation measures should be considered:

- re-orienting stockpiles to serve as a buffer between closest receivers along Bureen Road (R7 and R8) and the sole receiver to the west of the quarry (R5);
- limiting the use of the water cart on the section of the internal haul road closest to sensitive receivers south-east of the site (R7 and R8); and
- mobile crushing in the extraction areas should not take place until the pit has been constructed and plant is operable below natural levels. This would serve to provide a buffer between the most sensitive receivers along Bureen Road and the crushing activities onsite.

Truck haulage and loading will comply with the PNTL during all periods when assessed under calm meteorological conditions and during the evening and night periods over autumn when prevailing winds are predicted from the south-southeast. Noise levels up to 1dB(A) above the PTNL may be expected at receiver R2 and R8 during night periods when there are prevailing winds from the north west and strong temperature inversions presenting noise enhancing conditions.

Although Table 1 of the Voluntary Land Acquisition and Mitigation Policy (VLAMP) establishes that residual noise impacts of 0-2dB(A) are typically considered negligible and would not warrant receiver based treatments or controls, the recommendations should be taken into consideration when conducting haulage and loading operations during the night period over winter and autumn:

- keeping the haul road well-maintained;
- adhering to the speed limit of 60km/h along the external section of haul road; and the speed limit of 30km/h along the internal section of the haul road;
- running regular toolbox talks on the effects of noise and the use of quiet work practices; and
- limiting compression breaking.

6.5 Maximum Noise Level Predictions

Truck loading and movements along the haul road has the propensity to cause sleep disturbance during the early hours of the morning (prior to 7:00am). It has been indicated that nearby residents may experience transient peak noise events associated with haul trailers when moving along the haul road. A Lw for this activity was developed to appropriately model this scenario.

The Lw associated with this noise characteristic was derived from a 15-minute noise measurement taken at R8. This measurement involved a haul truck accessing the site via the haul road prior to 7:00am. Events in which the haul truck was audible over the 15-minute measurement were noted. The difference between the equivalent L_{Aeq} and L_{Amax} during these events were added to existing SWL measurements for truck and dog movements and incorporated into the model. This analysis is provided graphically in **Appendix II**.

Assessment of predicted noise levels associated with short-term high-level events (L_{AMax}) with potential to cause sleep disturbance at adjacent sensitive receivers are provided in **Table 17.**

Table 17: Maximum noise level predictions, activities outside daytime hours (L_{AMax} dB(A))

Scenario	Receiver ID	Prediction $L_{AeMAX15minute}$	Criteria (Night) L_{AMax}	Count Receivers > MNL
Quarry Operations (truck haulage and loading)	R1	37	52	Nil
	R2	41	52	Nil
	R3	30	52	Nil
	R4	30	52	Nil
	R5	38	52	Nil
	R6	43	52	Nil
	R7	44	52	Nil
	R8	43	52	Nil
	R9	39	52	Nil
	R10	38	52	Nil
	R11	37	52	Nil

The results of modelling indicate that contributions from short term, high level events associated with truck loading are expected to be lower than the recommended limits for maximum noise.

7. ASSESSMENT OF CONSTRUCTION NOISE LEVELS

7.1 Construction Activities

The noise model was also used to evaluate emissions associated with preliminary earthworks and construction activities. Review indicates that construction activities with potential to generate noise impacts may include:

- Operation of quarrying plant at natural surface levels prior to cutting of working faces and pit development.
- The construction and re-alignment of internal access roads between the site access and quarry.

A summary of sound power levels for plant utilised during these construction phase activities are shown in **Table 18.** Assumptions relating to equipment and power levels were determined based on the information provided by the proponent (construction hours and plant itinerary).

Noise level predictions are presented in **Table 19**, and adopt the following assumptions:

- day period meteorological conditions from the operational noise model are adopted for this analysis;
- all items of plant operate simultaneously;
- all noise generating plant is located at natural ground level.

Table 18: Construction Noise Sources (Lw, dB(A))

Construction Phase	Plant Description	A-wt Level
Construction of internal access road	Front End Loader	107 dB
	Water cart	113 dB
Construction of initial quarry footprint	Articulated Dump Truck	107 dB
	Front end loader	107 dB
	Excavator	108 dB

7.2 Noise Level Predictions

A summary of predicted $L_{Aeq,15minute}$ noise levels at the nearest sensitive receivers associated with proposed construction works is provided in **Table 19**.

Table 19: Worst case construction noise levels ($L_{Aeq,15minute}$ dB(A))

ID	Prediction $L_{Aeq,15minute}$		NML (Standard hours / OOHW) $L_{Aeq,15minute}$	NML Exceedance (Standard hours / OOHW)
	Initial quarry pit footprint development	internal haul road construction and re-alignment		
R1	<30	<30	45 / 40	Nil
R2	<30	<30	45 / 40	Nil
R3	<30	<30	45 / 40	Nil
R4	<30	<30	45 / 40	Nil
R5	<30	<30	45 / 40	Nil
R6	<30	33	45 / 40	Nil
R7	34	37	45 / 40	Nil
R8	39	43	45 / 40	Nil / 3
R9	33	36	45 / 40	Nil
R10	31	31	45 / 40	Nil
R11	30	30	45 / 40	Nil

The modelling results indicate that:

- Noise emissions associated with construction activities are:
  - expected to be below the NML for standard construction hours and out of hours work for the initial quarry footprint development;
  - expected to be below the NML for standard construction hours for the re-alignment and construction of the internal haul road;
- Exceedances of up to 3 dB above the may be expected at R8 if construction and re-alignment of the internal haul road is conducted outside of standard construction hours.

Adverse impacts are not expected where construction activities are restricted to standard work hours. If construction is to occur outside standard construction hours, it is suggested that the following measures are considered:

- liaise with affected residents and inform them when noisy work will occur;
- where practical, undertake the noisiest works during recommended standard hours.
- turn off plant that is not being used.
- locate noisy plant away from potentially noise affected neighbours or behind barriers, such as sheds or walls.
- ensure plant is regularly maintained, and repair or replace equipment that becomes noisy

8. ASSESSMENT OF ROAD TRAFFIC NOISE

8.1 Road Traffic Generated by the Development

Heavy vehicle movements generated by the development are evaluated against the $L_{Aeq,1hour}$ criteria for freeways/arterial/sub-arterial roads established in the RNP. A road traffic noise model was developed based on the following assumptions:

- Receivers are exposed to an existing level of road traffic noise, and additional movements generated by the proposed development have potential to increase existing levels of impact;
- Assessment of 1-hour noise levels associated with quarry related traffic movements was undertaken on the basis that the quarry is expected to generate an average of 120 heavy vehicle (HV) movements per day. This is predicted to equate to approximately 8 extra heavy vehicle movements an hour (12 total), over a 10-hour period (Intersect Traffic, 2018). The 10-hour period was modelled to occur between 5:00am and 15:00pm This is shown in **Table 20;**
- a 55/45 split of vehicles accessing and leaving the site via the Golden Highway from the west / east respectively (Intersect Traffic, 2018); and
- the following assumptions relating to average vehicle speeds:
  - 100km/h on the Golden Highway.

Table 20: Proposed Generated Traffic Volumes on Golden Highway

Hour of Day	Total Vehicles[1]	Proportion of Heavy Vehicles (nearest whole vehicle)[1]	Percentage of Heavy Vehicles
0:00 to 1:00	6	1	15%
1:00 to 2:00	5	1	15%
2:00 to 3:00	4	1	15%
3:00 to 4:00	5	1	15%
4:00 to 5:00	8	1	15%
5:00 to 6:00	55	15	27%
6:00 to 7:00	65	17	26%
7:00 to 8:00	56	15	27%
8:00 to 9:00	58	16	28%
9:00 to 10:00	80	19	24%
10:00 to 11:00	95	21	22%
11:00 to 12:00	119	25	21%
12:00 to 13:00	139	28	20%
13:00 to 14:00	124	25	20%
14:00 to 15:00	122	25	20%
15:00 to 16:00	104	16	15%
16:00 to 17:00	77	12	15%
17:00 to 18:00	75	11	15%
18:00 to 19:00	69	10	15%
19:00 to 20:00	37	6	15%
20:00 to 21:00	34	5	15%
21:00 to 22:00	14	2	15%
22:00 to 23:00	13	2	15%
23:00 to 0:00	8	1	15%

Note: Total Vehicles and Proportion of Heavy Vehicles calculated by accounting for eight extra heavy vehicle movements per hour from quarry site between 5:00am and 15:00pm. Assuming that four heavy vehicle moments already contribute to traffic volume between 5:00am and 15:00pm, this equates to a total of 12 heavy vehicle movements / hour from site over a 10-hour period.

