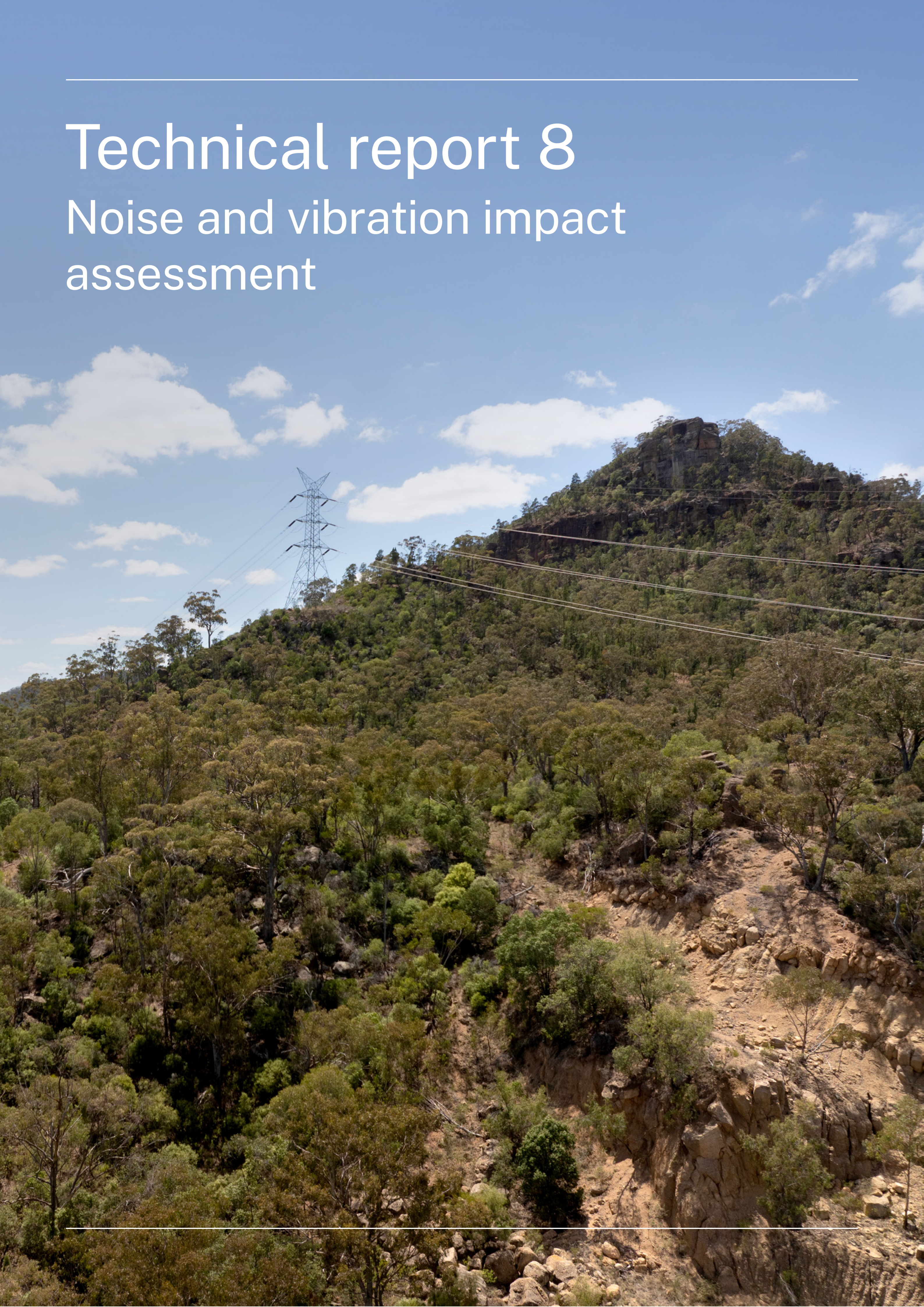
Technical report 8

Noise and vibration impact assessment



Noise and Vibration Impact Assessment

Hunter Transmission Project

Prepared for

EnergyCo

20 Bond Street
Sydney NSW 2000

Prepared by:

SLR Consulting Australia

SLR Project No.: 630.032094.00001

Client Reference No.: R01

August 2025

Revision: v1.0

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
v1.0	August 2025	Patrick Marshall	Martin Davenport	Martin Davenport

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with EnergyCo (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.

Executive Summary

Background

The Hunter Transmission Project (HTP, the project) involves the construction of a new overhead 500 kilovolt (kV) transmission line of around 110 kilometres connecting the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring in the Hunter region of New South Wales (NSW).

Due to its strategic importance, the NSW Minister for Planning and Public Spaces has declared the HTP to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This noise and vibration impact assessment (NVIA) accompanies the EIS for the HTP and addresses the Secretary's environmental assessment requirements (SEARs). The report outlines the method used in the assessment, describes the baseline noise environment in the study area and identifies the likely impacts from the project on nearby sensitive receivers. Where impacts are predicted, appropriate measures have been identified to mitigate and manage the potential impacts.

Construction

The project involves the construction of a new overhead 500 kilovolt (kV) transmission line of around 110 kilometres connecting the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring. The project would also include laydown areas, stringing sites and construction support facilities, some of which will include worker accommodation and helipads.

Construction noise and vibration has been assessed based on the Department of Environment and Climate Change, Interim Construction Noise Guideline (ICNG) (DECC, 2009) methodology, referencing other standards and guidelines as appropriate. Representative scenarios have been developed to assess the likely worst-case impacts from the construction of the project. Construction noise impacts have been identified based on the predicted exceedance of the Noise Management Levels (NML), which are based on the monitored existing background noise environment conducted for the project and as part of other noise assessments conducted in the study area.

Construction work would generally occur in standard day-time hours between 7:00 am and 6:00 pm Monday to Friday and 8:00 am to 1:00 pm on Saturday. Some work may be required outside of standard construction hours.

Extended construction hours across a 7-day work week between 7:00 am and 7:00 pm would be implemented where there are no sensitive receivers that would be impacted by the construction work. Extended work hours would increase construction productivity and therefore reduce the overall duration of the construction of the HTP.

Where construction noise has been predicted to exceed the NMLs, the impacts are categorised based on the following classifications from the Construction Noise and Vibration Guideline (CNVG) (TfNSW, 2023):

Daytime	**Out of hours**
• 1 to 10 dB – 'Clearly Audible'	• 1 to 5 dB – 'Noticeable'
• 11 to 20 dB – 'Moderately Intrusive'	• 6 to 15 dB – 'Clearly Audible'
• >20 dB – 'Highly Intrusive'	• 15 to 25 dB – 'Moderately Intrusive'
	• >25 dB – 'Highly Intrusive'

Construction noise levels are also compared to the highly noise affected criteria of 75 dBA, as per the ICNG.

Construction noise from construction support sites, laydown yards substations and switching stations

Construction support sites, laydown yards substation and switching station construction sites would be required during construction to support staging and equipment laydown, concrete batching, temporary storage of materials, plant and equipment and worker parking required to construct the various elements of the project.

Construction of the support sites, laydown yards and switching stations would involve noise intensive activities such as vegetation clearing, establishment of facilities and internal roads, during initial site establishment. During construction compound operation, ongoing work such as equipment laydown and concrete batching is expected to produce less noise compared to initial earthwork activities.

The potential construction noise impacts from construction support sites, laydown yards, substation and switching station sites are summarised below:

- the predicted impacts are generally limited to residential receivers closest to each site
- noise levels from the out of hours operation of the worker accommodation facilities are predicted to exceed the sleep disturbance screening level at two locations however no exceedance of the sleep disturbance screening level is predicted and are unlikely to cause awakening reactions
- one 'other sensitive' receiver (Millfield Cemetery) is predicted to have 'clearly audible' (1-10 dB) impacts.

Construction noise impacts from access track construction and intersection upgrades

The project would establish new access tracks as well as upgrade existing tracks to facilitate access to the often-remote transmission lines, transmission line towers and switching stations. Upgrades of intersections to facilitate heavy plant and equipment movements as well as delivery of transmission tower components may also be required.

The potential construction noise impacts from access track construction and intersection upgrades are generally limited to sensitive receivers closest to these areas, with highly noise affected receivers located immediately adjacent to proposed work areas. It is understood that typically receivers would only experience high noise levels for one to two days as construction occurs in proximity to the receivers before moving to other parts of the project.

Construction noise impacts from construction activities within the HTP corridor and stringing sites

Construction activities within the HTP corridor and stringing sites for the transmission lines would typically include:

- site establishment work including connection to the relevant access track, service relocation and vegetation clearance
- civil work including earthwork, construction of tower pads, construction of footings, steel fabrication, concrete pours, erection of transmission line structures and stringing work at work sites within the HTP corridor for the new double circuit 500 kV transmission lines
- clearing of vegetation within the HTP corridor where it may impact on transmission line clearance requirements between the new Olney switching station and Bayswater Power Station.

Out of hours works at the stringing sites may also be required where a road occupancy licence (or similar) is required such as across Wollombi Road, Cessnock Road and Putty Road.

The potential construction noise impacts from construction activities within the HTP corridor and stringing sites, are summarised below:

- the predicted impacts are generally limited to residential receivers closest to each site
- maximum noise levels from the potential out of hours use of the stringing sites are predicted to exceed the sleep disturbance screening level at up to 5 receivers. The highest predicted noise level at any residence is less than 65 dBA. As per the advice in the RNP out of hours operation of the stringing sites across Wollombi Road, Cessnock Road and Putty Road are unlikely to cause sleep disturbances.

Construction noise from aircraft

Several of the proposed construction support sites would potentially include a helipad to enable helicopter use during construction.

Helicopter L_{Amax} noise levels from arrival and departure at construction support sites are predicted to be above 85 dBA at the residential receivers nearest to the potential helipad location at the Freemans Drive support and accommodation site. The predicted helicopter L_{Amax} noise levels at Hebden Road, Pikes Gully Road and Gouldsville Road support sites are unlikely to cause any significant impacts to the noise amenity in the area due to receivers being sufficiently distant. Use of these helipad locations should be prioritised as they are further from sensitive receivers and unlikely to cause high L_{Amax} noise levels during regular movements throughout construction.

