Appendix F Noise and Vibration Impact Assessment

Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

31 October 2025

Centurion North Extension Project – Major Amendment

Noise and Vibration Impact Assessment

Centurion Coal Mining Pty Ltd

Level 14, 31 Duncan Street, Fortitude Valley,
Queensland 4006

Prepared by:

SLR Consulting Australia Pty Ltd

SLR Project No.: 620.042575.00007

28 October 2025

Revision: 01

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
01	28 October 2025	SH	JC	JC

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Centurion Coal Mining Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Basis of Report ..... **ii**
Acronyms and Abbreviations ..... **v**
1.0 Introduction **1**
1.1 Project Location 1
1.2 Project Description 1
1.3 Report Purpose 4
2.0 Existing Environment **5**
2.1 Sensitive Receptors 5
2.2 Acoustic Environment 7
3.0 Assessment Criteria **8**
4.0 Assessment Methodology **9**
4.1 Modelling Parameters and Assumptions 9
4.2 Noise and Vibration Modelling Scenarios 10
5.0 Assessment of Potential Impacts **13**
5.1 New Access Tracks, Well Pads and Laydown Area Development 13
5.1.1 Construction Noise 13
5.1.2 Construction Vibration 14
5.2 SIS/VPW Drilling 15
5.3 Borehole Drilling 16
5.4 Bleeder Shaft Construction 17
6.0 Management Practices **18**
7.0 Risk Assessment **18**

Tables

Table 1.1 Drill pad, ancillary infrastructure and access track disturbance area 3
Table 1.2 Report Structure 4
Table 2.1 Receptors Surrounding the Project 5
Table 2.2 Baseline noise monitoring results summary 7
Table 3.1 EA Schedule D Table 4 (Noise Limits) 8
Table 3.2 Project Noise Limits 9
Table 4.1 Modelled meteorological conditions 10
Table 4.2 Modelled scenarios and equipment SWL data – A-weighted 12
Table 5.1 Predicted worst-case new access track and drill pad construction noise levels ... 13
Table 5.2 Predicted worst-case well drilling noise levels 15

Table 5.3 Predicted worst-case borehole drilling noise levels 16
Table 5.4 Predicted worst-case bleeder shaft construction noise levels 17
Table 7.1 Noise and vibration risk assessment 18

Figures

Figure 1.1 Project location 2
Figure 2.1 Location of assessed receptors 6
Figure 5.1 Empirical predictors for groundborne vibration from construction works 14

Acronyms and Abbreviations

AS	Australian Standards
BoM	Bureau of Meteorology
CCM	Centurion Coal Mine
CND	Centurion North Development
CONCAWE	*Conservation of Clean Air and Water Europe*
CSG	Coal seam gas
dB	Decibel
dBA	A-weighted decibel (referenced 20 µPa)
DES	Department of Environment and Science
DETSI	Queensland Department of Environment, Tourism, Science and Innovation
EA	Environmental Authority
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1994*
EPA	Environmental Protection Agency
EPP(Noise)	*Environmental Protection (Noise) Policy 2019* (Qld)
ha	Hectare
Hz	Hertz
kHz	Kilohertz
km	Kilometre
L_{A1}	The A-weighted noise level exceeded for 1% during any given measurement period
L_{A10}	The A-weighted noise level exceeded for 10% during any given measurement period
L_{A90}	The A-weighted noise level exceeded for 90% during any given measurement period
m	Metres
ML	Mining Lease
MLA	Mining Lease Application
MMC	Model Mining Conditions – ESR/2016/1936, Version 6.03, Reviewed: 19 Feb 2024
mm/s	Millimetres per second
NATA	National Association of Testing Authorities
NMM	*Noise Measurement Manual 2020*
NVIA	Noise and Vibration Impact Assessment
PNC	*Planning for Noise Control 2004*
PPV	Peak Particle Velocity
QLD	Queensland
RBL	Rating Background Level
SDPWO Act	*State Development and Public Works Organisation Act 1971*

SIS	Surface-to-Inseam well
SWL	Sound Power Level
VPW	Vertical Production Wells

1.0 Introduction

1.1 Project Location

The Centurion North Extension Project, hereafter referred to as the 'Project', is located within Mining Lease (ML) 1790 (**Figure 1.1**), approximately 40 km north of Moranbah. The Project is located immediately adjacent to, and north of, the Centurion Coal Mine (CCM), which is located in ML 6949. The Project is planned to form part of the larger Centurion North Development (CND) which will be the subject of an Environmental Impact Study (EIS) under Part 4 of the *State Development and Public Works Organisation Act 1971* (SDPWO Act).

The Project Area is accessed from Moranbah via the Goonyella Road, the Red Hill Road and the North Goonyella Mine Access Road. Mackay is located approximately 140 km (and approximately 188 km by road) to the east and is accessed via the Peak Downs Highway, the Suttor Developmental Road, the Red Hill Road and the North Goonyella Mine Access Road.