8.1.1 Road Traffic Noise Model

A road traffic noise model was constructed within the Predictor environmental noise modelling software package using the Calculation of Road Traffic Noise (CRTN) method. A summary of the modelling assumptions is included in **Table 21.**

Table 21: Operational noise model parameters

Parameter	Details
Traffic Volumes (Existing)	Refer to **Table 8**
Traffic Volumes (Proposed)	Refer to **Table 20**
Traffic Speed	100km/h on highway
Modelling Method	CoRTN (Predictor v8.11)
Split Height Sources	Cars (RL+0.5m) Trucks (RL+1.5m) Truck Exhaust RL(+3.6m)
Road Surface Corrections	None applied, assume standard asphalt surface
Corrections for Australian Conditions (ARRB)	-1.7dB at façade locations
Ground Absorption	0.75
Receiver Locations	1m from building Height RL +1.5m
Facade Correction	+2.5dB at 1m from building

Table 22: Road traffic noise levels on the Golden Highway (Day $L_{Aeq,\ (15\ hour)}$ / Night $L_{Aeq,\ (9\ hour)}$, dB(A))

Receiver	Estimated Setback	Predicted Noise Level Day/Night	Criteria Day / Night	Road Noise Criteria Exceedance (Day / Night)
R12	520m	50 / 44	60 / 55	Nil
R13	350m	51 / 46	60 / 55	Nil
R14	450m	50 / 44	60 / 55	Nil
R15	230m	53 / 47	60 / 55	Nil
R16	50m	57 / 51	60 / 55	Nil
R17	510m	49 / 44	60 / 55	Nil
R18	150m	53 / 48	60 / 55	Nil

The results presented in **Table 22** indicate that road traffic noise levels are below criteria for both the day and night period at all receiver locations adjacent to the access route. Road noise levels at receiver. Further discussion relating to management of impacts during the early morning shoulder is presented in **Section 9.2.4.**

9. DISCUSSION AND RECOMMENDATIONS

9.1 Assessment Conditions and Criteria

Analysis of background noise monitoring indicates that the receiving environmental adjacent to the proposed development site are subject to influence by a range of environmental, and existing transportation noise sources (the Golden Highway and haul road). In all cases, the PNTL were established in terms of the Project Intrusiveness Criteria. For the purposes of evaluating potential impacts, it is recommended that the PNTL be adopted as assessment criteria for the development.

Review of prevailing meteorology indicates that there are prevailing wind conditions about the south-south east and north west occur more than 30% of the time during autumn (evening and night) and winter (night) respectively. On this basis, noise enhancing meteorological parameters are considered relevant to the assessment, and were assessed alongside standard weather conditions.

9.2 Assessment of Impacts and Recommendations for Management

9.2.1 Operational Noise

Review of noise modelling indicates that standard quarrying operations and quarrying operations involving the use of a mobile crusher would likely achieve noise levels below the criteria for the day period and early morning shoulder period. To reduce any residual impacts for these operations under worst case meteorological conditions, the following mitigation measures should be considered:

- re-orienting stockpiles to serve as a buffer between closest receivers along Bureen Road (R7 and R8) and the sole receiver to the west of the quarry (R5);
- limiting the use of the water cart on the section of the internal haul road closest to sensitive receivers south-east of the site (R7 and R8); and
- mobile crushing in the extraction areas should not take place until the pit has been constructed and plant is operable below natural levels. This would serve to provide a buffer between the most sensitive receivers along Bureen Road and the crushing activities onsite.

Noise modelling includes optimisations to the placement of the crushing plant within the quarry, (to take advantage of natural barriers formed by the pit, stockpiles and levees); despite this, residual impacts may be expected during periods prior to 6:00am and evening and night periods (after 6:00pm). A commitment to operating these activities after 6:00am will ameliorate these potential impacts, without representing a significant constraint to the productivity of the quarry.

Noise emissions associated with truck haulage and loading are expected to be below the criteria for the day period, but may approach the PNTL at the receivers close to the haul road (R2, R8) where these activities take place under night, early morning shoulder and evening periods. It is recommended that the following practices will help to maintain a compliant amenity level at nearby receivers:

- keeping the haul road well-maintained;
- adhering to the speed limit of 60km/h along the external section of haul road; and the speed limit of 30km/h along the internal section of the haul road;
- running regular toolbox talks on the effects of noise and the use of quiet work practices; and
- limiting compression breaking.

9.2.2 Maximum Noise Levels

While the NPfI requires assessment of maximum noise levels for activities carried out during the night period, assessment of potential impacts prior to 7:00am is considered consistent with the intent of the guidance. Following analysis presented above, the loading and haulage of heavy vehicles was identified as the only activity with potential to generate impacts during the early morning shoulder period. Review of modelling results indicates that L_{AMax} noise levels at adjacent sensitive receivers will be less than the assessment criteria, and no adverse impact may be expected.

This analysis indicates that haulage of trucks may be undertaken during the evening and night period (including the early prior to 7:00) without the prospect of an adverse sleep disturbance impact.

9.2.3 Construction Noise Levels

Noise emissions associated with construction activities are expected to be below the NML for standard construction hours. Exceedances of up to 3 dB above the NML may be expected when construction activities are undertaken outside of standard construction hours at R8, which is most exposed to construction activities and has a direct line of sight to the operation. It is recommended that construction is undertaken during standard working hours (Monday to Friday 7:00am to 6:00pm, Saturday 8:00am to 1:00pm) to avoid exceedance above the NML at nearby receivers. If construction outside standard work hours is required, it recommended that the construction of the 1.5 metre earth bund to the south east of the internal haul road be constructed initially to mitigate any further noise exceedances experienced at receiver R8 during construction.

9.2.4 Road Traffic Noise

Modelling indicates that traffic generated by the development is likely to comply with day period $L_{Aeq,15hour}$ and night period $L_{Aeq,\ 9\ hour}$ criteria for freeway/arterial/sub-arterial roads, at all receivers adjacent to the proposed Golden Highway haulage route. The heavy vehicle movements during the day period may result in noise levels approaching the day period criteria at one receiver (R16, on Jerrys Plains Road, the Golden Highway). It is considered that this impact may be ameliorated by engaging and encouraging haulage contractors to:

- operate in accordance with the approved operating hours;
- maintain and operate equipment in a quiet and efficient manner;
- maintaining the access route to minimise noise generated by truck bodies; and
- actively discouraging unnecessary use of compression brakes, and establishing exclusion zones (adjacent to sensitive receivers) for parked vehicles that may queue to access site;

10. CONCLUSION

Advitech Environmental was engaged to prepare an assessment of potential noise impacts associated with the proposed expansion of the Dalwinton Quarry at Dalswinton, NSW. The approved opening hours are 5:00am to 12:00am (midnight) Monday to Friday, and 5:00am to 1:30pm on Saturdays. The operation and use of plant machinery would mainly occur between 6:00am and 6:00pm on weekdays and between 6:00am and 1:30pm on Saturdays. The operation would have the capacity produce up to 500,000tpa of quarried material.

Noise assessment criteria were established for adjacent sensitive receiving noise environments. Modelling indicates that noise levels may reach levels above during the evening and night periods under some operational and meteorological conditions. In addition to general requirements around operation and maintenance of plant in a quiet and efficient manner, efforts should be made to take advantage of localised barrier effects associated with material stockpiles and heavy vehicles during truck loading. Analysis indicates that early morning truck loading and haulage has potential to approach exceedance of the PNTL at receivers immediately adjacent the internal haul road.

Modelling of operational activities indicate that predicted $L_{Aeq,15minute}$ noise levels would likely comply with the nominated PNTL criteria at each of the receiver locations providing the recommended noise management commitments are implemented. Furthermore, the results of the sleep disturbance analysis indicates that the L_{Amax} noise levels would not exceed the sleep disturbance criterion at any receiver locations.

Noise emissions associated with construction activities are expected to be below the Noise Management Level (NML) for standard construction hours. Exceedances of up to 3 dB above the NML may be expected when construction and re-alignment of the internal haul road is undertaken outside of standard construction hours at the closest receiver along Bureen road to the southeast receiver , which is most exposed to construction activities and has a direct line of sight to the operation. In order to manage these potential impacts, it is recommended that construction of the internal haul road is undertaken during standard working hours (Monday to Friday 7:00am to 6:00pm, Saturday 8:00am to 1:00pm).

Modelling indicates that traffic generated by the development is likely to comply with day period $L_{Aeq,15hour}$ and night period $L_{Aeq,\ 9\ hour}$ criteria for freeway/arterial/sub-arterial roads, at all receivers adjacent to the proposed Golden Highway haulage route.

11. REFERENCES

The following information was used in the preparation of this report:

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2. AS 2706-1984: *Numerical Values: Rounding and interpretation of limiting values;*
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8. NSW Environment Protection Authority (2000). *NSW Industrial Noise Policy*, NSW Environment Protection Authority, Sydney;
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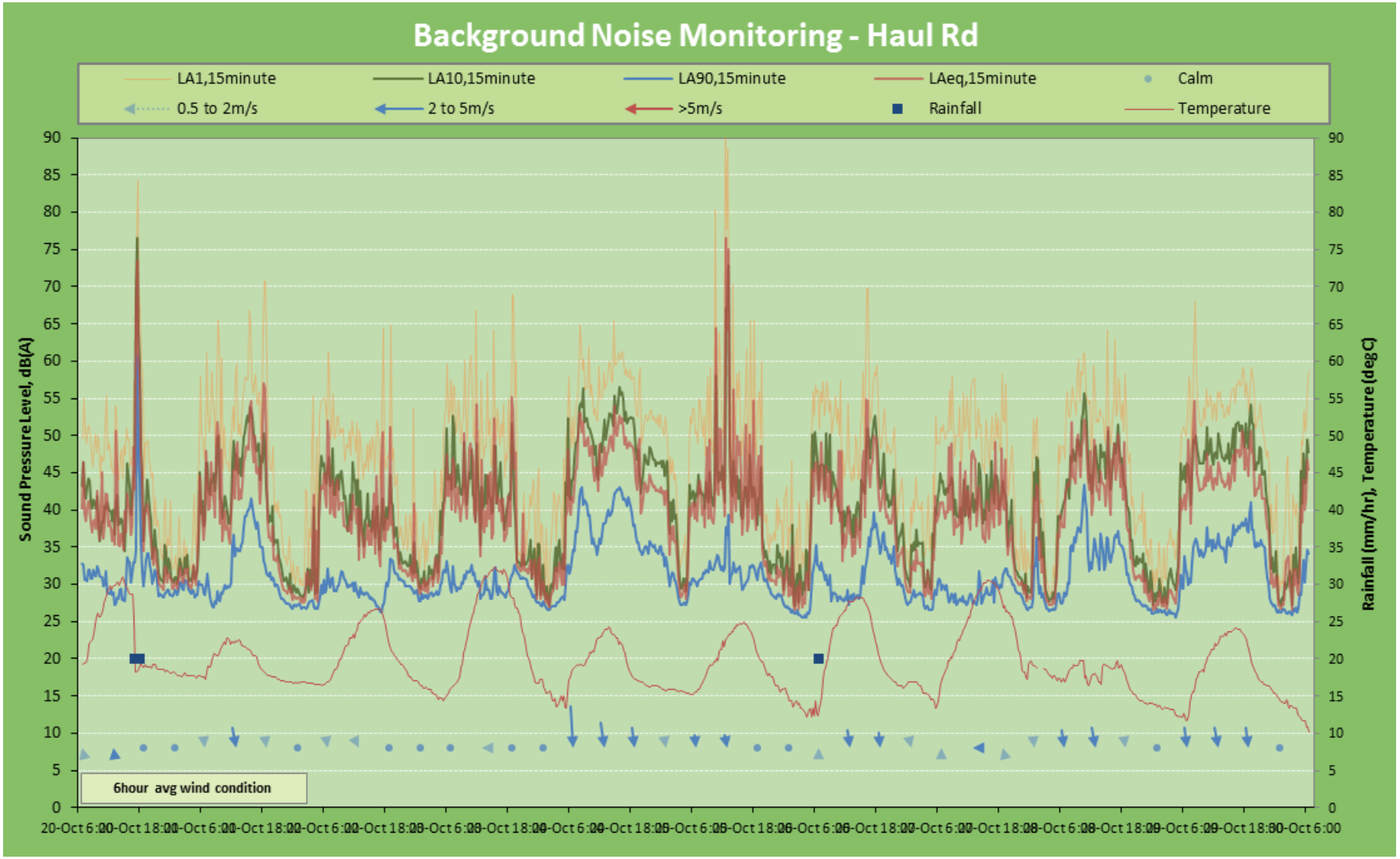
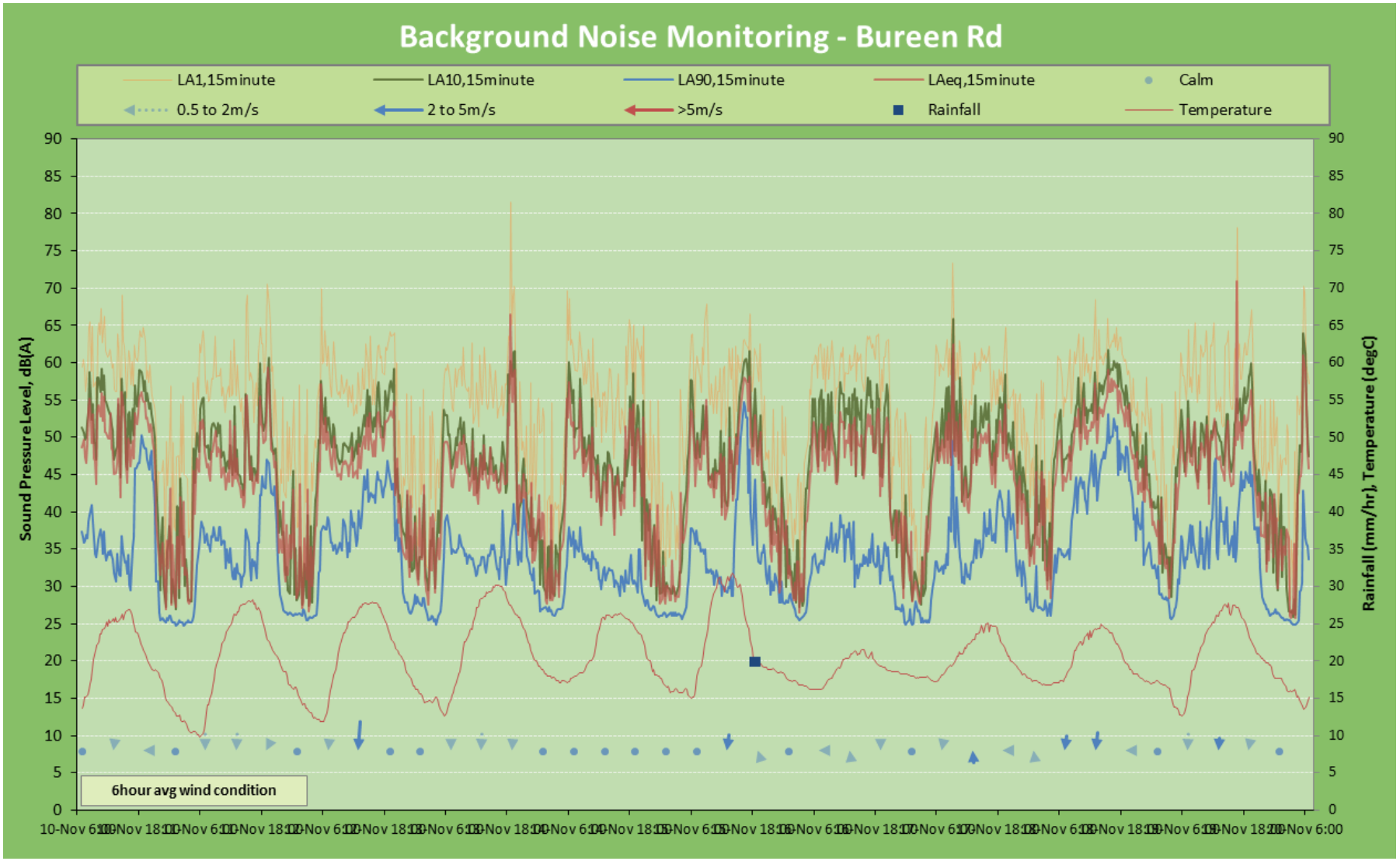
10. UK Department of Environment, Food and Rural Affairs (2005), *Update of noise database for prediction of noise on construction and open sites,* UK Department of Environment, Food and Rural Affairs, Norwich.