Helicopters would be required to fly from the nominated helipad to and from the HTP corridor work sites. This component of helicopter use would typically include flight over areas outside of the project impact area.

Helicopter noise from flights outside of the project impact area are expected to be relatively short-term and would likely be apparent for less than a minute at any individual sensitive receiver underneath the flight path.

Aircraft use within the HTP corridor would include helicopters and drones for stringing work. Aircraft may also be used to install final components such as conductor spacers on the newly installed transmission lines.

The number of sensitive receivers outside of the HTP corridor that would experience the predicted L_{Amax} noise from helicopter flights within the HTP corridor is expected to vary from 3 receivers experiencing noise levels greater than 85 dBA to 18 receivers experiencing noise levels between 60 dBA and 65 dBA.

Construction road traffic noise

The construction traffic volumes have been compared to the existing traffic volumes on all proposed construction traffic routes based on peak construction workforce mobilising on each route.

The construction road traffic noise impact assessment shows:

- on major roads such as the New England Highway, Golden Highway and Freemans Drive near Cooranbong, construction traffic would not increase existing road traffic noise levels by more than 2 dB
- construction traffic on arterial roads would likely result in a noticeable increase in noise levels (>2 dB) due to low existing traffic volumes on these roads. However, compliance with the RNP criteria is predicted for all arterial / sub arterial roads at offset distances greater than 60 m from the roadway
- construction traffic would likely result in a noticeable increase in noise levels (>2 dB) on all local roads with the exception of the AGL Bayswater Power Station site access road, due to low existing traffic volumes on these roads compared to the proposed construction traffic volume.

The peak construction workforce is predicted to occur in 2028. There will be times during construction when less vehicle movements are required, resulting in reduced road traffic noise impacts.

Construction vibration impacts

Where vibration intensive equipment is required for work near sensitive receivers, there is the potential for vibration impacts on buildings and the occupants within. Construction vibration has been assessed based on the recommended minimum working distances presented in the CNVG.

The assessment of potential construction vibration impacts is summarised below:

- a total of 10 receivers closest to construction areas would be within the minimum working distance for cosmetic damage, however 3 of these receivers would be within the project impact area
- a total of 58 receivers would be within the human comfort minimum working distance.
- all heritage items would be located outside of the safe working distance for structurally unsound heritage items, with the exception of the Catholic Church and Cemetery
- no vibration related impacts are predicted for the Newcastle – Sydney high pressure gas pipeline
- a total of 39 Aboriginal objects are within the adopted minimum 10 m safe working distance for Aboriginal heritage items. Of these, 21 are within the project impact area. Direct and indirect impacts to all identified Aboriginal objects and sites of high significance and their immediate environment (≥55 m) within the project impact area will be avoided

Operational noise

Operation of the project would include the new 500 kV transmission line, the Olney and Bayswater switching station and Eraring substation.

The operational noise has been assessed based on the Environmental Protection Authority Noise Policy for Industry (NPfI) (EPA, 2017) methodology, with Project Noise Trigger Levels (PNTL) derived from the existing monitored background noise environment as part of the project and other noise studies conducted in the study area. The assessment includes consideration of noise enhancing weather, where necessary.

Operational noise from transmission lines

Noise emissions from the operation of the project high voltage transmission lines have been assessed in terms of offset distance from the HTP corridor where audible noise is expected to exceed the adopted night-time PNTL with worst-case noise producing weather conditions, such as wet weather. The assessment considers the cumulative noise contribution of the project transmission line and existing parallel transmission lines where appropriate.

The assessment shows that during L50 conditions (light rain or mist), which is expected to be the infrequently occurring worst-case condition for audible noise impacts, 10 of the residential receivers closest to the HTP corridor are predicted to experience noise levels from the transmission lines exceeding the most stringent night-time PNTL.

The significance of the noise impact is:

- considered to be ‘significant’ at 2 residential receivers
- considered to be ‘moderate’ at 6 residential receivers
- considered to be ‘negligible’ at 2 residential receivers.

Operational noise from switching stations

Maximum noise levels from the operation of the Olney witching station are not predicted to cause sleep disturbances at any residential receiver.

Operational noise from the Bayswater South switching station is predicted to be significantly below the relevant PNTLs at all receivers.

Operational noise impacts from Eraring substation

The Eraring substation would be augmented to include an additional six transformers and two auxiliary transformers to facilitate the project.

Operational noise from the existing Eraring substation, including the augmentation and modification of the substation for the project, is predicted to be below the relevant PNTLs at all receivers.

Mitigation and management of impacts

All feasible and reasonable measures would be applied to reduce the potential noise and vibration impacts from the project. Specific mitigation measures have been recommended based on the predicted impacts.

The exact construction mitigation strategies would be determined as part of a Noise and Vibration Management Plan (NVMP) detailing the mitigation measures and strategies prepared during detailed design of the project.

Operational transmission line noise impacts will be reviewed during detailed design, once the transmission line placement, conductor arrangement and any property acquisitions are known.

For each residence where potential operational noise levels are predicted to exceed the PNTL, noise monitoring to confirm actual operational noise levels will be carried out at representative locations following commencement of project operation.

For residences where the monitoring identifies corona discharge levels above PNTLs, consultation will be undertaken with the landowner of the affected residence to identify solutions. Once the appropriate solutions have been agreed with the landowner, these will be implemented as soon as reasonably practical.

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Attachments

Acronyms and Abbreviations

Term	Definition/notes/acceptable use
Access tracks	Temporary and permanent access tracks used to access the project.
Bayswater power station	Existing power station at Bayswater owned by AGL.
Bayswater South switching station	New switching station that would be constructed south of Bayswater power station.
Construction impact area	A subset of project impact area. The area that would be directly impacted by the construction of the project, including (but not limited to) transmission towers and lines, stringing sites, access roads, access tracks, substations, switching stations, adjustments and upgrades to existing lines, communications infrastructure, workforce accommodation camps, construction compounds, laydown and utility adjustments.
Construction access routes	Roads used by construction vehicles (light and heavy).
Construction support site	An area used as the base for construction activities, usually for the storage of plant/equipment and materials, processing facilities (concrete batching, aggregate crushing, grinding and screening), maintenance facilities/workshops, staff facilities, firefighting equipment, helicopter landing pad and support facilities, access and parking and wastewater treatment. Some construction support sites would also include temporary workers accommodation. Construction support sites are discussed in *section 4.3.5* of the EIS.
Critical State significant infrastructure (CSSI) application area	The critical State significant infrastructure (CSSI) application for the HTP covers 5 local government areas (Muswellbrook, Singleton, Cessnock, Central Coast and Lake Macquarie).
Cumulative impact	The combined impacts of the project on a matter with other relevant future projects.
DPHI	(NSW) Department of Planning, Housing and Infrastructure (previously DPI, DPIE and DPE)
EnergyCo	The Energy Corporation of New South Wales constituted by section 7 of the NSW *Energy and Utilities Administration Act 1987* as the NSW Government-controlled statutory authority appointed as the infrastructure planner under the NSW *Electricity Infrastructure Investment Act 2020* responsible for the delivery of NSW's REZs. The proponent for the HTP.
Eraring Power Station	Existing power station at Eraring operated by Origin Energy.
Pre construction minor works	Minor works undertaken prior to construction that may include building and road dilapidation surveys; pre clearance surveys; investigative drilling, contamination investigations, excavation or salvage; installation of environmental impact mitigation measures; property acquisition adjustment works including installation of property fencing; archaeological testing; and maintenance of existing buildings or structures.

Term	Definition/notes/acceptable use
Hunter Transmission Project (HTP) or project	The HTP described in Chapter 4 *(Project description)* of the EIS and identified in the overview figure of the EIS.
HTP corridor	Comprises: • the transmission line corridor connecting Bayswater South switching station to Olney switching station • the transmission line corridor connecting the Bayswater South switching station to the existing 500 kV transmission line near Bayswater Power Station • the transmission line corridor connecting the Olney switching station to the existing 500 kV transmission line between Eraring and Kemps Creek. The HTP corridor is around 140 metres wide.
Landowner(s)	In relevant cases, refer to the landowner(s) before local communities and other stakeholders (e.g. feedback from landowners and local communities).
Laydown areas	Established to allow for flexibility in construction and to minimise the need for vehicle movements to and from the construction support sites. These would act as temporary staging, storage, and complex plant/equipment setup areas. They would also act as traffic control nodes during construction of the HTP.
m	metre
No clearing zone	Areas within the transmission line easement where vegetation removal is not required. These areas would occur where there is sufficient separation of 10m or more between the maximum operating temperature conductor position and the existing vegetation. This area is excluded from the disturbance area.
Noise catchment area (NCA)	Groups of receivers that have a similar noise environment.
Olney switching station	The new switching station that would be constructed in Olney State Forest.
Operation impact area	A subset of construction impact area. The area that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, substations, switching stations, communications infrastructure, maintenance facilities, permanent access roads to substations and switching stations and access tracks to easement.
(the) proponent	The Energy Corporation of NSW (EnergyCo).
Project impact area	The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
Receiver	A noise or vibration sensitive receiver within the study area.
Refinement	A change that fits within the limits set by the project description contained in the EIS for the HTP and does not change what the proponent is seeking approval for and/or does not require an amendment to the application for the HTP.

Term	Definition/notes/acceptable use
Renewable Energy Zone (REZ)	A geographic area identified and declared by the NSW Government as a Renewable Energy Zone.
Stringing site	Used for the preparation, assembly and operation of stringing equipment to connect the transmission line to the towers. Stringing sites would be positioned along the HTP corridor. On other transmission projects, they may be referred to as 'brake and winch' sites.
Study area	Defined by the outer envelope of the NCAs and forms a buffer around the project impact area.
Substation	A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
Switching station	A facility used to connect 2 or more distinct transmission lines of the same designated voltage.
Temporary worker accommodation	Temporary accommodation that would be erected and used during construction to house the construction workforce. Worker accommodation would be located at some construction support sites.
Transgrid	Preferred network operator for the HTP.
Transmission line easement	An area surrounding and including the transmission lines which is a legal proprietary right and allows for ongoing access and maintenance of the transmission lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.
Transmission tower	For 500kV transmission lines, this is typically a free-standing steel lattice structure (suspension or tension tower). Transmission towers for the HTP would generally be up to 85 m high.