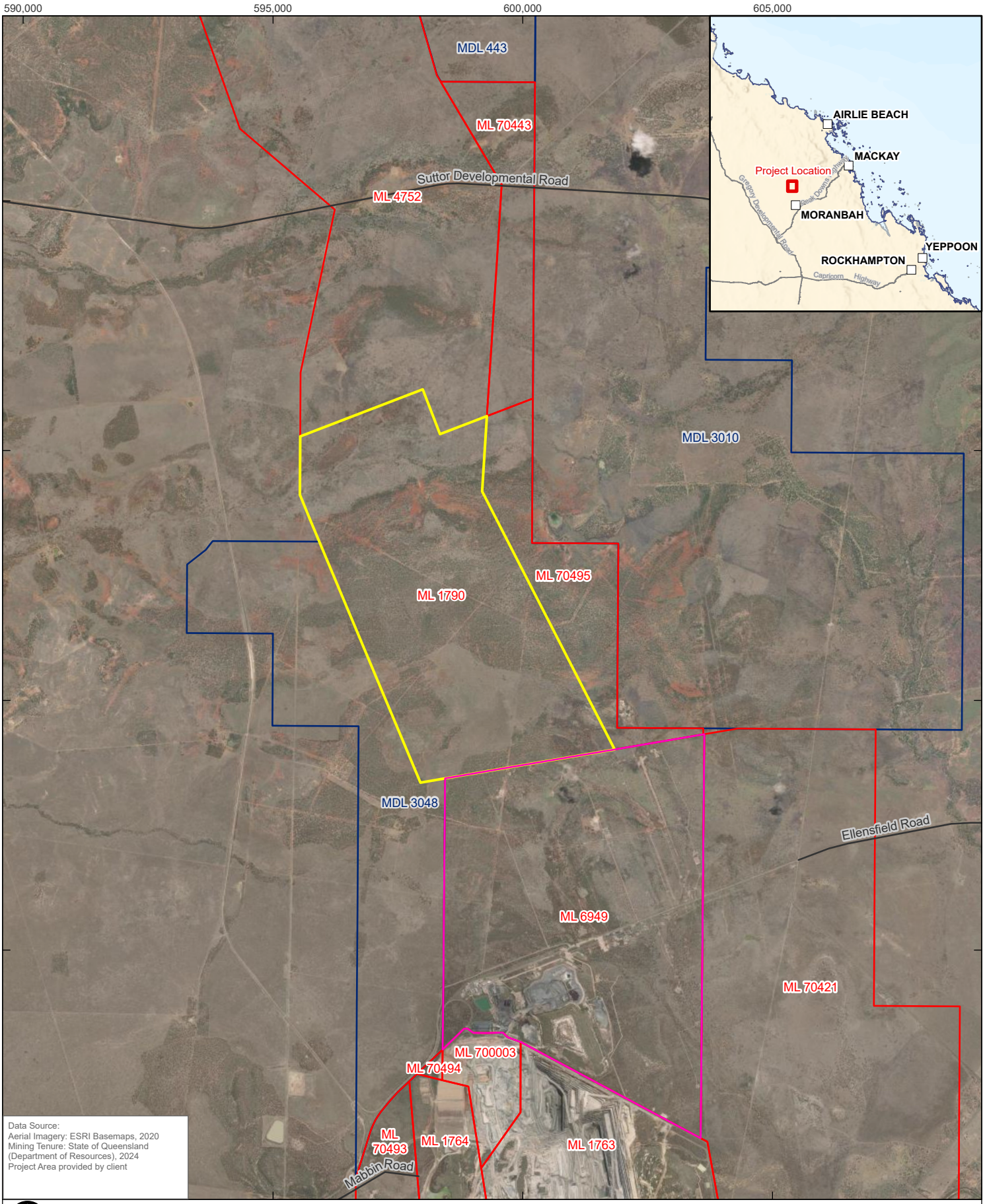
1.2 Project Description

The Project involves the development of supporting infrastructure to enable coal seam gas (CSG) extraction to facilitate safe underground coal mining operations within the Project Area, as well as early works to support future longwall extraction. All works associated with the Project will be undertaken within ML 1790.

Project activities include the following:

- Construction of new access tracks;
- Preparation of a laydown area;
- Construction of drill pads for Surface-to-Inseam (SIS) wells, Vertical Production Wells (VPW), gas risers, service boreholes, a bleeder shaft, and boreholes for gas conformance, specific gas emissions, spontaneous combusting testing, geotechnical and exploration;
- Drilling and operation of vertical and lateral SIS wells to drain gas from coal seams;
- Construction of gas risers to manage gas transfer to surface facilities;
- Construction of service boreholes to transfer materials from the surface to underground;
- Drilling of boreholes for gas, coal propensity, geotechnical and exploration sampling purposes;
- Development of a bleeder shaft for mine ventilation and safe gas management; and
- Disturbance for future goaf drainage lines.

All drilling will be undertaken using directional drilling, blind boring technologies and other conventional drilling methods, with strict safety, environmental, and gas management measures in place.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.040594.00001
Date Drawn:	31-Oct-2025
Drawn by:	RB

LEGEND

- Road
- Mining Lease
- Mineral Development Licence
- Project Area
- Centurion Coal Mine

CENTURION NORTH DEVELOPMENT

PROJECT LOCATION

CENTURION

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FIGURE 1.1

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.042575.00001 Centurion North Extension Proj\06 SLR Data\01 GIS\GIS\CNEP Major Amendment\CNEP Major Amendment.aprx\620040594_EA_ANV_F01-01_Project Location

Table 1.1 details the disturbance areas associated with drill pads, ancillary infrastructure and access tracks.

Table 1.1 Drill pad, ancillary infrastructure and access track disturbance area

Component	Disturbance type	Dimensions (m)	No of pads	Area (ha)
Drill pads for wells and boreholes	Vertical and lateral SIS wells	80 x 80 m	50*	32.00
	VPW design drill pads	30 x 30 m	4	0.36
	Gas risers	80 x 80 m	43	27.52
	Service boreholes	30 x 30 m	24	2.16
	Gas conformance boreholes	30 x 30 m	145	13.00
	Specific gas emission boreholes	30 x 30 m	14	1.26
	Spontaneous combustion testing boreholes	30 x 30 m	14	1.26
	Geotechnical boreholes	30 x 30 m	38	3.42
	Exploration boreholes	30 x 30 m	2	0.18
Ancillary infrastructure and tracks	Bleeder shaft	n/a	1	1.54
	New access tracks	n/a	n/a	23.78
	Laydown area	150 x 150 m	1	1.50
	Disturbance for Future Goaf Drainage Lines	n/a	n/a	59.43
Total New Disturbance**	**334 drill pads plus ancillary infrastructure /tracks**			**167.41** (6.15% of ML 1790 area)
Total New Disturbance accounting for Existing Approved Disturbance***				**142.98** (5.25% of ML 1790 area)

Notes:

* 50 SIS well pads will be constructed, supporting a total of 66 SIS wells. Select pads will accommodate two SIS wells within the one pad footprint.