Appendix I Unattended Monitoring Results

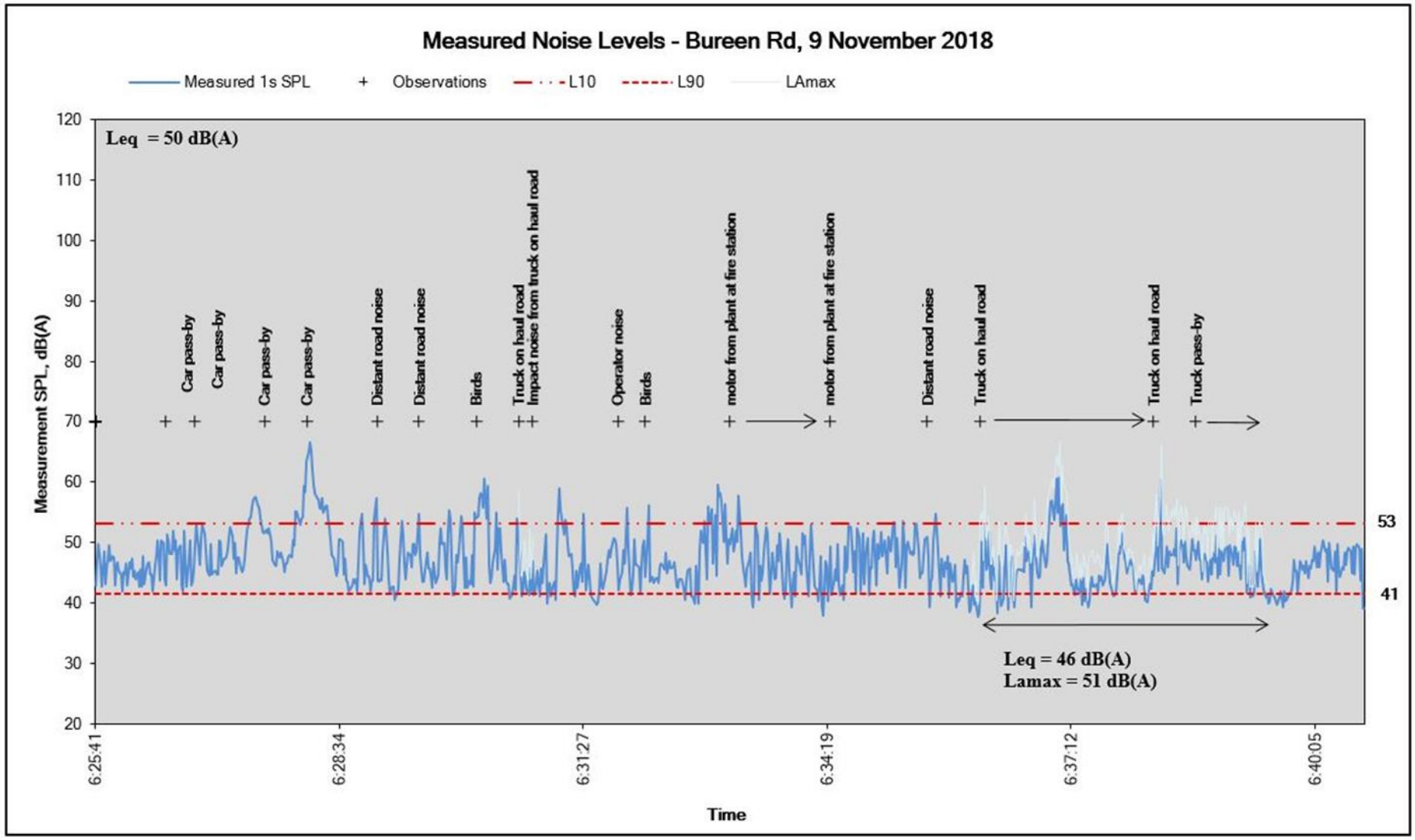


A1: Unattended monitoring - Receivers adjacent internal haul road



A2: Unattended monitoring – Receivers adjacent Bureen Road

Appendix II Attended monitoring – Trucks on Haul Road



A3: Attended monitoring – truck along haul road

Appendix III Operational Scenarios

Table A4: Operational scenarios used to model quarry operations

Scenario	Plant Equipment	Number of plant operational	Lw dB(A)	Noise prop. height (m)	Number of sources modelled	Utilisation (1hr period)
Crushing & quarrying operations	Hydraulic Excavator	2	108	3	2	100%
	Front End Loader	2	107	2	2	100%
	Moxy (articulated dump trucks)	2	107	1.5	2	100% / 4 movements
	Haul Truck	10	107	1.5	1	10 movements
	Water Carts	1	113	1.5	1	4 movements
	Washery/ stockpiler	1	110	3	1	100%
	Stockpiler	2	112	3	2	100%
	Mobile Crusher	1	115	3	1	100%
Standard quarry operations	Hydraulic Excavator	2	108	3	2	100%
	Front End Loader	2	107	2	2	100% / 4 movements
	Moxy (articulated dump trucks)	2	107	1.5	2	6 movements
	Haul Truck	10	107	1.5	1	10 movements
	Water Carts	1	113	1.5	1	4 movements
	Washery/ stockpiler	1	110	3	1	100%
	Stockpiler	2	112	3	2	100%
Haulage and loading	Front End Loader	2	107	2	2	100%/4 movements
	Haul Truck	10	107	1.5	2	10 movements

Appendix IV Noise Impact Predictions

Standard meteorological conditions

A summary of predicted $L_{Aeq,15minute}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios associated in Work Area 1 and Work Area 2 under standard meteorological conditions is provided in **Table A1**.

Table A1: Standard meteorological conditions - Noise impact predictions ($L_{Aeq,15minute}$ dB(A))

ID	Prediction $L_{Aeq,15minute}$			PNTL (Day / Evening / Night / Shoulder) $L_{Aeq,15minute}$	PNTL Exceedance?
	Haulage & truck loading	Standard quarry operation	Quarry operation with Crusher		
R1	28	29	29	40 / 35 / 35 / 35	No
R2	33	33	33	40 / 35 / 35 / 35	No
R3	<25	28	30	40 / 35 / 35 / 35	No
R4	<25	29	30	40 / 35 / 35 / 35	No
R5	29	36	38	40 / 37 / 35 / 40	Yes (evening & night)
R6	25	33	34	40 / 37 / 35 / 40	No
R7	27	36	37	40 / 37 / 35 / 40	Yes (night)
R8	33	39	39	40 / 37 / 35 / 40	Yes (evening & night)
R9	30	34	34	40 / 37 / 35 / 40	No
R10	29	32	33	40 / 37 / 35 / 40	No
R11	28	31	32	40 / 37 / 35 / 40	No

Prevailing south-southeast winds

A summary of predicted $L_{Aeq,15minute}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios associated in Work Area 1 and Work Area 2 under prevailing south-southeast winds at 3m/s during the evening and night period over the autumn season is provided in **Table A2**. Assessment of the shoulder period was included as it is possible for these weather conditions to occur during the early morning.

Table A2: Prevailing south-southeast winds noise impact predictions ($L_{Aeq,15minute}$ dB(A))

ID	Prediction $L_{Aeq,15minute}$			PNTL (Evening / Night/ Shoulder) $L_{Aeq,15minute}$	PNTL Exceedance?
	Haulage & truck loading	Standard quarry operation	Quarry operation with Crusher		
R1	29	30	30	35 / 35 / 35	No
R2	35	35	35	35 / 35 / 35	No
R3	26	32	34	35 / 35 / 35	No
R4	26	32	34	35 / 35 / 35	No
R5	32	40	42	37 / 35 / 40	Yes (all assessed periods)
R6	22	31	31	37 / 35 / 40	No
R7	24	33	34	37 / 35 / 40	No
R8	30	36	36	37 / 35 / 40	Yes (night)
R9	27	31	31	37 / 35 / 40	No
R10	26	30	30	37 / 35 / 40	No
R11	25	29	29	37 / 35 / 40	No

Prevailing north west winds

A summary of predicted $L_{Aeq,15minute}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios associated in Work Area 1 and Work Area 2 under prevailing north west winds and F class Pasquil stability during the night and early morning shoulder period in winter season is provided in **Table A3**.

Table A3: Prevailing north west winds - noise impact predictions ($L_{Aeq,15minute}$ dB(A))

ID	Prediction $L_{Aeq,15minute}$			PNTL (Night / Shoulder) $L_{Aeq,15minute}$	PNTL Exceedance?
	Haulage & truck loading	Standard quarry operation	Quarry operation with Crusher		
R1	31	32	32	35 / 35	No
R2	34	34	35	35 / 35	No
R3	23	29	31	35 / 35	No
R4	23	29	31	35 / 35	No
R5	29	37	39	35 / 40	No
R6	28	37	38	35 / 40	Yes (night)
R7	30	40	41	35 / 40	Yes (all assessed periods)
R8	36	42	43	35 / 40	Yes (all assessed periods)
R9	33	37	37	35 / 40	Yes (night)
R10	32	35	36	35 / 40	Yes (night)
R11	31	34	34	35 / 40	No

Temperature Inversion – Calm conditions

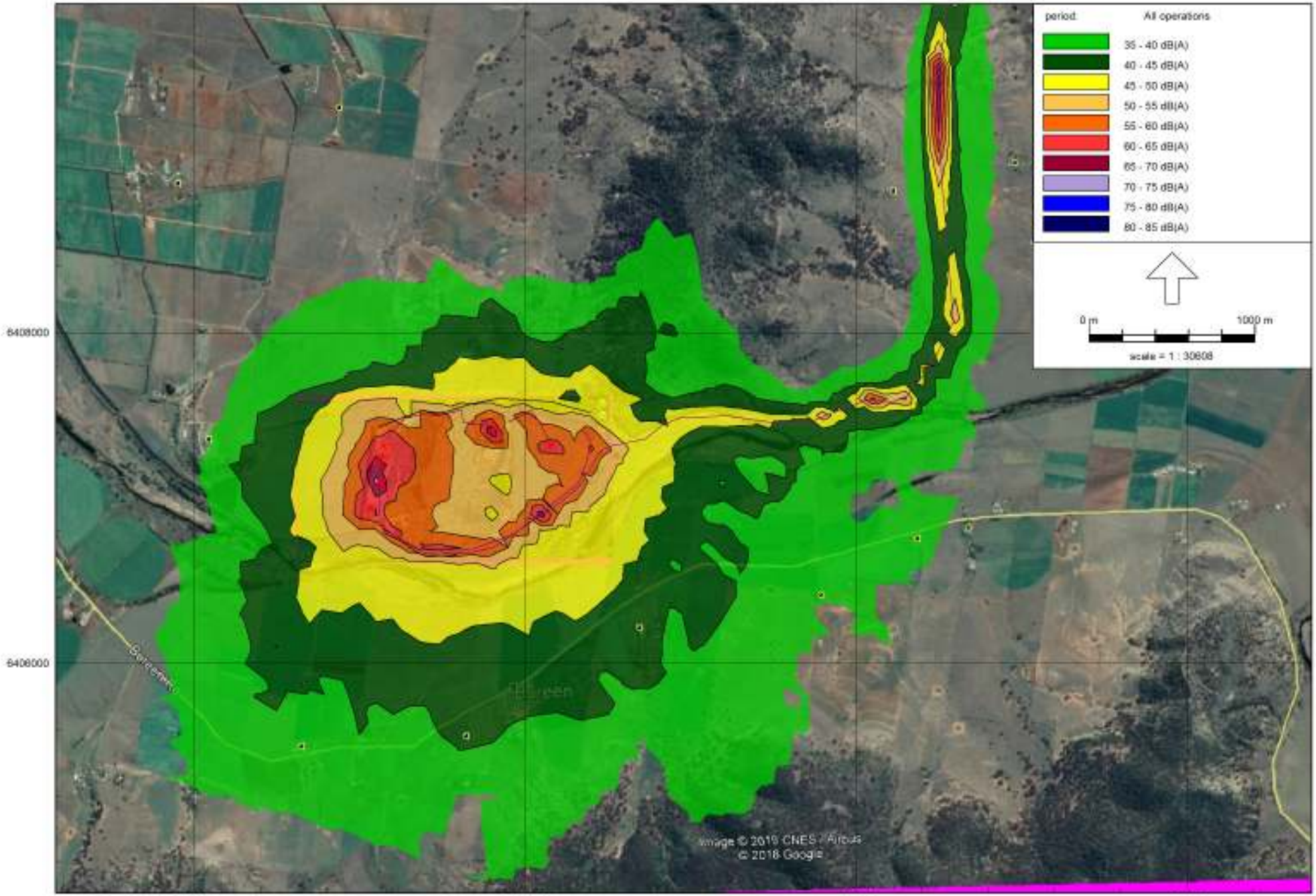
A summary of predicted $L_{Aeq,15minute}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios associated in Work Area 1 and Work Area 2 under F class Pasquil stability during the night and early morning shoulder periods is provided in **Table A4**.