1.0 Introduction

The Hunter Transmission Project (HTP, the project) involves the construction of a new overhead 500 kilovolt (kV) transmission line of around 110 kilometres connecting the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring in the Hunter region of New South Wales (NSW).

Due to its strategic importance, the NSW Minister for Planning and Public Spaces has declared the HTP to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Under this process, the Energy Corporation of NSW (EnergyCo, the proponent) is required to prepare an environmental impact statement (EIS) in accordance with the NSW Environmental Planning and Assessment Regulation 2021.

This noise and vibration impact assessment (NVIA) accompanies the EIS for the HTP and addresses the Secretary's environmental assessment requirements (SEARs) issued on 12 August 2024 (see **Table 1-1**).

In addition to the SEARs, advice from several government agencies was received on the HTP. Agency advice relevant to and considered in this NVIA is provided on the Major Projects website maintained by the NSW Department of Planning, Housing and Infrastructure (DPHI).

Table 1-1 HTP SEARs – Noise

HTP SEARs	Relevant Section of Report
Amenity:	
an assessment of the construction, operational and road noise and vibration impacts of the project, including corona noise; and	**Section 5.0**
a description of the measures that would be implemented to avoid / mitigate visual and noise impacts.	**Section 6.0**

2.0 The Hunter Transmission Project

The Hunter Transmission Project (HTP, the project) is critical State significant infrastructure (CSSI). It must be built by end of 2029 to protect energy security in NSW as the remaining coal-fired power stations close.

The HTP includes:

- a new overhead 500 kilovolt (kV) double circuit transmission line of around 110 kilometres
- 2 new switching stations (Bayswater South and Olney)
- upgrades to the existing Bayswater and Eraring substations
- adjustments to existing transmission lines
- property adjustment works to facilitate access to the transmission lines and switching stations
- utility adjustments required for the construction of the transmission network infrastructure

- ancillary works including road upgrades, establishment of new access tracks and upgrades to existing access tracks, construction support sites (some with temporary worker accommodation), and other construction facilities such as laydown areas.

The new transmission line would transport electricity generated in the Central-West Orana and New England Renewable Energy Zones (REZs). It would connect the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring. This would strengthen the State's core electricity grid and supply clean and reliable energy to NSW consumers for generations to come.

The HTP involves development across 5 local government areas (Muswellbrook, Singleton, Cessnock, Central Coast and Lake Macquarie). Most of this development would be concentrated in and around the HTP corridor.

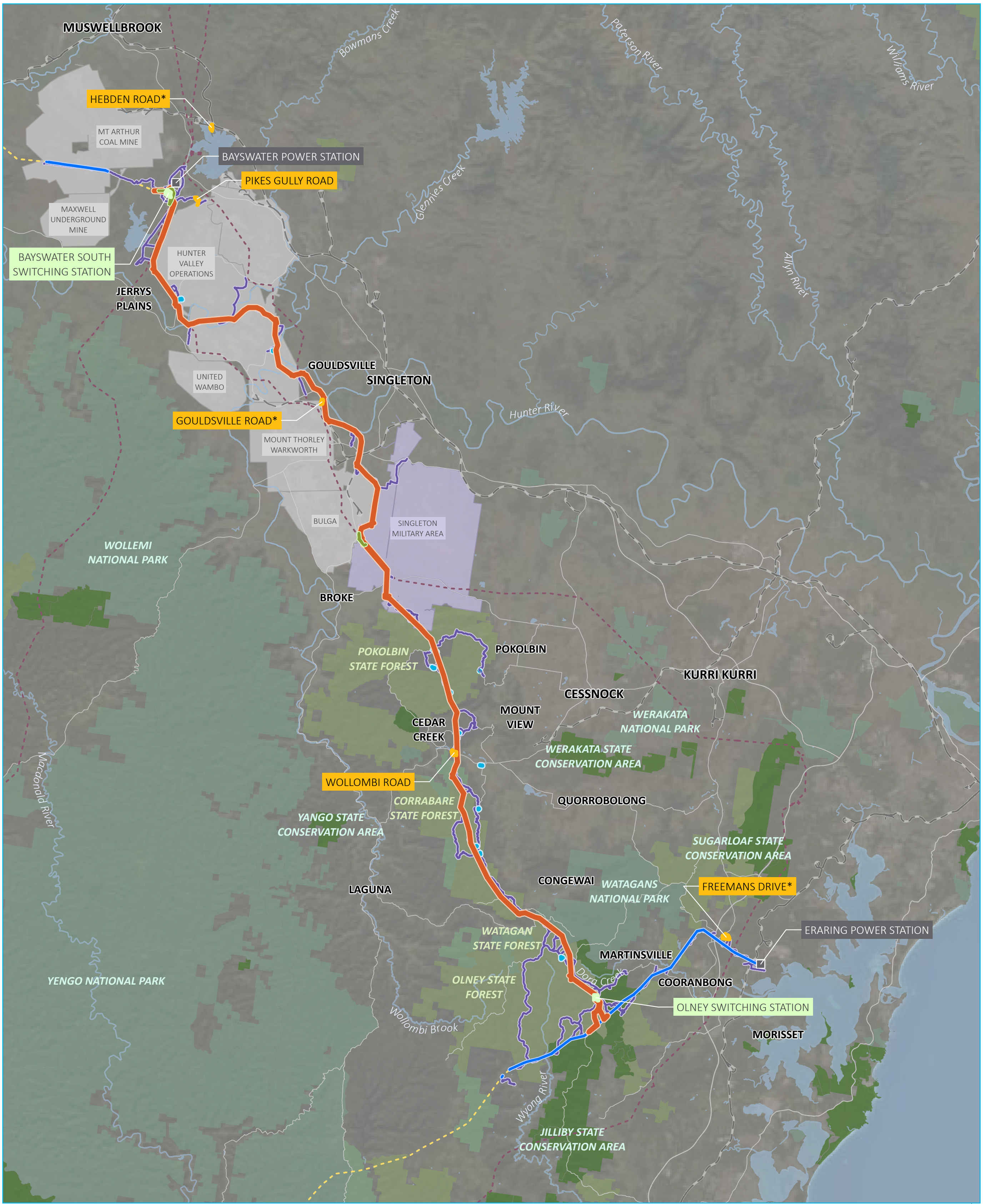
An overview of the HTP is provided in **Table 2-1** and shown in **Figure 2-1**. The key project elements are shown in **Figure 2-1**.

Further details are provided in Chapter 3 of the HTP environmental impact statement (EIS).

Table 2-1 Project overview

The project	• The critical State significant infrastructure application for the HTP covers 5 local government areas • Most development will be concentrated in and around the HTP corridor. Some ancillary development such as construction support sites and worker accommodation, road upgrades and laydown areas would be outside the corridor
Project impact area	• The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
Construction and operation	• Construction impact area around 2351 ha • Operation impact area around 1261 ha
Disturbance area	• Disturbance area around 1266 ha • Disturbance area A around 683 ha • Disturbance area A (centreline) around 214 ha • Disturbance area B around 367 ha • Disturbance HZ around 1.84 ha
New transmission line	• Overhead 500 kV double circuit transmission line of around 110 km between Bayswater South 500 kV switching station and Olney 500 kV switching station • Steel lattice towers generally up to 85 m high and that are spaced anywhere between 75 m to around 1.3 km apart depending on topography (typically between 300 and 600 m) • 500 kV transmission lines with a minimum ground clearance of 13.5 m • Ancillary infrastructure such as earth wire and communications systems • Construction easement of around 140 m wide • Operational easement around 70 m wide

Switching stations/ substation works	• New Bayswater South 500 kV switching station – construction impact area around 26.6 ha • Modifications at the existing Bayswater 500 kV/330 kV substation within the existing footprint • New Olney 500 kV switching station – construction impact area around 20 ha • Augmentation and modifications at the existing Eraring 500 kV/330 kV substation, including installation of 2 new 1500 MVA transformers
Adjustments/ upgrades and crossings – existing transmission lines	• Adjustments to existing double circuit 500 kV transmission lines: - Line 5A1 and 5A2: Eraring – Kemps Creek 500 kV at Ravensdale to connect to the new Olney 500 kV switching station - Line 5A3: Bayswater – Mt Piper 500 kV at Bayswater to connect to the new Bayswater South 500 kV switching station - Line 5A4: Bayswater – Wollar 500 kV at Bayswater to connect to the new Bayswater South 500 kV switching station • Adjustments to existing double circuit 330 kV transmission lines: - Line 31: Bayswater – Regentville 330 kV - Line 32: Bayswater – Sydney West 330 kV - Line 81: Newcastle – Liddell 330 kV • Crossing of existing double circuit 330 kV transmission lines: - Line 31: Bayswater – Regentville 330 kV at Bayswater - Line 32: Bayswater – Sydney West 330 kV at Bayswater - Line 81: 330 kV: Newcastle – Liddell 330 kV at Lemington and again at the Singleton Military Area • Line 82: 330 kV: Tomago – Liddell 300 kV at Warkworth and again at the Singleton
Upgrades – existing transmission lines and towers	• Upgraded earth wire on Line 5A3 and Line 5A4 • Upgraded earth wire and communications systems on Line 5A1 and Line 5A2 • Tower strengthening on various existing towers on Line 5A1, Line 5A2, Line 5A3 and Line 5A4
Roads works	• Modifications to the existing public road network • New and upgraded access tracks for construction and operation
Construction support sites	• Five construction support sites: Hebden Road, Pikes Gully Road, Gouldsville Road, Wollombi Road and Freemans Drive • Helicopter pads (helipads) indicatively at: Hebden Road, Pikes Gully Road, Gouldsville Road and Freemans Drive
Ancillary sites	• Laydown areas, which would be established to allow for flexibility in construction and to minimise the need for vehicle movements to and from the construction support sites
Utility adjustments	• Third party utility works including gas, telecommunications, water, sewer and stormwater
Timing	• Construction to start in 2027 • Operation by end of 2029



Source: EMM (2025); Beca (2025); ESRI (2025); DCSSS (2024); FCNSW (2022); DFSI (2017)