** Total disturbance area excludes overlapping drill pads.

*** Total disturbance area excluding overlapping drill pads and excluding existing approved disturbance footprints within ML 1790.

1.3 Report Purpose

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Centurion Coal Mining Pty Ltd to prepare a Noise and Vibration Impact Assessment (NVIA) to support the Major Environmental Authority (EA) Amendment Application for the Project. The structure of this technical report is outlined in **Table 1.2**.

Table 1.2 Report Structure

Section	Description
1: Introduction	Provides an overview of the purpose of this report, the Project and outlines the structure and supporting documentation of the report.
2: Existing environment	Provides an overview of the assessed sensitive receptors and a summary of baseline studies.
3: Assessment criteria	Provides an overview of the noise and vibration assessment criteria that have been prepared for this technical report based on the existing ML 1790 EA.
4: Assessment methodology	Presents the noise impact assessment methodology including assumptions and inputs for the noise modelling.
5: Noise and vibration impact assessment	Presents the results from the noise and vibration modelling and impact assessment.
6: Noise and vibration management	Provides management recommendations for this Project based on the outcomes of the noise and vibration assessment (Section 5).
7: Risk assessment	Presents a risk assessment of the key findings of the assessment.

This technical report has been prepared with reference to the following key documents:

- Queensland Government *Environmental Protection Act* 1994;
- Queensland Government *Environmental Protection (Noise) Policy* 2019;
- Department of Environment and Science's (DES) *Noise Measurement Manual* 2020 (NMM);
- DES's *Application Requirements for Activities with Noise Impacts* Guideline 2017; and
- Environmental Protection Agency's (EPA) *Planning for Noise Control* Guideline 2004 (PNC) (withdrawn by the Department of the Environment, Tourism, Science and Innovation (DETSI) and is not currently an approved guideline).

2.0 Existing Environment

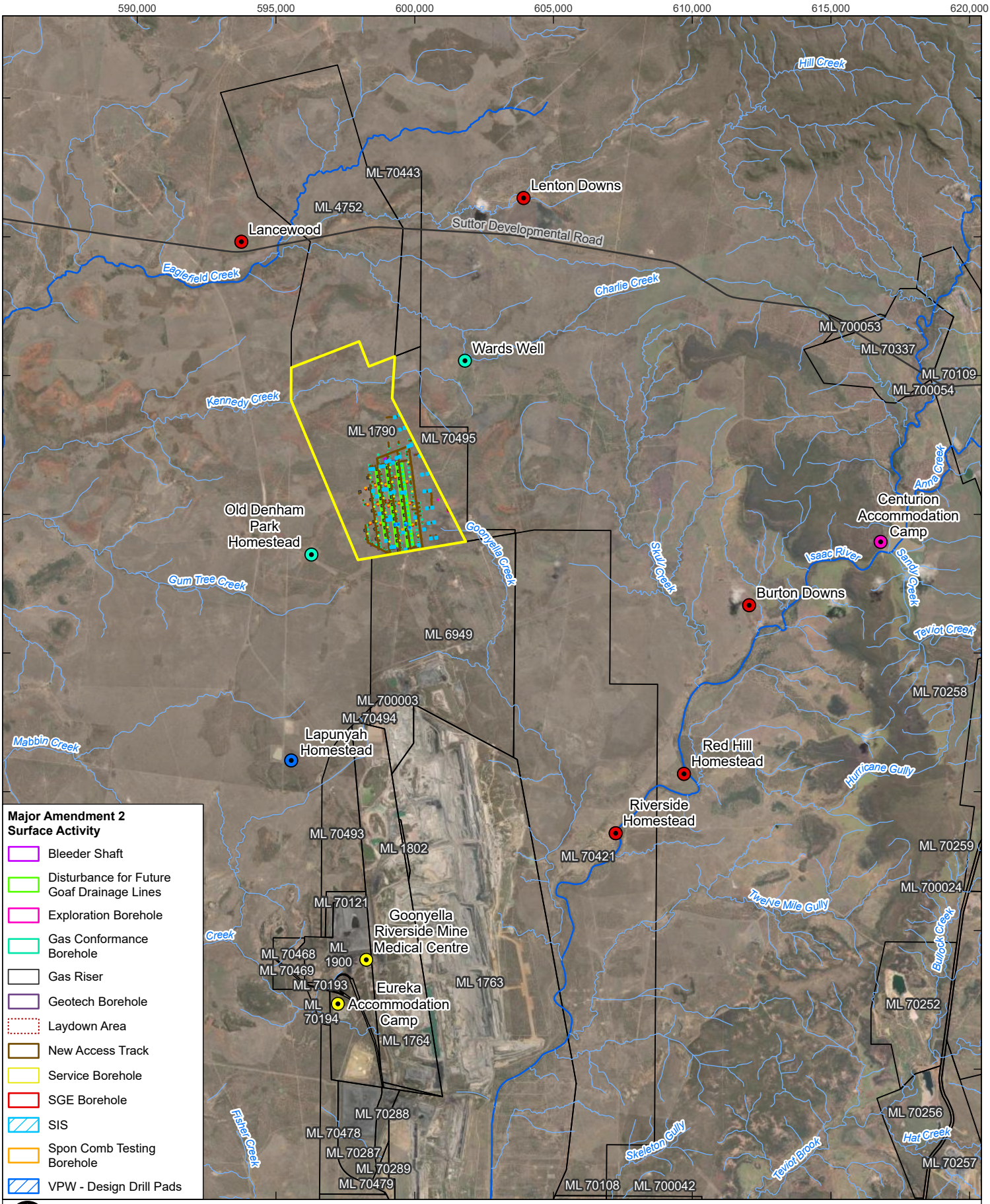
2.1 Sensitive Receptors

Potential sensitive receptors surrounding the Project Area, are presented in **Table 2.1** and **Figure 2.1**. Sensitive receptors have been identified through a desktop review of historical information (e.g. EIS, EA amendments, etc) and an analysis of available aerial photographic images.