Table A4: Prevailing F class Pasquill stability night period - noise impact predictions ($L_{Aeq,15minute}$ dB(A))

ID	Prediction $L_{Aeq,15minute}$			PNTL (Night/ Shoulder) $L_{Aeq,15minute}$	PNTL Exceedance?
	Haulage & truck loading	Standard quarry operation	Quarry operation with Crusher		
R1	31	32	32	35 / 35	No
R2	36	36	36	35 / 35	Yes (all assessed periods)
R3	26	32	34	35 / 35	No
R4	26	32	34	35 / 35	No
R5	32	40	42	35 / 40	Yes (all assessed periods)
R6	28	37	38	35 / 40	Yes (night)
R7	30	40	41	35 / 40	Yes (all assessed periods)
R8	36	42	43	35 / 40	Yes (all assessed periods)
R9	33	37	37	35 / 40	Yes (night)
R10	32	35	36	35 / 40	Yes (night)
R11	31	34	34	35 / 40	No

Appendix V Noise Contour Maps

Quarrying and Crushing Operations (NW Winds at 3m/s)



Industrial noise - ISO 9613.1/2 (1/3 Octave). [Operations Dalswinton Quarry - Operations NW Winds] . Predictor V8.11

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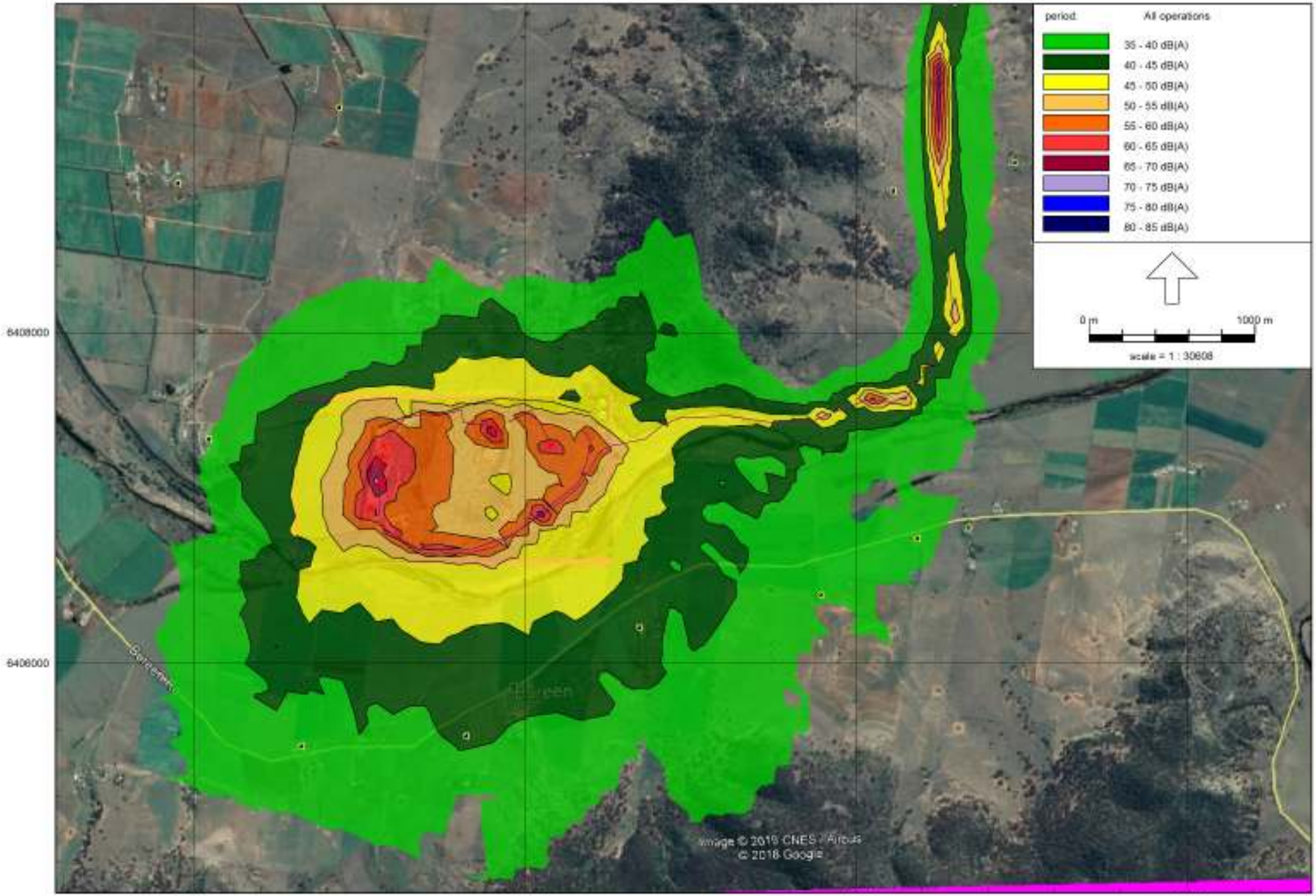
Quarrying and Crushing Operations (NW Winds at 3m/s)



Industrial noise - ISO 9613.1/2 (1/3 Octave). [Operations Dalswinton Quarry - Operations NW Winds] . Predictor V8.11

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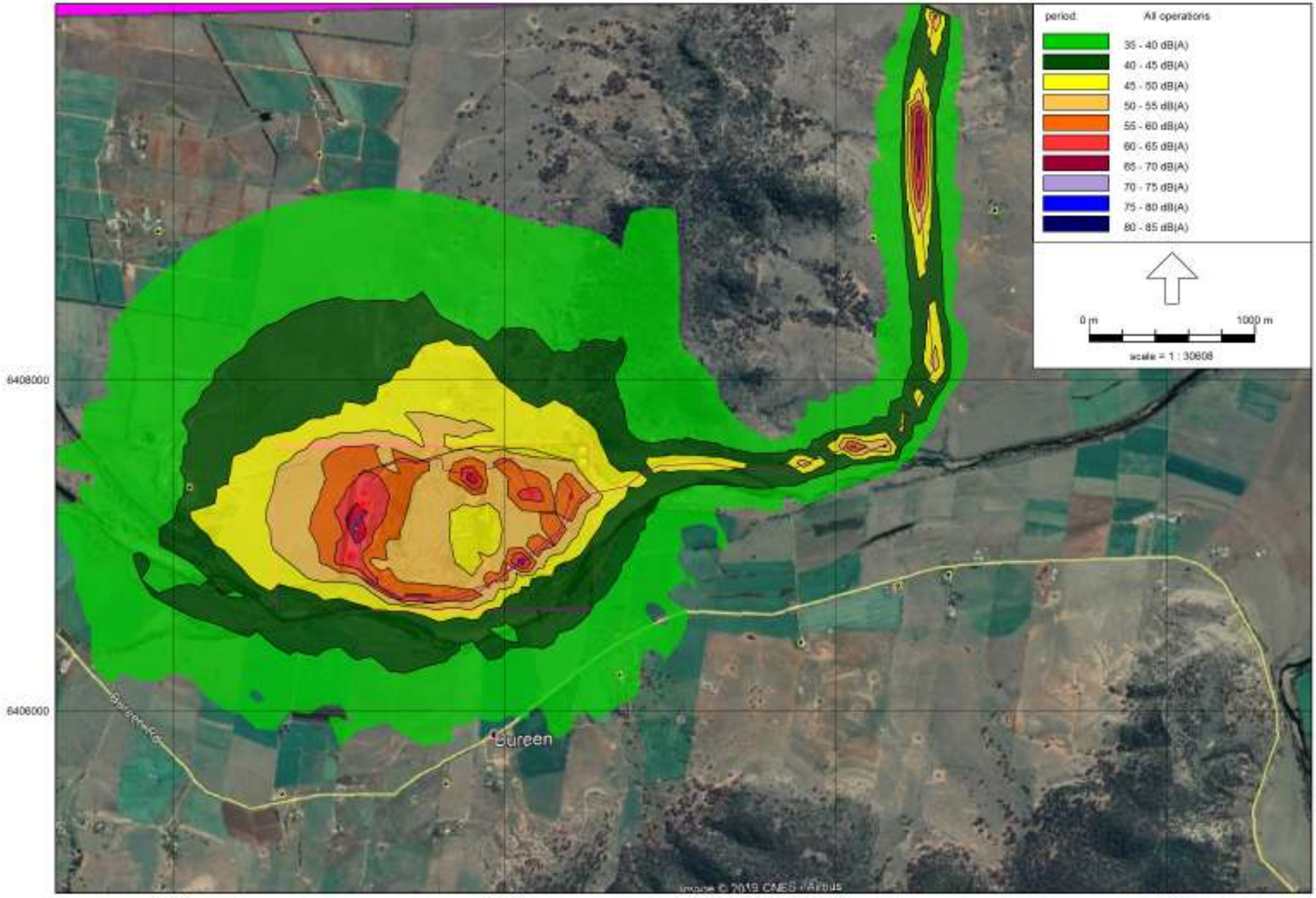

Industrial noise - ISO 9613.1/2 (1/3 Octave). [Operations Dalswinton Quarry - Copy of Operations SSE Winds] . Predictor V8.11