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KEY

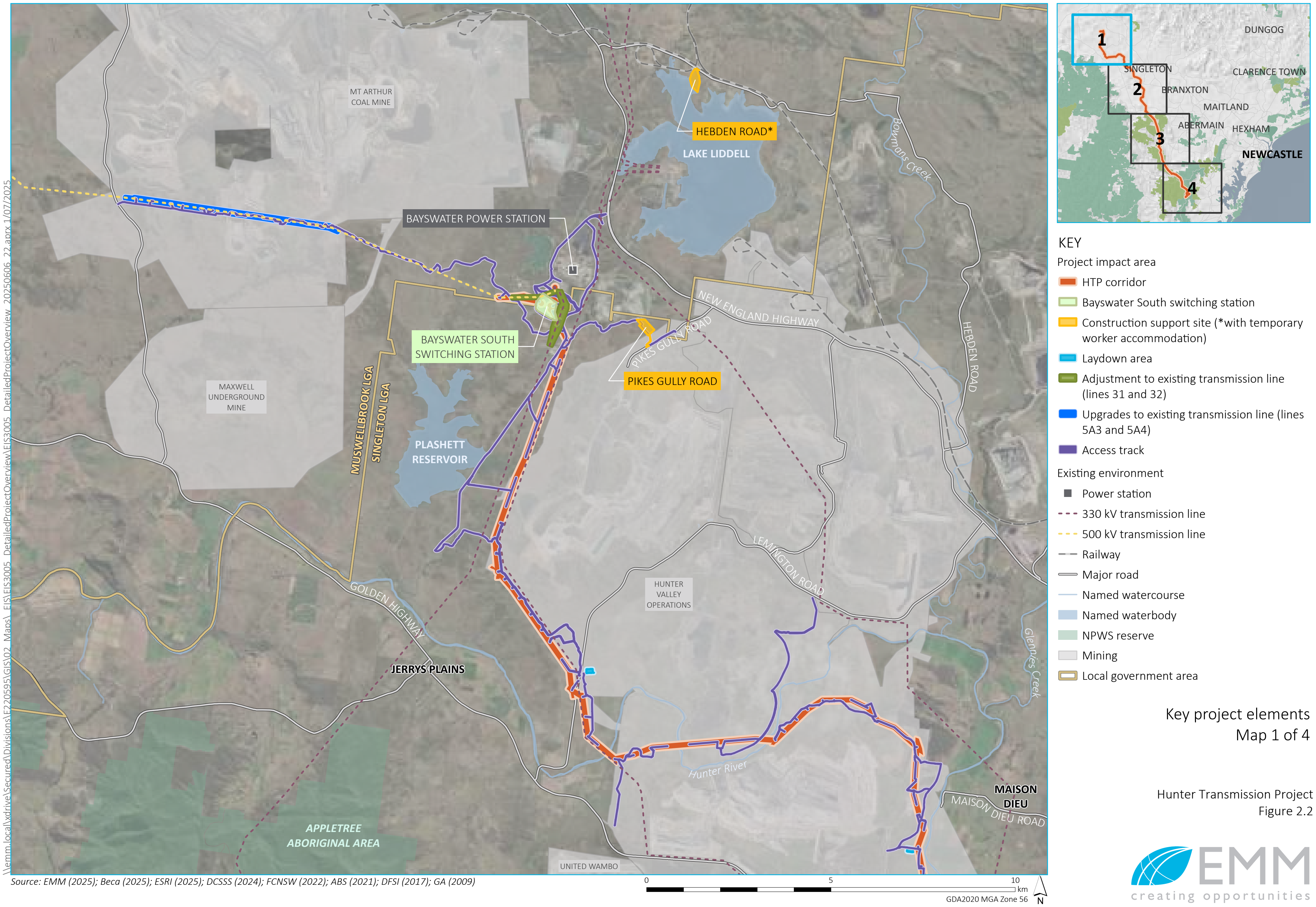
Project impact area
- HTP corridor
- Switching station
- Construction support site (*with temporary worker accommodation)
- Laydown area
- Adjustment to existing transmission line
- Upgrades to existing transmission line
- Access track

Existing environment
- Power station
- 330 kV transmission line
- 500 kV transmission line
- Railway
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State conservation area
- State forest
- Defence
- Mining

Project overview

Hunter Transmission Project
Figure 2.1

EMM
creating opportunities

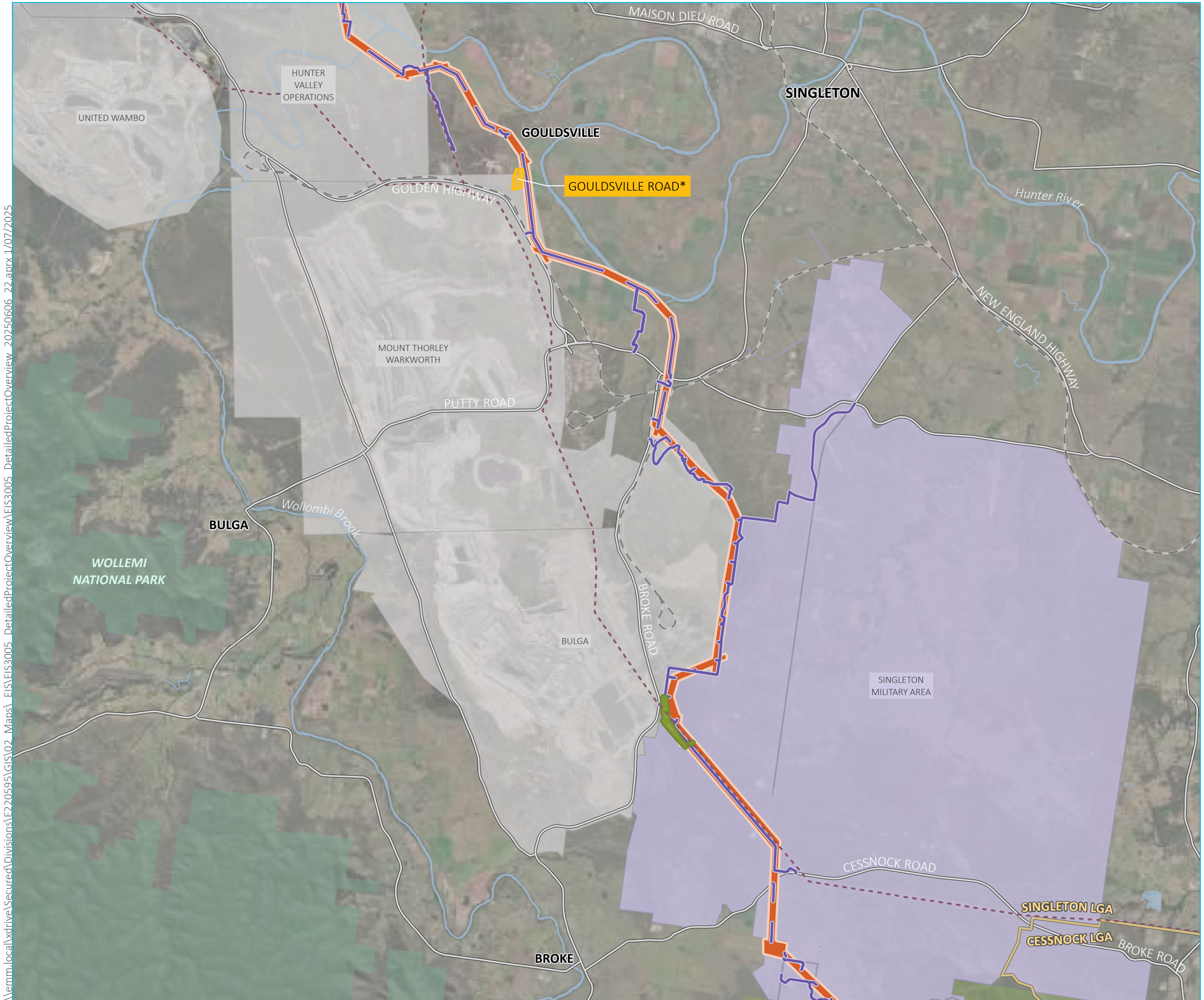


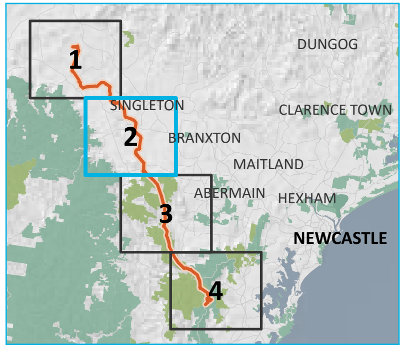
Source: EMM (2025); Beca (2025); ESRI (2025); DCSSS (2024); FCNSW (2022); ABS (2021); DFSI (2017); GA (2009)

Key project elements
Map 1 of 4

Hunter Transmission Project
Figure 2.2

EMM creating opportunities





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KEY

Project impact area

- HTP corridor
- Construction support site (*with temporary worker accommodation)
- Adjustment to existing transmission line (line 81)
- Access track