Table 2.1 Receptors Surrounding the Project

ID	Receptor Name	Easting (m) [1]	Northing (m) [1]	Approximate Distance to Closest Drill Pad (km)	Ownership/Agreement Status
1	Old Denham Park Homestead	596275	7608546	2.0	Stanmore SMC Pty Ltd (commercial agreement)
2	Wards Well	601809	7615534	3.0	Stanmore SMC Pty Ltd (commercial agreement)
3	Lancewood	593750	7619821	8.3	Privately owned
4	Lenton Downs	603922	7621398	9.0	Privately owned
5	Centurion Accommodation Camp	616790	7609005	15.6	Centurion Coal Mining Pty Ltd
6	Burton Downs	612051	7606721	11.5	Privately owned
7	Red Hill Homestead	609702	7600644	12.2	Privately owned
8	Riverside Homestead	607241	7598505	12.3	Privately owned
9	Goonyella Riverside Mine Medical Centre	598253	7593944	14.6	BMA
10	Eureka Accommodation Camp	597230	7592356	16.3	BMA
11	Lapunyah Homestead	595547	7601128	8.2	Stanmore SMC Pty Ltd

Note 1: GDA 2020 MGA Zone 55 projection.



0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:180,000 at A4
Project Number:	620.042575
Date Drawn:	31-Oct-2025
Drawn by:	RB

LEGEND

- Major Road
- Major Watercourse
- Minor Watercourse
- Project Area
- Mining Lease

Sensitive Receptor

- BMA
- Centurion Coal Mining Pty Ltd
- Privately owned
- Stanmore SMC Pty Ltd
- Stanmore SMC Pty Ltd (commercial agreement)

CENTURION NORTH DEVELOPMENT

LOCATION OF ASSESSED RECEPTORS

CENTURION

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FIGURE 2.1

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.042575.00001 Centurion North Extension Proj\06 SLR Data\01 GIS\GIS\CNEP Major Amendment\CNEP Major Amendment.aprx\620042575_EA_ANV_F02-01_Location of Assessed Receptors

2.2 Acoustic Environment

Historical noise monitoring results obtained from measurements completed by SLR have been used to inform the assessment criteria for the Project. The baseline noise levels are summarised in **Table 2.2** and have been applied to the assessment of the Project.

All items of acoustic instrumentation employed during the noise monitoring were set to A-weighted and 'Fast' response in accordance with the relevant Australian Standards and NMM. All items of acoustic instrumentation employed during the noise measurement surveys were designed to comply with AS/NZS IEC 61672.1-2019 *Electroacoustics-Sound level meters–Specifications* and carried current manufacturer or NATA calibration certificates.

Table 2.2 Baseline noise monitoring results summary

Monitoring Location	Description	Rating Background Level (dBA)		
		Day (7 am – 6 pm)	Evening (6 pm – 10 pm)	Night (10 pm – 7 am)
(ID 1) Old Denham Park Homestead	Noise logger located in south-eastern corner of front yard, approximately 15 m from the homestead	28	25	25
(ID 6) Burton Downs Homestead	Noise logger located in centre of front yard, approximately 100 m from the homestead (between homestead and working shed, next to fruit garden)	25	24	24
(ID 8) Riverside Homestead	Noise logger located in north-eastern corner of tennis court, approximately 40 m from the homestead	30	23	23
(ID 10) Eureka Accommodation Camp	Noise logger located ~200 m from Eureka Creek & ~500 m from Riverside Mine Road	36	39	36
(ID 11) Lapunyah Homestead	Noise logger located in south-eastern corner of front yard, approximately 20 m from the homestead	26	30	28

The following is noted from the existing baseline noise monitoring data:

- Excluding the Eureka Camp, Rating Background Levels (RBL) ranged from 25 dBA to 30 dBA during the daytime, and 23 dBA to 30 dBA during both the evening and night-time.
- The observed noise levels were typical of a rural environment with natural noise sources, such as birds, light wind in trees, insects, as well as mining noise contributions associated with the Goonyella Riverside Mine complex and CCM.
- RBLs at the Eureka Village ranged between 36 dBA to 39 dBA during the daytime, evening and night-time. The ambient noise environment at this location was largely controlled by local (i.e. camp-related) vehicle movements, mechanical plant noise from within the camp and noise from Goonyella Riverside Mine.

Of the above, the observation most relevant to this study is that background noise levels (in the context of the existing EA) were shown to be 30 dBA or lower during the day, evening and night-time assessment periods. This is expected to also be the case at other sensitive receptor locations listed in **Table 7.1**.

3.0 Assessment Criteria

Under the current EA (P-EA-100658735) that applies to drilling and associated activities on ML 1790, the Project is required to be undertaken in accordance with Schedule D Acoustic Conditions D1 to D5. The current EA conditions, summarised as follows, have been used for the purpose of setting assessment criteria for the Project.

Conditions relevant to noise are contained within Conditions D1 to D5, with numerical noise limits prescribed in *Table 4 (Noise Limits)* of the EA. Conditions D1 and D4 (which relate to noise nuisance) and Table 4 are reproduced below and in **Table 3.1**.