Quarrying and Crushing Operations (SSE winds at 3m/s)

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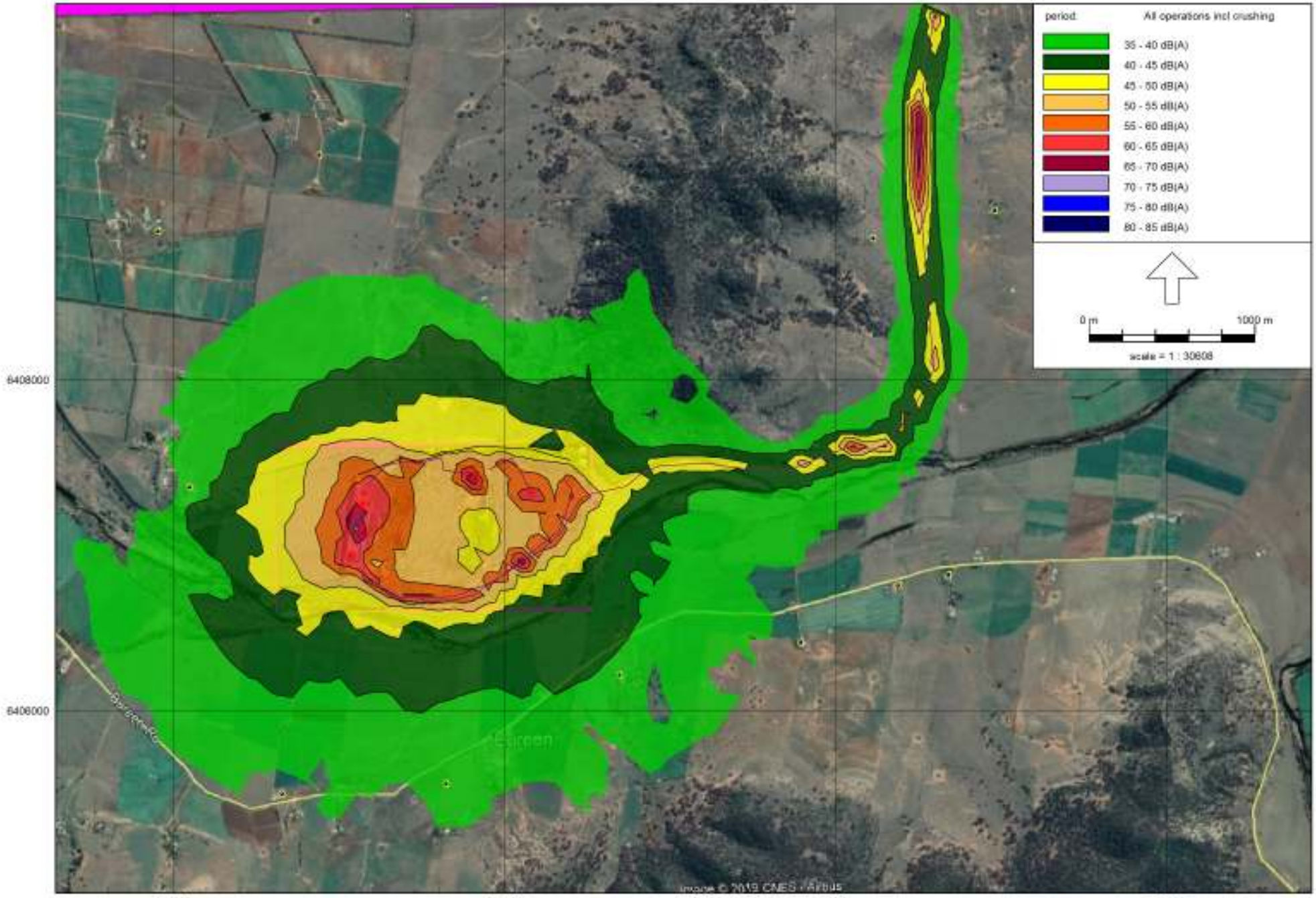
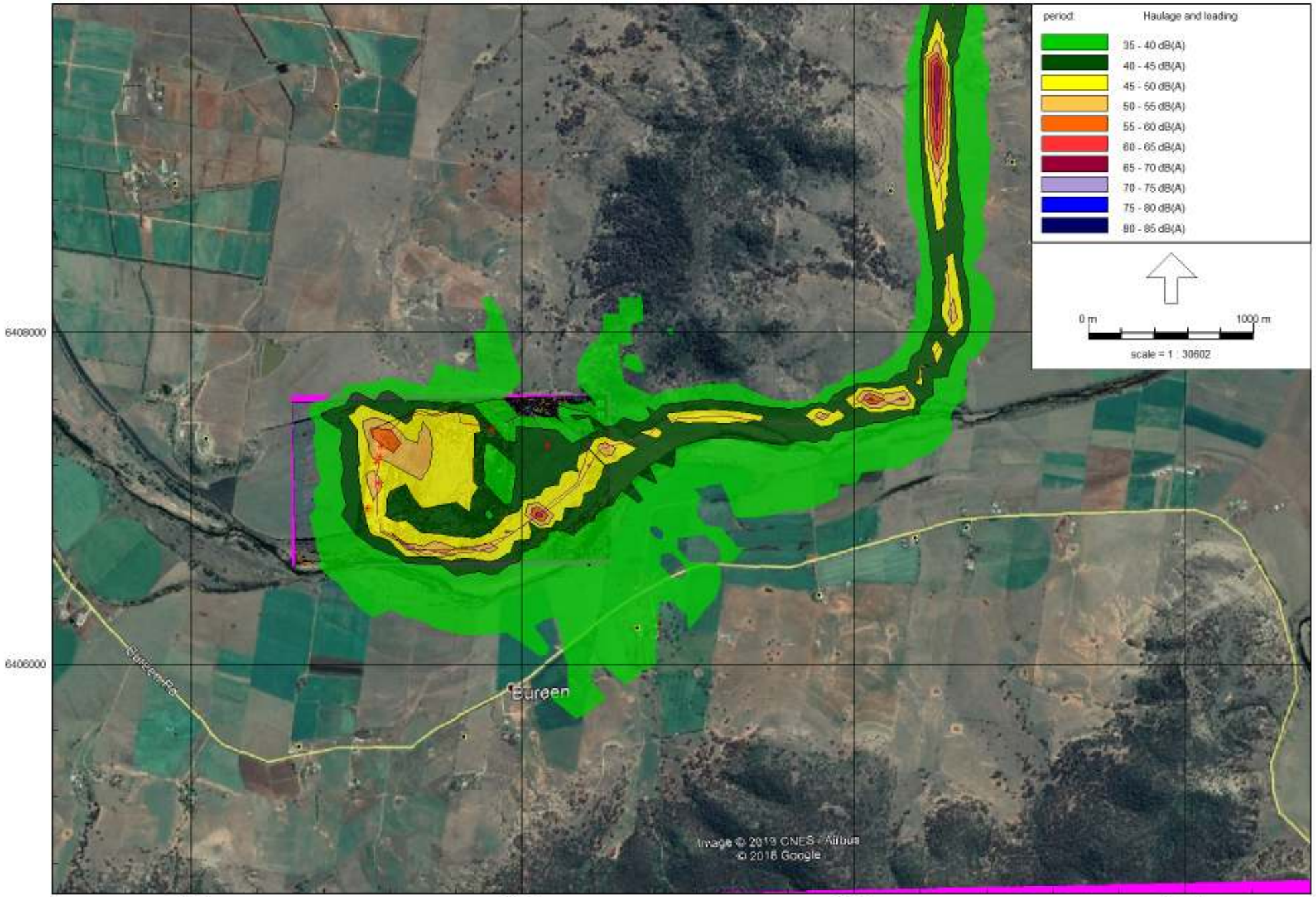


Industrial noise - ISO 9613.1/2 (1/3 Octave), [Operations Dalswinton Quarry - Operations (Standard Met)] , Predictor V8.11

Quarrying and Crushing Operations (Standard Met)