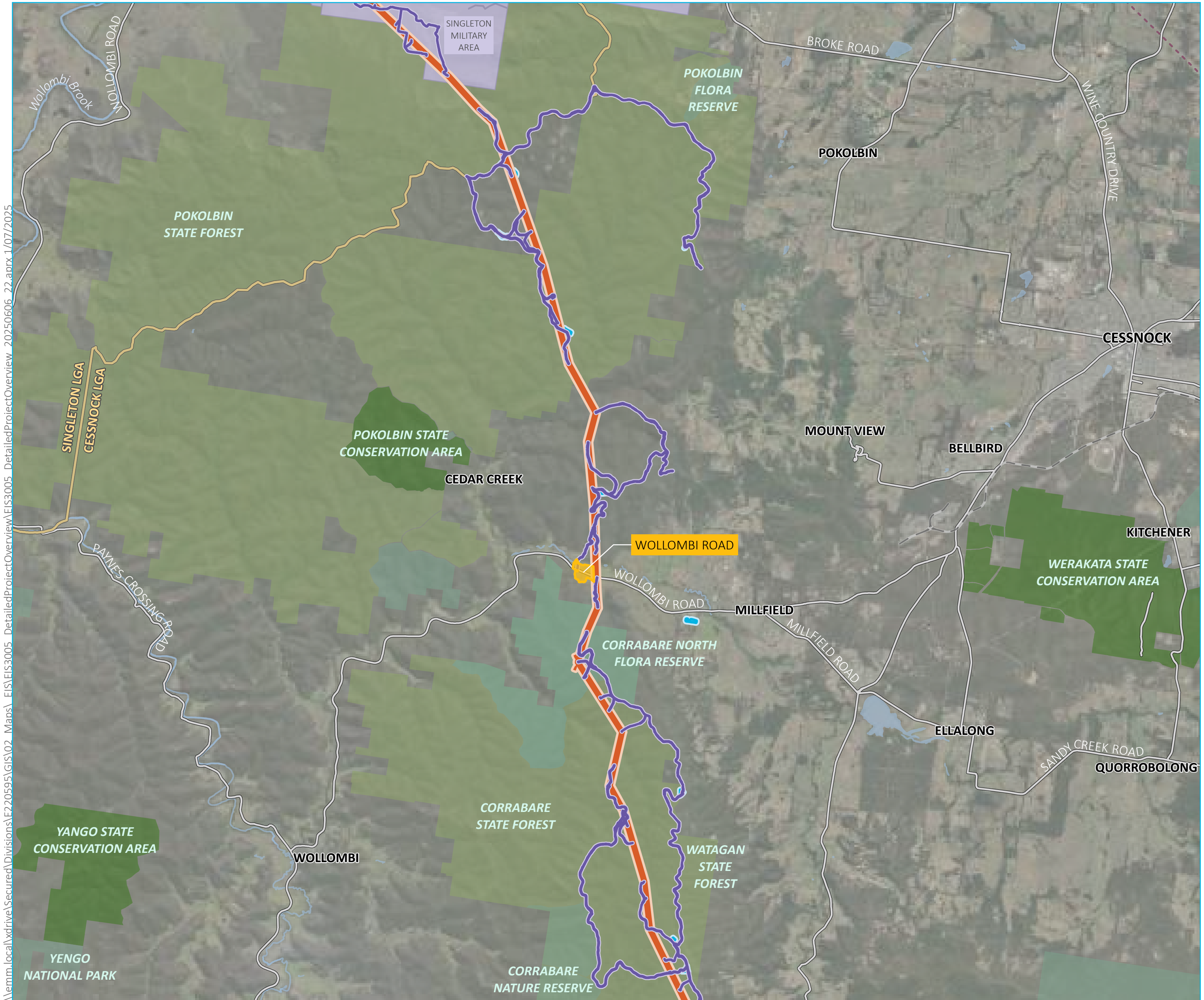
Existing environment

- 330 kV transmission line
- Railway
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Defence
- Mining
- Local government area

Key project elements
Map 2 of 4

Hunter Transmission Project
Figure 2.2

EMM
creating opportunities



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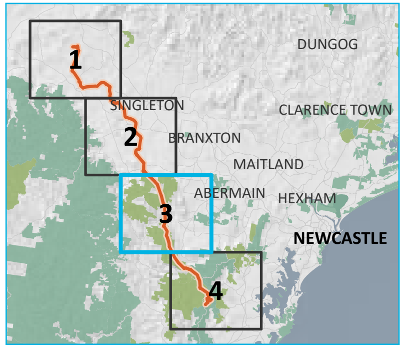

KEY

Project impact area

- HTP corridor
- Construction support site (*with temporary worker accommodation)
- Laydown area
- Access track

Existing environment

- 330 kV transmission line
- Railway
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State conservation area
- State forest
- Defence
- Local government area

Key project elements
Map 3 of 4

Hunter Transmission Project
Figure 2.2

EMM
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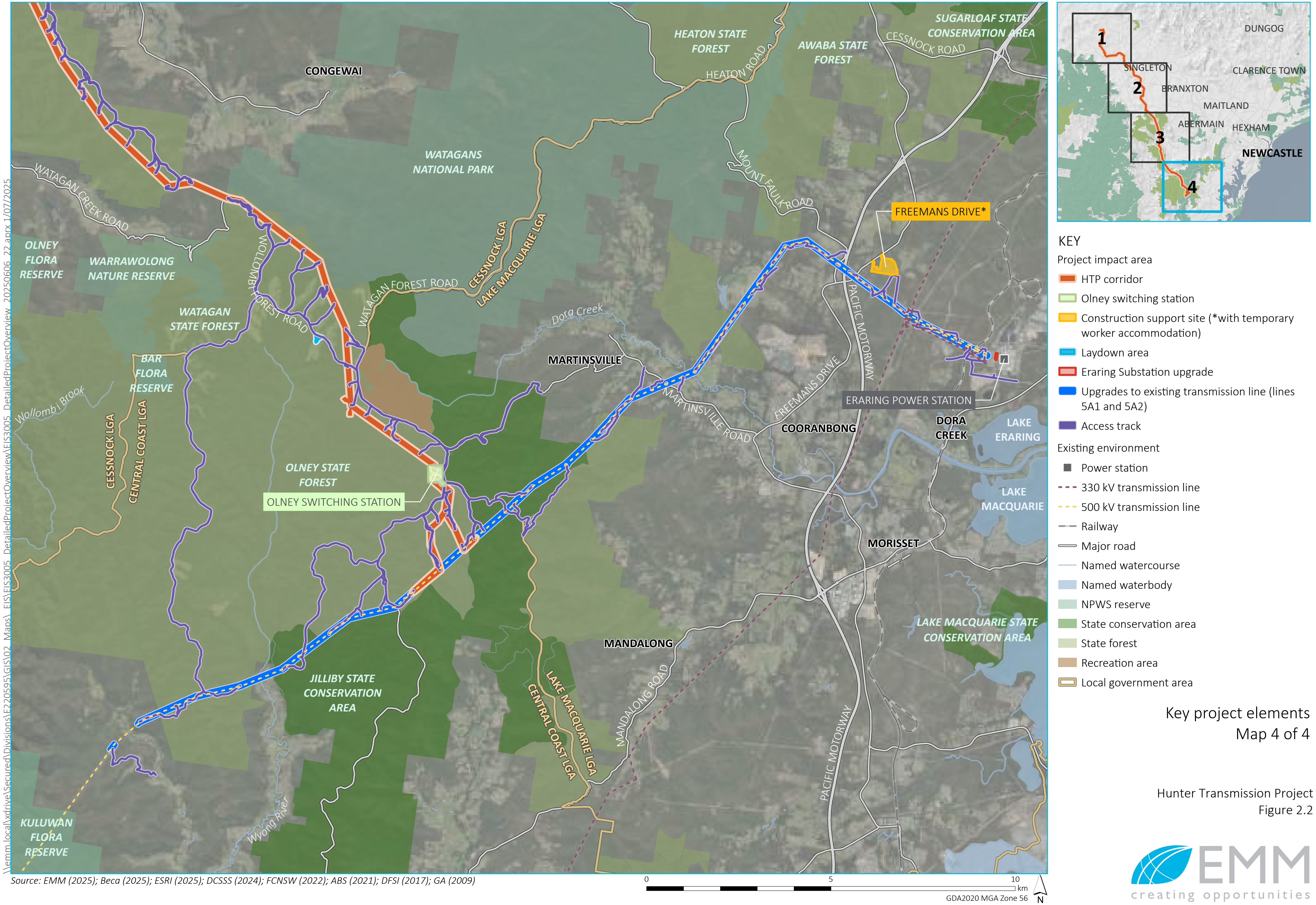

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Source: EMM (2025); Beca (2025); ESRI (2025); DCSSS (2024); FCNSW (2022); ABS (2021); DFSI (2017); GA (2009)

KEY

Project impact area
- HTP corridor
- Olney switching station
- Construction support site (*with temporary worker accommodation)
- Laydown area
- Eraring Substation upgrade
- Upgrades to existing transmission line (lines 5A1 and 5A2)
- Access track

Existing environment
- Power station
- 330 kV transmission line
- 500 kV transmission line
- Railway
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- State conservation area
- State forest
- Recreation area
- Local government area

Key project elements
Map 4 of 4

Hunter Transmission Project
Figure 2.2

creating opportunities

3.0 Assessment methodology

3.1 Government plans, policies and guidelines

This NVIA has been prepared with reference to the following noise and vibration policies, standards and guidelines:

Road traffic noise

- *Road Noise Policy* (RNP) (NSW EPA 2011)

Construction noise

- *Interim Construction Noise Guideline* (ICNG) (NSW EPA 2009)
- Australian Standard AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS 2107)

Operational noise

- *Air Navigation Act 1920*
- *Air Navigation (Aircraft Noise) Regulations 2018*
- *Airservices Australia Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise* (2002)
- *Noise Policy for Industry* (NPfI) (NSW EPA 2017)

Vibration

- *Assessing Vibration: a technical guideline* (AVaTG) (NSW EPA 2006)
- Australian Standard AS 2436:2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*
- British Standard BS 6472: Part 1 2008 *Guide to* evaluation *of human exposure to vibration in buildings Part 1: vibration sources other than blasting*
- British Standard BS 7385: Part 2 1993 *Evaluation and measurement for vibration in buildings Part 2* (BS 7385)
- German Standard DIN 4150-3:1999-02 *Structural vibration – Effects of vibration on structures* (DIN 4150)
- *Construction Noise and Vibration Guideline* (CNVG) (Transport for NSW 2023)
- *Designing, Constructing and Operating Assets Near Jemena Gas Pipelines* (Jemena Limited 2021)

3.2 Road traffic noise criteria

The NSW *Road Noise Policy* (RNP) sets out noise criteria applicable to particular types of projects, road categories and land uses for the purpose of defining traffic noise impacts.

Table 3-1 presents the most relevant RNP criteria for residential land uses affected by noise from additional traffic on a freeway, arterial, sub-arterial, or local road. Noise levels provided in **Table 3-1** are external noise levels and refer only to road traffic noise; they do not include ambient noise from other sources.