D1 ***Noise nuisance*** *– Subject to conditions D2 and D3, noise from the mining activity must not cause an environmental nuisance at any sensitive or commercial place.*

D4 *If monitoring indicates exceedance of the limits in Table 4 (Noise Limits), then the environmental authority holder must:*

a) address the complaint including the use of appropriate dispute resolution if required; and

b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.

Table 3.1 EA Schedule D Table 4 (Noise Limits)

Noise Level (dBA)	Monday to Sunday (including public holidays)		
	Day 7 am – 6 pm	Evening 6 pm – 10 pm	Night 10 pm – 7 am
Noise measured at a 'sensitive or commercial place'			
$L_{A10, adj,10mins}$	B/g + 5	B/g + 5	B/g + 3
$L_{A1, adj,10mins}$	B/g + 10	B/g + 10	B/g + 5

Note: Where "Background" means background sound pressure level measured in accordance with the latest edition of the administering authority's NMM. Table 4 (Noise Limits) does not purport to set operating hours for the mining activities.

With reference to the criteria in **Table 3.1** and RBLs summarised in **Table 2.2** (interpreted as "B/g" in **Table 3.1**), **Table 3.2** outlines the noise criteria applied to the assessment for the Project. In accordance with Schedule D (Noise) of the MMC, it states that where the measured background noise level is less than 30 dBA, which according to **Table 2.2** was the case for all receptors locations except for the Eureka Accommodation Camp, then 30 dBA can be substituted for the measured background level.

Table 3.2 Project Noise Limits

Noise Level (dBA)	Monday to Sunday (including public holidays)		
	Daytime 7 am – 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm – 7 am
Noise measured at a sensitive or commercial place			
$L_{A10, adj,10mins}$	35 [1]	35 [1]	33 [1]
$L_{A1, adj,10mins}$	40 [1]	40 [1]	35 [1]

Note 1: Based on the MMC threshold background noise level of 30 dBA.

Regarding the Eureka Accommodation Camp, given this camp is located at least 15 km from the Project site on ML 1790 and noise impacts (from the Project) are very unlikely to occur, the noise limits presented in **Table 3.2** have been conservatively applied to the camp.

Further to the noise limits, we note the EA references vibration in the heading of Condition D1, however, there is no further mention nor prescribing of actual vibration limits in the EA. In the absence of vibration limits in the EA, the assessment of vibration from the Project has referenced the criteria recommended in Table D2 of the MMC.

4.0 Assessment Methodology

4.1 Modelling Parameters and Assumptions

A SoundPLAN (Version 8.2) computer noise model was developed to predict project noise levels at potentially impacted receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The Conservation of Clean Air and Water Europe (CONCAWE[1]) industrial prediction algorithm has been used to model predicted noise levels from the Project. The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to ±2 dBA in any one octave band between 63 hertz (Hz) and 4 kHz and ± 1 dBA overall.

In relation to the modelling of atmospheric conditions, the PNC guideline (which we note is currently retracted but still referenced in the NMM), provides guidance with respect to applying default atmospheric conditions deemed suitable for the assessment of mining operations. The default weather parameters recommended by the PNC guideline are summarised in **Table 4.1** and have been applied to the assessment of noise impacts from the Project.

[1] Report no. 4/81 the propagation of noise from petroleum and petrochemical complexes to neighbouring communities

Table 4.1 Modelled meteorological conditions

Parameter	Neutral Weather	Adverse Weather
Temperature	10°C	10°C
Humidity	70%	90%
Pasquill stability class	D	F (representative of temperature inversion)
Wind speed	0 m/s	2 m/s

4.2 Noise and Vibration Modelling Scenarios

The following provides an overview of the noise and vibration modelling completed to inform the assessment of the potential for noise and vibration impacts from the Project:

- New access tracks, drill pads and laydown area construction:
  - The pre-drilling stage involving the development of the new access tracks and drill pads has been modelled based on the combined fleet of construction equipment listed in **Table 4.2** operating simultaneously during the construction. Noise from the new access tracks and drill pad construction activities have been modelled individually to identify the proposed access track and drill pad site with the highest (i.e. worst-case) predicted noise level at each receptor.
  - Vibration modelling and assessment has been carried out for the 12t vibratory roller required for soil compaction as part of the earthmoving fleet.
- Drilling of SIS and VPWs:

The modelling of well drilling noise has been conservatively based on the lateral well rig setup (spread) for all Project wells (i.e. both vertical and lateral wells), noting noise emission from the drilling of vertical wells will potentially be lower, given the smaller rig spread. Noise from the drill rig has been modelled at the closest proposed well site to each receptor. The modelled sound power level (SWL) data is summarised in **Table 4.2**.

  - No discernible sources of vibration are anticipated during this stage of the Project.
- Drilling of boreholes:
  - Noise from the borehole drill rig has been modelled at the closest borehole to each receptor. The modelled SWL data is summarised in **Table 4.2**.
  - No discernible sources of vibration are anticipated during this stage of the Project.
- Bleeder shaft construction:
  - Bleeder shaft construction noise has been modelled based on the combined fleet of plant and equipment listed in **Table 4.2** operating simultaneously within the area shown in **Figure 1.1**.
  - No discernible sources of vibration are anticipated during this stage of the Project.

- VPW operation:
  - We note that Peabody is progressing several gas abatement projects aimed at the beneficial use of CSG extracted as part of the Project. As a last resort, CSG may be directed to candlestick flares located within the disturbance footprint of the drill pads. This flare system will allow for the controlled combustion of methane to reduce the greenhouse gas intensity of the operation or during emergency scenarios. Notwithstanding this, modelling of flare noise has previously been completed by SLR for the Minor EA Amendment for the gas extraction program with compliance (of the noise assessment criteria) predicted for all sensitive receptors. No further modelling and assessment of CSG flaring noise has been completed as part of this study.
  - No discernible sources of vibration are anticipated during this stage of the Project.