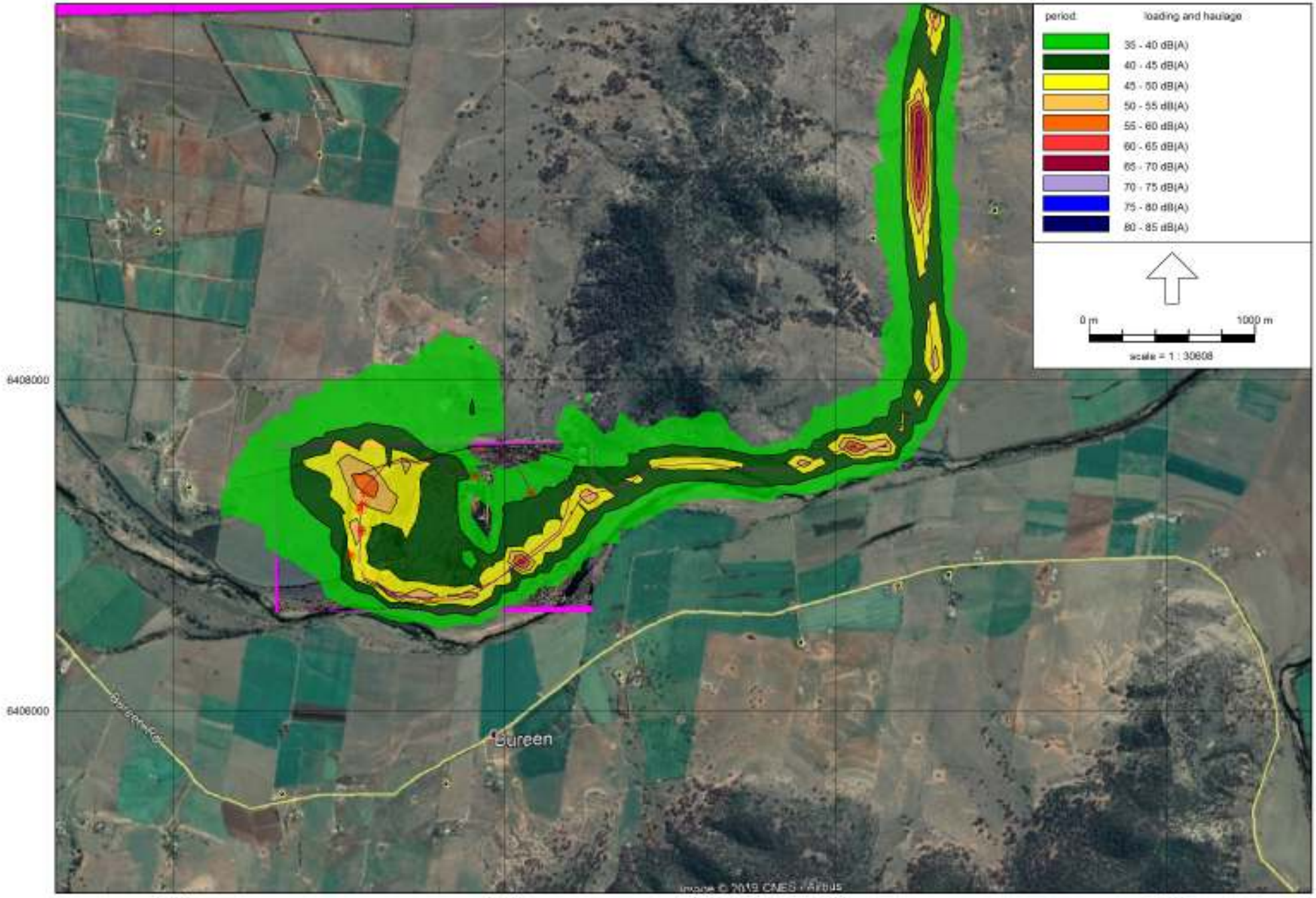
Advitech Pty Ltd



Industrial noise - ISO 9613 1/2 (1/3 Octave), [Operations Dalswinton Quarry - Operations NW Winds] , Predictor V8.11

Haulage and Loading (NW Winds at 3m/s)

Advitech Pty Ltd



Haulage and Loading (SSE winds at 3m/s)

Industrial noise - ISO 9613.1/2 (1/3 Octave). [Operations Dalswinton Quarry - Copy of Operations SSE Winds] . Predictor V8.11

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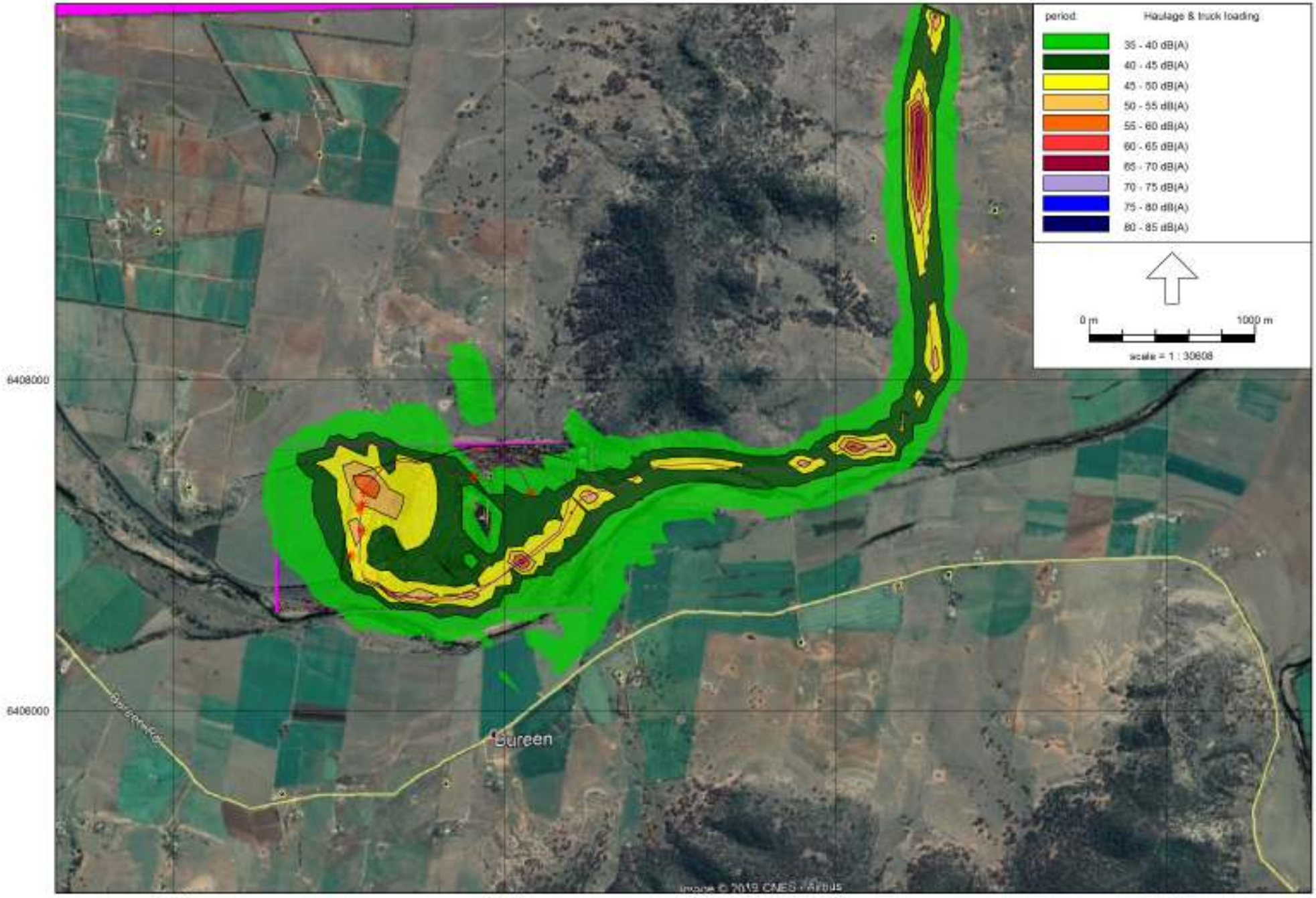
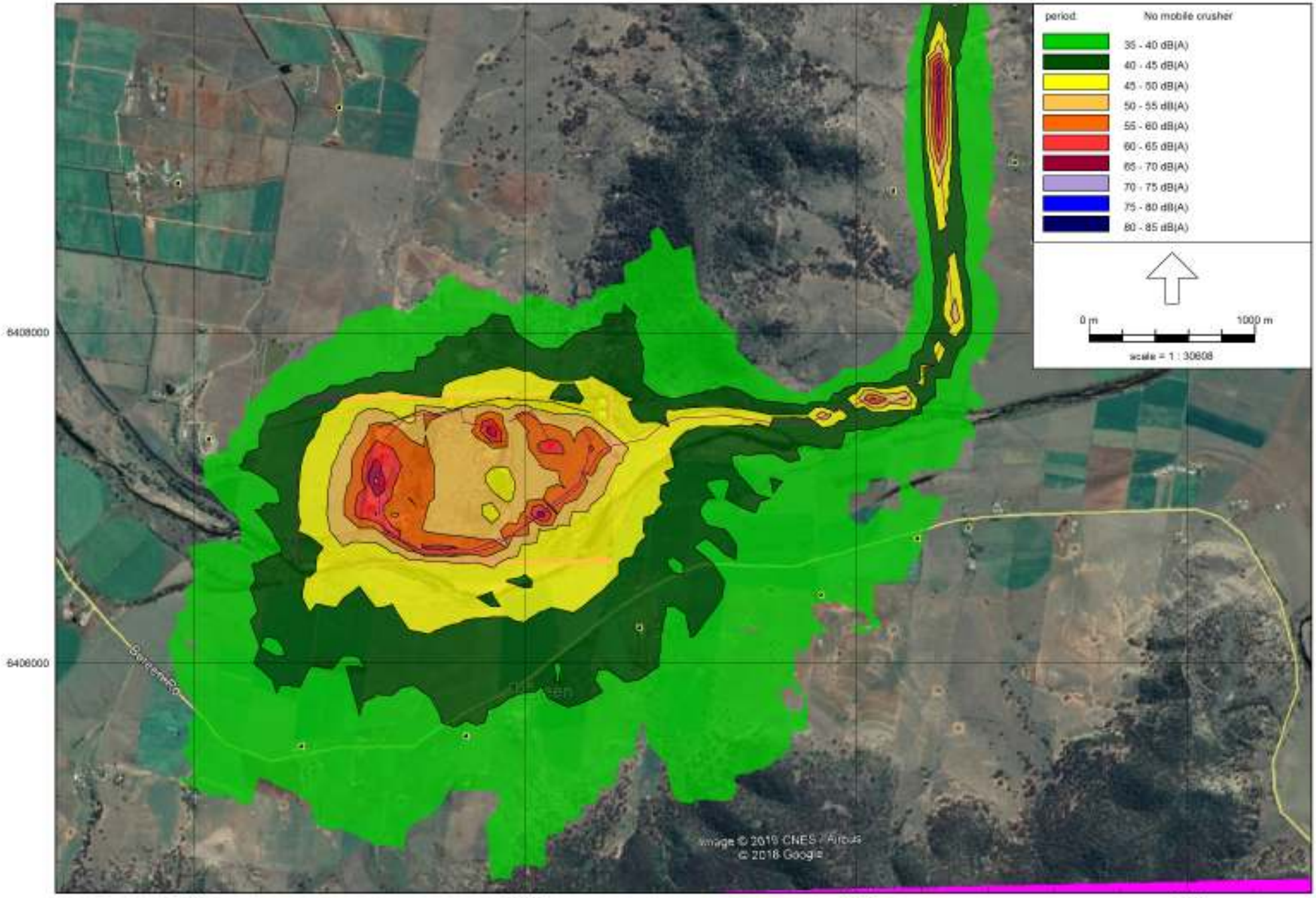