Table 3-1 Road traffic noise assessment criteria for residential land uses

Road Category	Type of project/land use	Assessment criteria (dBA)	
		Day (7 am - 10 pm)	Night (10 pm - 7 am)
Freeway/arterial/ sub-arterial roads	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors 2. Existing residences affected by noise from redevelopment of existing freeway/ arterial/ sub-arterial roads 3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 (external)	$L_{Aeq(9hour)}$ 55 (external)
Local roads	4. Existing residences affected by noise from new local road corridors 5. Existing residences affected by noise from redevelopment of existing local roads 6. Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 (external)	$L_{Aeq(1hour)}$ 50 (external)
Note 1: Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning NSW 2007) for sensitive developments near busy roads (see Appendix C10 of the RNP for details). Note 2. Sub-arterial roads previously designated as 'collector roads' in the Environmental criteria for road traffic noise.			

Furthermore, Section 2.4 of the RNP states that in addition to the assessment criteria presented in **Table 3-1**, any increase in the traffic noise level at a location due to a traffic generating development must be considered. Residences experiencing increases in total traffic noise level above the relative increase criteria should also be considered for mitigation. **Table 3-2** shows relative increase criteria for residential land uses. The relative increase criterion does not apply for local roads.

Table 3-2 Relative increase criteria for residential land uses

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

In **Table 3-2** the 'existing' traffic noise level refers to the level from all road categories which would occur for the relevant 'no build' option. Where the existing $L_{Aeq(period)}$ road traffic noise level is found to be less than 30 dBA, it is deemed to be 30 dBA.

Section 3.4 of the RNP also states:

Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria.

In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'.

3.3 Construction noise criteria

3.3.1 Residential noise sensitive receivers

The NSW EPA's *Interim Construction Noise Guideline* (ICNG) sets out noise management levels (NMLs) for residential noise-sensitive receivers and outlines how they are to be applied. The policy suggests restricting the hours of construction for activities that generate noise at residences above the 'highly affected' noise management level. A summary of the noise management levels from the ICNG is contained in **Table 3-3**.

Table 3-3 Construction noise management at residential sensitive receivers

Time of day	Noise management level $L_{Aeq(15minute)}$ [1]	How to apply
Recommended standard hours. Monday to Friday 7 am - 6 pm Saturday 8 am - 1 pm No work Sundays or public holidays	Noise Affected RBL [2] + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Time of day	Noise management level $L_{Aeq(15minute)}$[1]	How to apply
Outside recommended standard hours	Noise Affected RBL [2] + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.
Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise-affected residence. Note 2: RBL: Rating Background Level, as defined in the NSW Industrial Noise Policy (EPA, 2000).		

3.3.2 Sleep disturbance – residential receivers

Where construction work is planned to extend over more than two consecutive nights, such as the accommodation facilities, the ICNG recommends that an assessment of sleep disturbance impacts from maximum noise levels should be completed at residential receivers.

An appropriate method for assessing sleep disturbance from maximum noise levels due to construction projects is contained in the NPfI. Although the NPfI sleep disturbance criteria relate to industrial noise, they are considered relevant for assessing potential sleep disturbance impacts during the night-time period from construction noise.

The NPfI defines sleep disturbance criteria above which a detailed maximum noise assessment should be conducted as 52 dBA L_{Amax} or the prevailing background level plus 15 dB, whichever is the greater.

3.3.3 Other sensitive receivers

The ICNG also contains NMLs for ‘other sensitive’ non-residential land uses. Due to the potential broad range of sensitivities to construction noise from a wide range of commercial and industrial land uses the ICNG recommends that suitable construction noise levels be determined on a project-by-project basis.

The ICNG recommends the highest design sound levels from the range for the type of occupancy Australian Standard AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS2107) be adopted. These have been applied as NMLs for these ‘other sensitive’ receivers . The NMLs for ‘other sensitive’ receivers are shown in **Table 3-4**.

Table 3-4 Construction noise management levels at 'other sensitive' receivers

Land Use	Noise Management Level $L_{Aeq(15minute)}$ (dBA) (applied when the property is in use)	
	Internal	External
ICNG 'other sensitive' receivers		
Classrooms at schools and other educational institutions	45	55[1]
Hospital wards and operating theatres	45	55[1]
Places of worship	45	55[1]
Active Recreation Areas	-	65
Passive Recreation Areas	-	60
Offices, retail outlets	-	70
Industrial	-	75
Non-ICNG 'other sensitive' receivers		
Hotel – daytime and evening[3]	50	70[2]
Hotel – night-time[3]	40	60[2]
Public building[3] (when in use)	50	60[1]

Note 1: It is assumed that these receptors have windows partially open for ventilation which results in internal noise levels being around 10 dB lower than the external noise level.

Note 2: It is assumed that these receptors have windows that can be closed with alternate means of ventilation which conservatively results in internal noise levels being around 20 dB lower than the external noise level.

Note 3 Taken from AS2107.

The external noise levels should be assessed at the most-affected occupied point of the premises.

3.4 Vibration criteria

3.4.1 Human response

The AVaTG presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The Guideline is based on *British Standard BS6472-2008 Evaluation of human exposure to vibration in buildings (1-80Hz)* which is similar to *AS2670.2-1990* but includes additional guidelines in relation to intermittent vibration. The criteria presented in the AVaTG are non-mandatory. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, the operator would need to negotiate directly with the affected community.

Section 2.4 of AVaTG provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted root mean square (rms) acceleration over the frequency range 1 Hz to 80 H. To calculate VDV the following formula is used:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

Where VDV is the vibration dose value in $m/s^{1.75}$, *a(t)* is the frequency-weighted acceleration in m/s^2 and *T* is the total period of the day (in seconds) during which vibration may occur. The acceptable VDV are reproduced here in **Table 3-5**.

Table 3-5 Acceptable Vibration Dose Values for Intermittent Vibration

Location	Daytime		Night-time	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical working areas (eg operating theatres or laboratories)	0.10 $m/s^{1.75}$	0.20 $m/s^{1.75}$	0.10 $m/s^{1.75}$	0.20 $m/s^{1.75}$
Residences	0.20 $m/s^{1.75}$	0.40 $m/s^{1.75}$	0.13 $m/s^{1.75}$	0.26 $m/s^{1.75}$
Offices, schools, educational institutions and places of worship	0.40 $m/s^{1.75}$	0.80 $m/s^{1.75}$	0.40 $m/s^{1.75}$	0.80 $m/s^{1.75}$
Workshops	0.80 $m/s^{1.75}$	1.60 $m/s^{1.75}$	0.80 $m/s^{1.75}$	1.60 $m/s^{1.75}$
Note: Daytime is 7 am to 10 pm and night-time is 10 pm to 7 am				

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

3.4.2 Building response

British Standard BS 7385 provides criteria against which the likelihood of building damage from ground vibration can be assessed. The criteria adopted for this assessment are presented in **Table 3-6** and include a reduction of 50% to account for dynamic magnification due to resonance.

Table 3-6 Transient vibration guide values for cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and Above
Reinforced or framed structures Industrial and heavy commercial buildings	25 mm/s at 4 Hz and above	-
Unreinforced or light framed structures Residential or light commercial type buildings	7.5 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above
Note: Values referred to are at the base of the building being considered.		

3.4.3 Heritage buildings or structures

Heritage buildings and structures should be considered on a case-by-case basis but as noted in BS 7385, they should not be assumed to be more sensitive to vibration, unless structurally unsound. Where the heritage building or structure is structurally sound the vibration guide values for cosmetic damage in **Table 3-6** would apply.

Where a heritage building is deemed to be sensitive, the more stringent DIN 4150 Group 3 guideline values in **Table 3-7** can be applied.

Table 3-7 Cosmetic damage – DIN 4150 guideline values for short-term vibration on structures

Group	Type of structure	Guideline values vibration velocity (mm/s)[1]				
		Foundation, all directions at a frequency of			Topmost floor, horizontal	Floor slabs, vertical
		1to 10 Hz	10 to 50 Hz	50 to 100 Hz	All frequencies	
3	Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 and are of great intrinsic value (eg heritage listed buildings)	3	3 to 8	8 to 10	8	20
Note: It may be necessary to lower the relevant guideline value markedly to prevent minor damage.						

3.4.4 Archaeological / Geological vibration damage criteria

There are no regulatory criteria nominated in Australia for the assessment of damage to archaeological/geological structures from vibration. Research, however, has been undertaken on fragile sandstone cliffs and Aboriginal heritage sites indicating that a conservative safe Peak Particle Velocity (PPV) vibration criterion of 50 mm/s as being applicable to archaeological/geological structures and Aboriginal heritage items (i.e. rock shelters or the like).

Given that detailed geotechnical studies of identified aboriginal heritage items have not been conducted, a twofold safety factor vibration criterion of 25 mm/s PPV has been applied to aboriginal heritage items. This criterion can be revised based on performance outcomes and field observations of the heritage item condition.

3.4.5 High pressure gas pipeline

Designing, Constructing and Operating Assets Near Jemena Gas Pipelines GAS-960-GL-PL-001 prepared by Jemena Gas Networks (NSW) Ltd, who own and operate the Newcastle – Sydney high pressure gas pipeline that runs in proximity to the project impact area provides vibration criteria for the buried high pressure pipeline as follows:

> *Vibrations from any equipment or processes including vibrating compaction equipment, jack hammers, rock hammers, seismic measuring processes, etc.* ***are not to exceed peak particle velocity readings of 20 mm/second*** *at the nearest surface of the buried pipeline.*
>
> *In the event that such vibrating equipment is to be used close to the pipeline or in blasting operations, suitable trials (as accepted by Jemena) are to be conducted prior to proceeding with the proposed development to ensure that the stipulated peak particle velocities will not be exceeded.*
>
> *Suitable (as accepted by Jemena) vibration monitoring equipment is to be used to record the tests and works as they progress in accordance with agreed procedures with Jemena.*

In accordance with Jemena Gas Networks (NSW) Ltd guideline document a vibration limit of 20 mm/s PPV has been applied to the buried high pressure gas pipeline.

3.5 Operational noise

The NSW Noise Policy for Industry (NPfI) was released in 2017 and sets out the requirements for the assessment and management of operational noise from industry in NSW.