Table 4.2 Modelled scenarios and equipment SWL data – A-weighted

Plant Item	Octave Band Centre Frequency (Hz)								Total SWL	Source Height
	63	125	250	500	1k	2k	4k	8k		
New access track and drill pad construction (note: fleet consists of one (1) of each item)										
Slasher	83	103	105	110	112	104	102	92	115	2.0 m
Dozer D8T	84	93	97	105	101	100	98	90	108	2.5 m
Vibratory roller (12t)	97	102	95	100	102	101	98	93	108	2.0 m
Water truck (30 kL)	84	90	95	100	100	99	95	85	106	2.5 m
Grader CAT 150	94	100	106	103	109	106	102	90	113	3.0 m
Well drilling										
SIS/VPW drill rig	105	109	111	117	122	119	111	102	125	3.0 m
Borehole drilling										
Hydraulic drill rig	87	105	97	104	108	108	105	101	114	3.0 m
Bleeder shaft construction (blind boring/drilling)										
Delivery truck (semi)	93	91	96	99	99	98	93	88	105	3.0 m
Crawler crane	93	99	95	97	97	96	90	83	105	4.0 m
Genset	78	85	85	83	85	85	79	65	92	1.0 m
Compressor	77	83	84	95	99	98	91	84	103	1.0 m
Blind boring rig	93	111	107	112	113	112	104	95	119	5.0 m
Excavator (30t)	87	90	96	102	101	100	97	90	107	2.0 m
Water truck	84	90	95	100	100	99	95	85	106	2.0 m
Concrete truck	85	86	85	94	98	107	89	82	108	2.0 m
Concrete pump	85	89	94	100	102	104	96	90	108	1.5 m
Welding equipment	71	81	86	85	87	89	85	80	94	1.0 m

5.0 Assessment of Potential Impacts

5.1 New Access Tracks, Well Pads and Laydown Area Development

5.1.1 Construction Noise

Predicted new access tracks, drill pads and laydown area construction noise levels, under neutral and adverse weather conditions, are summarised in **Table 5.1**. Construction is anticipated to occur continuously (i.e. 24 hours per day, 363 days per year), as such, the EA noise limits for the daytime period (i.e. 7:00 am to 6:00 pm), evening (i.e. 6:00 pm to 10:00 pm) and night-time period (i.e. 10:00 pm to 7:00 am) have been included for reference in **Table 5.1**.

Table 5.1 Predicted worst-case new access track and drill pad construction noise levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)			Predicted Construction Noise Level $L_{A10,adj,10min}$ (dBA)	
	Daytime 7 am- 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm to 7 am	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead [1]	N/A	N/A	N/A	38	33
2 - Wards Well [1]	N/A	N/A	N/A	32	26
3 - Lancewood	35	35	33	16	<10
4 - Lenton Downs	35	35	33	15	<10
5 - Centurion Accommodation Camp	N/A	N/A	N/A	<10	<10
6 - Burton Downs	35	35	33	12	<10
7 - Red Hill Homestead	35	35	33	11	<10
8 - Riverside Homestead	35	35	33	10	<10
9 - Goonyella Riverside Mine Medical Centre [2]	35	35	33	<10	<10
10 - Eureka Accommodation Camp [2]	35	35	33	<10	<10
11 - Lapunyah Homestead [1]	35	35	33	16	<10

Note: Greyed cells indicate the receptor is either owned by CCM or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

From the noise modelling results presented in **Table 5.1**, the following is noted:

- Worst-case new access track, drill pads and laydown area construction noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level was 38 dBA $L_{A10,adj,10mins}$ at the Old Denham Park Homestead, which is noted to be owned by Stanmore SMC Pty Ltd with a commercial agreement in place between CCM and Stanmore.
- The highest predicted noise level at a privately-owned sensitive receptor was 16 dBA $L_{A10,adj,10mins}$ at Lancewood. Based on a typical +5 dB relationship between the $L_{A10,adj,10mins}$ and $L_{A1,adj,10mins}$, a predicted noise level of 21 dBA $L_{A1,adj,10mins}$ complies with the 35 dBA EA night-time period noise limit.

5.1.2 Construction Vibration

The current EA does not prescribe vibration limits, nor does it provide guidance in relation to the prevention of vibration impacts from activities occurring on ML 1790. Consequently, the potential for vibration impacts associated with the operation of the 12t vibratory roller (required as part of the earthworks fleet) has been assessed against the following criterion:

- Human comfort peak particle velocity (PPV) vibration limit of 5 mm/s, based on guidance from the MMC guideline.

It is noted that the above criterion specifically refers to ground vibration from blasting; however, it is considered that the vibration limits are relevant to the assessment of vibration from the Project vibratory compaction works, particularly given the temporary and short-term nature of these works. Notwithstanding this, vibration offset buffer distances to comply with the threshold of human perception (i.e. <0.15 mm/s[2]) have also been calculated and assessed for the Project.

Prediction of PPV vibration levels from the 12t roller are based on the following methodology:

- Vibratory compaction – BS 5228-2:2009 Evaluation and measurement for vibration in buildings - Part 2 (plus 2014 Amendment), specifically Table E.1 '*Empirical predictors for groundborne vibration arising from mechanized construction works*'.

Vibratory compaction PPV vibration levels were calculated using the empirical formulae shown in **Figure 5.1**.