Industrial noise - ISO 9613.1/2 (1/3 Octave), [Operations Dalswinton Quarry - Operations (Standard Met)] , Predictor V8.11

Haulage and Loading (Standard Met)

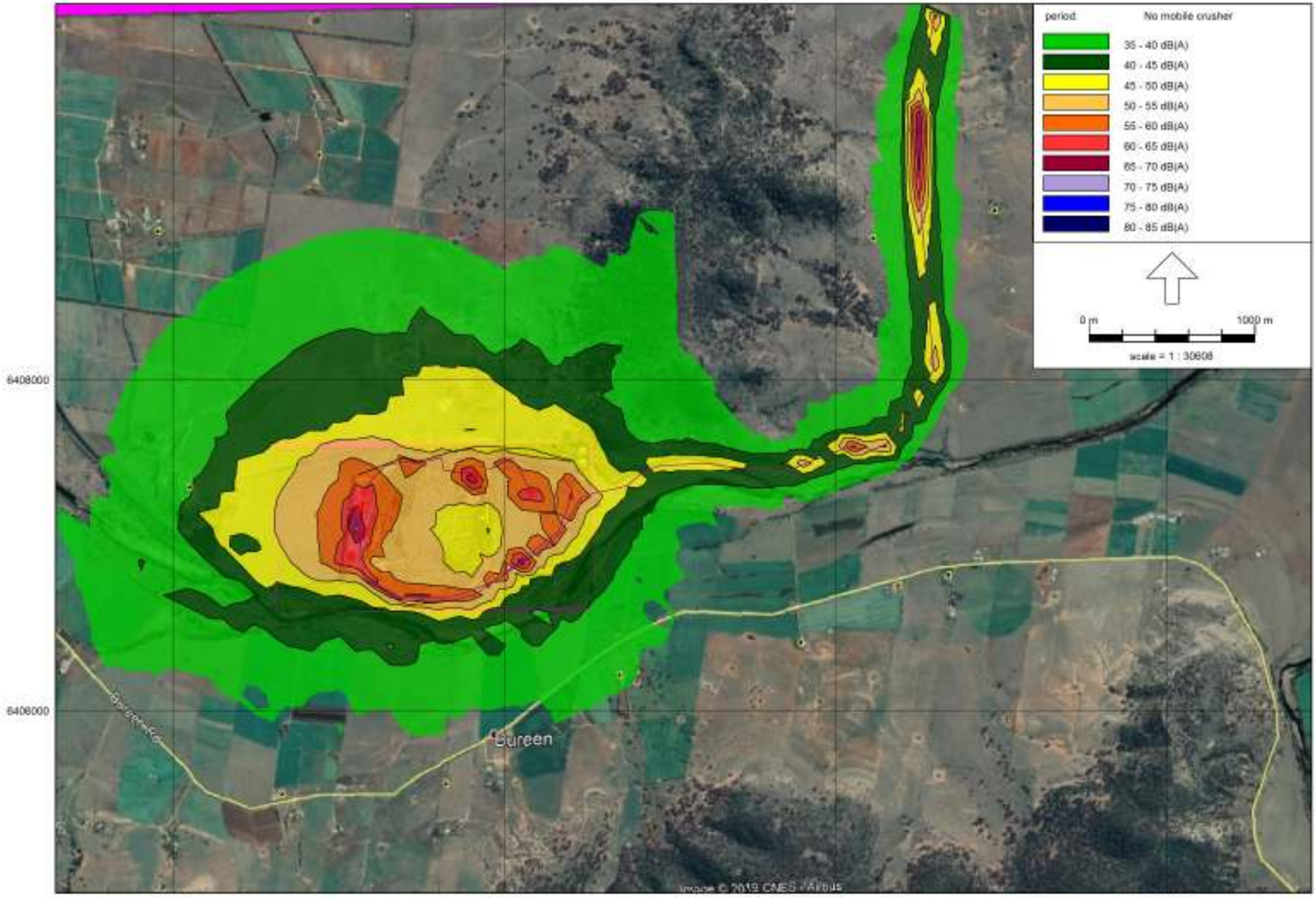
Advitech Pty Ltd



Industrial noise - ISO 9613.1/2 (1/3 Octave). [Operations Dalswinton Quarry - Operations NW Winds] . Predictor V8.11

Standard Quarrying Operations (NW Winds at 3m/s)

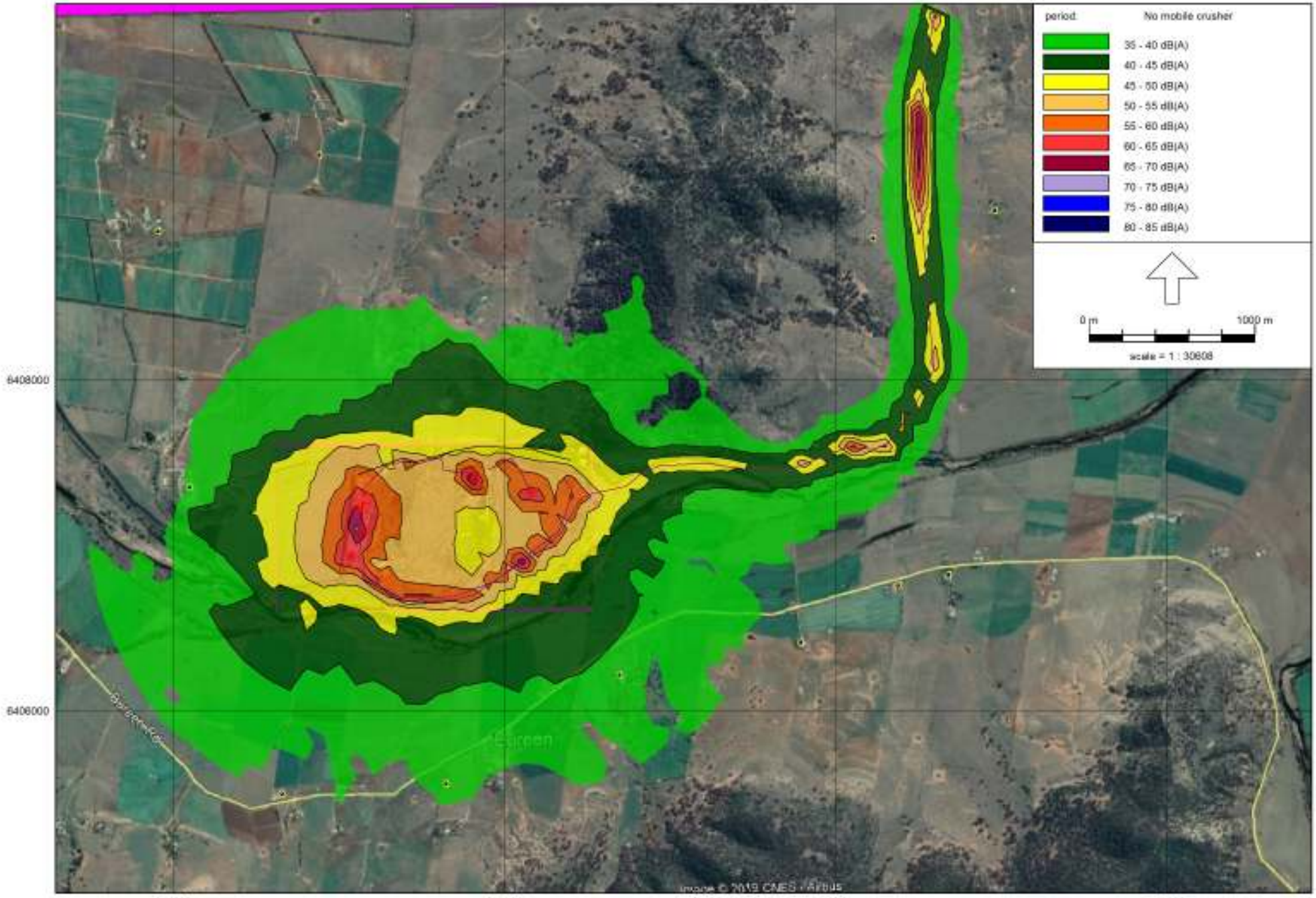
Advitech Pty Ltd



Industrial noise - ISO 9613.1/2 (1/3 Octave). [Operations Dalswinton Quarry - Copy of Operations SSE Winds] . Predictor V8.11

Standard Quarrying Operations (SSE winds at 3m/s)

Advitech Pty Ltd



Industrial noise - ISO 9613.1/2 (1/3 Octave), [Operations Dalswinton Quarry - Operations (Standard Met)] , Predictor V8.11

Standard Quarrying Operations (Standard Met)

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