The NPfI states that the objectives of the policy are to:

- *provide the noise levels that are used to assess both change in noise level and long-term noise levels*
- *provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals*
- *promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified*
- *support a process to guide the determination of achievable noise limits for planning approvals and/or licences, taking into account the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).*

In general terms, the NPfI sets out procedures for establishing the project intrusiveness $L_{Aeq(15minute)}$ and project amenity $L_{Aeq(period)}$ noise levels, with a view determining the lower (that is, the more stringent) being the Project Noise Trigger Level (PNTL), NPfI Section 2.1 states:

> *The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.*

For assessing intrusiveness, the existing background noise generally needs to be measured. The intrusive trigger level essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured (or default) Rating Background Level (RBL).

The amenity assessment is based on amenity noise levels specific to the land use and associated activities. The NPfI Recommended and Project Amenity Noise Levels are shown in **Table 3-8** and relate only to industrial/commercial-type noise and do not include road, rail or community noise. Depending on the ambient noise environment, residential receivers have been categorised as 'rural', 'suburban', or 'urban' in this assessment.

Table 3-8 Amenity noise levels

Type of receiver	Indicative noise amenity area	Time of day	Amenity Noise level (dBA)	
			Recommended amenity $L_{Aeq(period)}$	Project amenity[2] $L_{Aeq(15minute)}$
Residential	Rural	Day	50	48
		Evening	45	43
		Night	40	38
	Suburban	Day	55	53
		Evening	45	43

Type of receiver	Indicative noise amenity area	Time of day	Amenity Noise level (dBA)	
			Recommended amenity $L_{Aeq(period)}$	Project amenity[2] $L_{Aeq(15minute)}$
		Night	40	38
	Urban	Day	60	58
		Evening	50	48
		Night	45	43
Hotels, motels, caretakers' quarters holiday accommodation, permanent resident caravan parks			Add 5 dBA to a residence for the relevant noise amenity area and time of day	
School classroom (internal)	All	Noisiest 1-hour period when in use	35[1]	
Hospital ward (internal)	All	Noisiest 1-hour	35	33
Hospital ward (external)	All	Noisiest 1-hour	50	48
Place of worship (internal)	All	When in use	40	38
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50	48
Active recreation area (e.g. school playground, golf course)	All	When in use	55	53
Commercial premises	All	When in use	65	63
Industrial premises	All	When in use	70	68
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dB(A) to recommended noise amenity area	

Note: Weekdays; Day 7 am - 6 pm; Evening 6 pm - 10 pm; Night 10 pm - 7 am.
Sundays and Public Holidays, Day 8 am - 6 pm; Evening 6 pm - 10 pm; Night 10 pm - 8 am.

Note 1: In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hour)}$.

Note 2: The recommended amenity noise levels have been reduced by 5 dB to give the project amenity noise levels and then converted to a 15 minute level by adding 3 dB as outlined in the NPfI.

The PNTLs are then determined in accordance with NPfI Section 2.1 *Project Noise Trigger Level* by identifying the lower of the project amenity or project intrusive noise levels (following conversion of the $L_{Aeq(period)}$ project amenity noise level to an equivalent $L_{Aeq(15minute)}$ value for comparison with the $L_{Aeq(15minute)}$ project intrusive noise level). NPfI Section 2.2 *Noise Descriptors* assumes a default conversion factor of plus 3 dB for the conversion of $L_{Aeq(period)}$ noise levels to $L_{Aeq(15minute)}$ noise levels.

3.5.1 Assessing sleep disturbance

NPfI provides criteria for when a sleep disturbance assessment should be conducted. Section 2.5 of the NPfI states:

> *Where the subject development/premise night-time noise levels at a residential location exceed:*
>
> - *$L_{Aeq(15minute)}$ 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 greater,*
>
> *A detailed maximum noise level event assessment should be undertaken.*

Guidance regarding potential for sleep disturbance is provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

- maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep
- one or two noise events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly.

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dBA lower than external noise levels. Based on attenuation, with windows open, of 10 dBA, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one or two noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

3.6 Project impact area and study area

The project impact area includes the HTP corridor, access roads, access tracks, substations, switching stations, adjustments and upgrades to existing lines, communications infrastructure, temporary worker accommodation, construction support sites, laydown areas and utility adjustment (refer **Figure 2-1**). The study area for the NVIA is defined by the outer envelope of the Noise Catchment Areas (NCA) and forms a buffer around the project impact area. The NCAs have been defined to reflect groups of receivers that have a similar noise environment. Sensitive receivers within each NCA have been identified depending on the existing ambient acoustic environment, the relevant construction and operational activities proposed within each NCA of varying size depending on the relevant project component and proposed construction activities. The study area and NCAs are shown in **Attachment B** with the NCAs further described in **Section 4.1**.

3.7 Sensitive receivers

Sensitive receivers have been identified within the study area via aerial imagery and site visits. These have been categorised as residential buildings, commercial/industrial buildings, or ‘other sensitive’ land uses. All sensitive receivers considered within the study area are shown in **Attachment B**.

3.7.1 Sensitive heritage receivers

The heritage listed buildings and structures within the study area which are potentially sensitive to vibration are detailed in **Table 3-9**.

Table 3-9 Heritage listed items

Item Name	Address	Heritage significance	Item number	Distance to nearest structure[1]
Oakley Estate	Singleton Military Area	State Commonwealth	170126/170127	45 m
Warringah Stud/Old Myrtle	Singleton Military Area	Commonwealth	170129	65 m
Catholic Church and Cemetery	6 Martinsville Rd, Cooranbong	Local (Lake Macquarie)	I77	20 m
Former Union Church	447 Martinsville Rd, Martinsville	Local (Lake Macquarie)	I242	35 m
Millfield General Cemetery	Crump St and Hayes Rd, Millfield	Local (Cessnock)	I141	45 m
Bellevue Vineyard and Winery	529 and 555 Oakey Creek Road	Local (Cessnock)	I174	68 m
Archerfield and outbuildings	Off Comleroi Road, Warkworth	Local (Singleton)	I141	70 m
Note 1: Approximate minimum horizontal distance from the project impact area to the nearest structure of the heritage listed item.				

3.7.2 Aboriginal heritage items

Numerous aboriginal heritage items have been identified within the project impact area. Items that may be directly impacted by ground disturbance and earthworks are shown in **Attachment H.3**.

3.8 Construction noise assessment approach

3.8.1 Construction scenarios

Representative construction scenarios have been used to assess the likely impacts from construction activities. Equipment lists for each scenario and sound power level data is provided in **Attachment C**.

The assessment uses ‘realistic worst-case’ scenarios to predict the potential airborne noise impacts from the noisiest 15-minute period for each work scenario, as required by the ICNG.

It is expected that there would be relatively long periods where construction noise levels are much lower than the worst-case levels presented in this assessment. There would also be times when work is not audible at receivers due to less noisy items of equipment being used or where work is in distant parts of the project impact area relative to the nearest receivers.

The representative scenarios considered are described in **Table 3-10**.

Table 3-10 Construction scenario descriptions

Scenario	Description
Earthworks and access	Bulk earthworks across the construction impact area and construction activities for switching stations, substation upgrades and access tracks. Typical activities included in this scenario are the clearing of vegetation and topsoil, excavation work, levelling/grading the ground, and drainage works. Noise intensive equipment such as a rock-breaker would be required at times during the works. Some access tracks would only require ‘minor’ works such as minimal excavation and laying of suitable road base while others would require ‘major’ construction activities involving the use of earthwork equipment such as graders, excavators (with and without hydraulic hammer) and rollers. This construction scenario has been applied to construction support sites, tower pads, stringing sites, switching station locations, the Eraring and Bayswater substation areas, new access tracks and access road upgrade areas.
Intersection works	Construction activities required to upgrade/augment existing road intersections to accommodate project related traffic movements. Depending on the extent and type of work proposed at each intersection a ‘typical’ and ‘intensive’ construction scenario has been assessed. Some intersections would only require ‘typical’ works while others would require ‘typical’ and ‘intrusive’ construction activities.
Vegetation clearing	Vegetation clearing, processing and removal for vegetated areas of the HTP corridor.
Concrete works for hardstand areas	Construction and concrete works for hardstand areas across the construction impact area including construction support sites, tower locations, switching station locations and Eraring and Bayswater substation areas.
Tower assembly / construction of structures	Construction of transmission line structures by assembling sections of the structures on the ground and hoisting or lifting successive sections into place using cranes or erected in place on the footings by installing individual sections hoisted into place.
Stringing	Stringing, tensioning and pulling of transmission line by ground-based winches.
Construction support sites	These sites would be required to support construction activities and would include: • laydown yards for temporary storage of materials, plant and equipment. • concrete batch plant • delivery and handling of materials • worker parking • site offices and worker accommodation • helicopter/ helipad facilities. • The construction support sites with worker accommodation would operate out of standard construction hours and would include vehicle movements and power generators.

3.8.2 Working hours

Construction of the project would be carried out during the ICNG recommended standard construction hours, where possible. These are:

- Monday to Friday between 7am and 6pm
- Saturday between 8am and 1pm)
- No work on Sundays or public holidays.

Project specific constraints, however, would require out of hours (OOH) evening and night-time work for some construction activities.

Work to be undertaken OOH may include (but not be limited to):

- transmission line construction at crossings of a main road or railway
- work where a road occupancy licence (or similar) is required, depending on licence conditions
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons due to their size such as the delivery of transformer and reactor units, utility relocations
- connection of the new assets to existing assets under outage conditions
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages
- situations where agreement is reached with affected sensitive receivers
- activities that do not generate noise that exceeds the applicable noise management level at any sensitive receiver.

Overhead stringing of conductors outside of standard daytime hours is assumed to be required at:

- Wollombi Road
- Cessnock Road
- Putty Road
- M1 Motorway for optical ground wire (OPGW) works between Eraring power station and the Olney switching station.

If there are no sensitive receivers that would be impacted by the construction work in a given location, the construction hours may be extended across a 7-day work week between 7:00 am and 7:00 pm. Examples of this would be construction work in the vicinity of the existing Bayswater and Eraring power stations, the mining complexes and in some parts of the State forests where construction would not impact recreational or operational activities. Extended work hours would increase construction productivity and therefore reduce the overall duration of the construction of the HTP.

3.8.3 Calculation approach

Given the extent of the project across a large geographical area, construction noise has primarily been assessed based on the two-dimensional distance between the project footprint and the surrounding receivers. The assessment uses the ISO 9613-2 method of calculation and assumes flat ground conditions, which represent the worst-case propagation path.