Figure 5.1 Empirical predictors for groundborne vibration from construction works

Operation	Prediction question	Scaling factors (and probability of predicted value being exceeded)	Parameter range
Vibratory compaction (steady state)	$v_{res} = k_s\sqrt{n_d}\left[\frac{A}{x+L_d}\right]^{1.5}$	k_s = 75 (50%) k_s = 143 (33.3%) k_s = 276 (5%)	$1 \leqslant n_d \leqslant 2$ $0.4 \leqslant A \leqslant 1.72$ mm $2 \leqslant x \leqslant 110$ m
Vibratory compaction (start up and run down)	$v_{res} = k_t\sqrt{n_d}\left[\frac{A^{1.5}}{(x+L_d)^{1.3}}\right]$	k_t = 65 (50%) k_t = 106 (33.3%) k_t = 177 (5%)	$0.75 \leqslant L_d \leqslant 2.2$ m

Source: Table E.1, Vibratory rolling – BS 5228-2:2009 Evaluation and measurement for vibration in buildings - Part 2 (plus 2014 Amendment)

[2] British Standard BS 5228-2:2009, *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*, states "*Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 mm/s to 0.3 mm/s*".

Based on the formulae presented in **Figure 5.1**, vibration offset buffer distances for the 12t roller have been calculated to inform the assessment:

- Approximately 30 m to comply with the 5 mm/s human comfort vibration limit.
- Approximately 480 m to be below the threshold of human perception (i.e. <0.15 mm/s).

Based on the above vibration offset buffer distances and the receptor to drill pad distances in **Table 2.1** (i.e. 8.3 km to 12.3 km for privately-owned sensitive receptors), the risk of vibration-related impacts is negligible for any sensitive receptor during the vibratory compaction works.

5.2 SIS/VPW Drilling

Predicted well drilling noise levels, under neutral and adverse weather conditions, are summarised in **Table 5.2** and are assessed against the daytime, evening and night-time period noise limits.

Table 5.2 Predicted worst-case well drilling noise levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)			Predicted Construction Noise Level $L_{A10,adj,10min}$ (dBA)	
	Daytime 7 am- 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm to 7 am	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead [1]	N/A	N/A	N/A	39	34
2 - Wards Well [1]	N/A	N/A	N/A	37	32
3 - Lancewood	35	35	33	19	12
4 - Lenton Downs	35	35	33	18	10
5 - Centurion Accommodation Camp	N/A	N/A	N/A	<10	<10
6 - Burton Downs	35	35	33	14	<10
7 - Red Hill Homestead	35	35	33	13	<10
8 - Riverside Homestead	35	35	33	13	<10
9 - Goonyella Riverside Mine Medical Centre [2]	35	35	33	11	<10
10 - Eureka Accommodation Camp [2]	35	35	33	<10	<10
11 - Lapunyah Homestead [1]	35	35	33	19	11

Note: Greyed cells indicate the receptor is either owned by CCM or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

The noise modelling results presented in **Table 5.2** indicate the following:

- Worst-case well drilling noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level at a privately-owned sensitive receptor was 19 dBA $L_{A10,adj,10mins}$ at Lancewood. It is important to note that this predicted noise level relates to the operation of just one (1) drill rig. If both drill rigs operate simultaneously at similar offset distances from Lancewood, a worst-case cumulative noise level of 22 dBA is predicted which is also well below the EA night-time period noise limit of 33 dBA $L_{A10,adj,10mins}$.

5.3 Borehole Drilling

The predicted noise levels during drilling of the proposed boreholes (as detailed in **Table 1.1**), under neutral and adverse weather conditions are summarised in **Table 5.3**, and are assessed against the daytime and night-time period noise limits.

Table 5.3 Predicted worst-case borehole drilling noise levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)			Predicted Construction Noise Level $L_{A10,adj,10min}$ (dBA)	
	Daytime 7 am- 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm to 7 am	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead [1]	N/A	N/A	N/A	31	26
2 - Wards Well [1]	N/A	N/A	N/A	23	18
3 - Lancewood	35	35	33	11	<10
4 - Lenton Downs	35	35	33	10	<10
5 - Centurion Accommodation Camp	N/A	N/A	N/A	<10	<10
6 - Burton Downs	35	35	33	<10	<10
7 - Red Hill Homestead	35	35	33	<10	<10
8 - Riverside Homestead	35	35	33	<10	<10
9 - Goonyella Riverside Mine Medical Centre [2]	35	35	33	<10	<10
10 - Eureka Accommodation Camp [2]	35	35	33	<10	<10
11 - Lapunyah Homestead [1]	35	35	33	12	<10

Note: Greyed cells indicate the receptor is either owned by CCM or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

The noise modelling results presented in **Table 5.3** indicate the following:

- Worst-case borehole drilling noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level at a privately-owned sensitive receptor was 11 dBA $L_{A10,adj,10mins}$ at Lancewood. Like the assessment of cumulative noise from two (2) well drilling rigs (in **Section 5.2**), if multiple borehole drill rigs are operated simultaneously the resultant cumulative noise level would be expected to be below the EA noise limits.

5.4 Bleeder Shaft Construction

Predicted bleeder shaft construction noise levels, under neutral and adverse weather conditions, are summarised in **Table 5.4** and are assessed against the daytime and night-time period noise limits.

Table 5.4 Predicted worst-case bleeder shaft construction noise levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)			Predicted Construction Noise Level $L_{A10,adj,10min}$ (dBA)	
	Daytime 7 am- 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm to 7 am	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead [1]	N/A	N/A	N/A	28	22
2 - Wards Well [1]	N/A	N/A	N/A	28	22
3 - Lancewood	35	35	33	18	11
4 - Lenton Downs	35	35	33	17	10
5 - Centurion Accommodation Camp	N/A	N/A	N/A	<10	<10
6 - Burton Downs	35	35	33	14	<10
7 - Red Hill Homestead	35	35	33	13	<10
8 - Riverside Homestead	35	35	33	13	<10
9 - Goonyella Riverside Mine Medical Centre [2]	35	35	33	12	<10
10 - Eureka Accommodation Camp [2]	35	35	33	10	<10
11 - Lapunyah Homestead [1]	35	35	33	16	<10

Note: Greyed cells indicate the receptor is either owned by CCM or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

The noise modelling results presented in **Table 5.4** indicate the following:

- Worst-case bleeder shaft construction noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level at a privately-owned sensitive receptor was 18 dBA $L_{A10,adj,10mins}$ at Lancewood.

6.0 Management Practices

The assessment of the potential for noise and vibration impacts to sensitive receptors has indicated that impacts would likely be avoided without the need for specific mitigation and management measures. Nonetheless, it is recommended that the following good practice measures are applied during the Project to assist with the control of noise and vibration levels:

- Use of the quietest available equipment to complete the earthworks, drilling and bleeder shaft construction works.
- All plant and equipment should be operated in accordance with the manufacturer's instruction and regularly maintained in order to minimise noise emission levels.
- Lining pipe racks with rubber to dampen the metal-on-metal impact.
- Equipment should be shut down when not in use.
- Broadband "buzzer", not tonal "beeper", reversing alarms should be utilised on all mobile plant.
- For vibratory compaction works, selecting appropriately sized equipment for the task.
- Minimising drop height of materials when unloading on site.

7.0 Risk Assessment

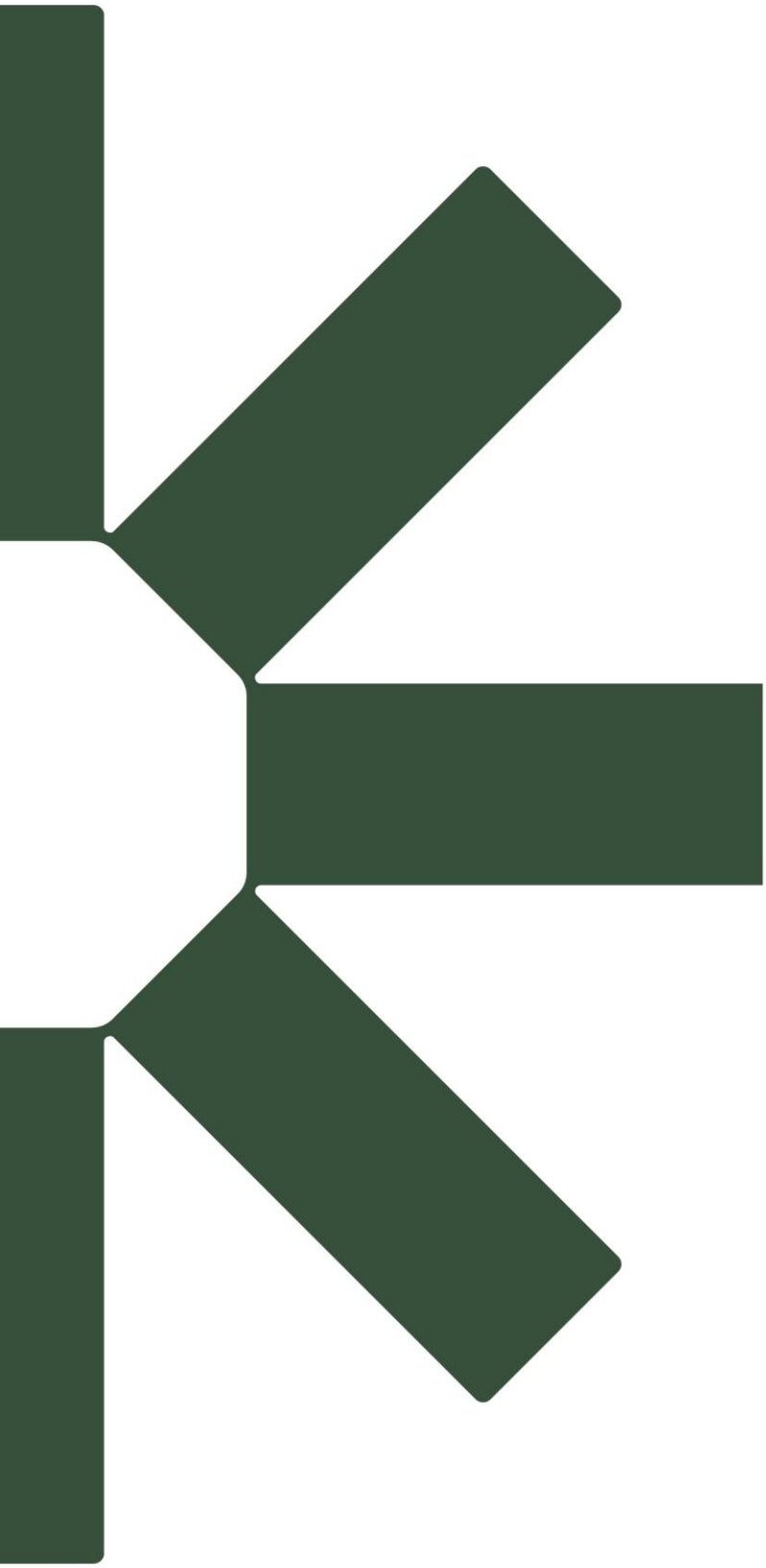
The potential noise and vibration impacts were assessed to provide an overall risk rating, which are presented in **Table 7.1**.

Table 7.1 Noise and vibration risk assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Noise disturbance at sensitive receptors during new access track, drill pad construction works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm
Vibration disturbance at sensitive receptors during vibratory compaction associated with new access track and drill pad construction works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Noise disturbance at sensitive receptors during well drilling works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm
Noise disturbance at sensitive receptors during borehole drilling works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm
Noise disturbance at sensitive receptors during construction of the bleeder shaft	Unlikely (2)	Low (2)	Low	Due to the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm

The risk-based assessment presented in **Table 7.1** has determined that noise and vibration impacts to sensitive receptors surrounding the Project are low due to the scale of the proposed activities and the distance separation to sensitive receptors.



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