For intersection upgrades in the built-up townships of Millfield, Cessnock and Cooranbong a computer model was used to predict noise emissions from intersection upgrade construction activities. The noise modelling was undertaken using the Conservation of Clean Air and Water Europe (CONCAWE) algorithms within SoundPLAN v8.2 software. A three-dimensional digital terrain map providing relevant topographic information was used in the modelling process, together with noise source data, shielding by barriers/terrain and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

3.8.4 Construction road traffic noise approach

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers which are adjacent to construction routes. This assessment has been completed for the construction routes to be used for access between the construction support sites, temporary worker accommodation, laydown areas, the transmission line alignment and switching stations. The road sections which are expected to carry additional road traffic during construction of the project have been obtained from *Technical Report 4 – Traffic and transport impact assessment*.

The potential impacts from construction traffic on public roads have been predicted using the Calculation of Road Traffic Noise (CORTN) algorithm. The assessment of potential construction traffic noise includes consideration of all roads expected to carry traffic for construction of the project. Several construction routes include sections of unsealed roads. A +7 dB correction has been applied to the predictions for these unsealed roads to account for increased pass-by noise levels.

The forecast construction traffic volumes have been used to determine where potentially noticeable increases in road traffic noise (ie a greater than 2.0 dB increase above the existing noise level) is likely. Where potential 2.0 dB increases are identified, the total road traffic noise levels are compared to the RNP L_{Aeq} criteria. Existing traffic volumes on some of the access roads is not available. Given the expected low volume of traffic on these roads, for the purpose of calculating a potential increase in road traffic noise it has been assumed that at least one non-project related light vehicle would use the road during the morning (night-time) and afternoon (daytime) peak hour period.

A summary of the inputs for the construction traffic noise assessment is presented in **Attachment D**.

3.9 Noise from aircraft operations during construction

3.9.1 Aircraft noise overview

Noise emissions from flight operations of aircraft in Australia are regulated by the Air Navigation (Aircraft Noise) Regulations 2018, which is made under the Air Navigation Act 1920.

The regulations require that a noise certificate be issued for the aircraft where the aircraft meets the relevant standards. Aircraft operation is not considered for construction noise or regulated under the *Protection of the Environment Operations Act 1997* (POEO Act) in NSW.

Any ground activity associated with aircraft operation such as refuelling or maintenance at helipads within the construction support sites would, however, fall within ICNG assessment requirements.

The assessment presents indicative noise levels from proposed aircraft use during construction. The output of the assessment is L_{Amax} noise contours, which represent the indicative maximum transient noise levels at ground level during nearby aircraft overflight.

The assessment considers the following aircraft noise scenarios:

- helicopter arrival and departure at the nominated four construction support sites (Hebden Road, Pikes Gully Road, Gouldsville Road and Freemans Drive)
- helicopter flight between potential helipads and the HTP corridor. This component of the assessment is limited to prediction of aircraft noise at indicative offset distances, due to the unknown and potentially variable flight paths at this time
- helicopter flight within the HTP corridor for stringing at 52 m (170 ft)

The above considerations account for the relatively high frequency of aircraft use in these areas compared to the wider project impact area during construction, and therefore the noise amenity of sensitive receivers in these locations may be impacted due to the duration of noise exposure. Conversely, noise from flight paths outside of the HTP corridor and helipads at construction support sites is expected to be relatively transient at any sensitive receiver and helicopters would be flying at comparatively greater elevations resulting in reduced ground-based noise impacts.

3.9.2 Aircraft noise modelling

Aircraft noise is predicted with a three-dimensional noise model implemented using SoundPLAN 8.2. The noise model uses the *DIN 45684-1: 2013-07 Standard*, recognised as a current best practice model and suitable for the assessment of helicopter noise. The *DIN 45684-1: 2013-07 Standard* provides aircraft groups, dependant on the maximum take-off weight of the aircraft. The assessment has assumed the use of a H1.1 group helicopter with maximum take-off mass of more than 1,000 kg up to 3,000 kg.

The modelling assumes a 30-degree departure and approach angle for helicopters at the potential helipads, noting that actual flight parameters will vary based on pilot discretion and safety requirements regarding surrounding structures, vegetation, and other obstacles.

3.10 Construction vibration approach

Minimum working distances for typical vibration intensive construction equipment are provided in the CNVG and are shown in **Table 3-11**. The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort (from AVaTG). They are calculated from empirical data which suggests that where work is further from receivers than the quoted minimum distances, impacts are not considered likely.

Table 3-11 Recommended minimum working distances from vibration intensive equipment

Plant Item	Rating/Description	Minimum working distance		
		Cosmetic damage		Human response (AVaTG)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
Vibratory Roller	<50 kN (1–2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2–4 tonne)	6 m	13 m	20 m

Plant Item	Rating/Description	Minimum working distance		
		Cosmetic damage		Human response (AVaTG)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
	<200 kN (4–6 tonne)	12 m	25 m	40 m
	<300 kN (7–13 tonne)	15 m	31 m	100 m
	>300 kN (13–18 tonne)	20 m	40 m	100 m
	>300 kN (>18 tonne)	25 m	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 tonne excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 tonne excavator)	7 m	15 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 tonne excavator)	22 m	44 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	5 m to 40 m	20 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	5 m	4 m
Jackhammer	Handheld	1 m (nominal)	3 m	2 m

The minimum working distances are indicative and will vary depending on the particular item of equipment and local geotechnical conditions. The distances apply to cosmetic damage of typical buildings under typical geotechnical conditions.

As noted earlier, heritage buildings and structures should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound. Where heritage buildings and structures are found to be structurally unsound, a more conservative cosmetic damage objective of 2.5 mm/s PPV (from DIN 4150) would be considered.

The potential impacts during vibration intensive work have been assessed by identifying structures which are within the minimum working distances as shown in **Table 3-12**.

Table 3-12 Adopted minimum working distances from vibration intensive equipment

Construction work area	Vibration intensive equipment	Minimum distance		
		Cosmetic damage		Human response (AVaTG)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
Earthworks at construction support sites, laydown sites, tower sites, substation/switching stations and access track construction	Medium hydraulic hammer 900 kg (12 tonne to 18 tonne excavator)	7 m	15 m	23 m

Construction work area	Vibration intensive equipment	Minimum distance		
		Cosmetic damage		Human response (AVaTG)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
Earthworks at construction support sites, laydown sites, tower sites, substation/switching stations and access track construction	Medium vibratory roller 8 tonne to 10 tonne	15 m	31 m	100 m
Minor road widening and intersection works	Small vibratory roller 3 tonne to 5 tonne	12 m	25 m	40 m

Based on the use of an 8 tonne to 10 tonne vibratory roller and potentially varying geotechnical conditions within the project impact area in the vicinity of aboriginal heritage items, a conservative minimum safe working distance for aboriginal heritage items of 10 m has been applied.

3.11 Operational noise assessment approach

3.11.1 Operational transmission line noise

Operation of high voltage transmission lines has the potential to generate audible noise during certain meteorological conditions. To assess the potential noise impacts associated with the project transmission lines, an audible noise report has been completed (*Hunter Transmission Project – HTP Audible Noise and Radio Frequency Interference Study* prepared by Beca Pty Ltd dated July 2025). The sections of the audible noise report relating to the modelling and description of audible noise emissions are summarised in **Attachment E**.

Noise emissions from the project transmission lines are considered for the Olney to Bayswater section only as the project would result in only minor alterations to the existing 500 kV transmission line from Eraring to Kemps Creek.

Where existing 330 kV transmission lines run parallel to the proposed HTP corridor (generally through the Singleton Military Area and areas of Howick) their cumulative noise emissions are considered at the surrounding receivers. Other existing transmission lines were considered but are expected to produce much lower noise levels that would not contribute to the cumulative impact at surrounding receivers.

The audible noise report includes noise curves representing the predicted transmission line noise levels versus distance from the centre of a 70 m easement. As the tower locations within the HTP corridor are indicative, predicted noise levels are conservatively based on the distance from the edge of the HTP corridor to allow for variation in placement of the transmission towers.

3.11.2 Operational maintenance and traffic

The project switching stations and transmission lines would be inspected on a regular basis once operational. This work may include:

- line inspection via light vehicles or by air via helicopter or drone
- maintenance activities with a small crew in light and heavy vehicles
- vegetation removal to maintain required clearances.

Maintenance and operational road traffic movements on public roads and access tracks are not expected to be significant or occur for extended periods of time with about 10 total daily vehicle movements from light vehicles and a light truck required on occasion.

Project vehicle movements on public roads are not expected to exceed the RNP screening criteria of a >2.0 dB increase for road traffic noise impacts, noting that this level of increase generally requires a 60% increase in traffic.

As such impacts, from road traffic during maintenance would not likely be significant and have therefore not been considered further in this assessment.

During the operational phase of the project, the transmission lines may be inspected via helicopter on a regular schedule or as needed. The assessment of helicopter noise from work within the HTP corridor, as described in **Section 3.9,** is considered to be conservatively representative of aircraft noise from flyover inspections. This is due to helicopters during inspections likely flying at higher elevations and generally moving more quickly along the corridor, reducing the potential for noise impacts to nearby sensitive receivers. As such, impacts from aircraft used during maintenance would not likely be significant and have therefore not been considered further in this assessment.

Similarly, the significance of noise and vibration impacts at sensitive receivers from ground-based maintenance activities is considered minimal and has not been considered further in this assessment.

3.11.3 Operation of switching stations

A computer model was used to predict noise emissions from the operation of the Olney and Bayswater South switching stations. It is understood that the only operational noise sources associated with the Olney switching station would be during activation of the switches.

Operation of the Olney switching station would result in the generation of a sound power level in the order of 115 dBA L_{Amax} for a short duration. Given the short duration of the noise, the operation of the switching stations has only been assessed against the sleep disturbance L_{Amax} criteria.

The following equipment would be incorporated into the new Bayswater South switching station:

- two 120 MVAr shunt reactors with sound power level of 98 dBA
- two 145 kV neutral earthing reactors with a sound power level of 80 dBA.

The operational noise modelling was undertaken using the CONCAWE prediction algorithm within SoundPLAN v8.2 software.

3.11.4 Operation of substations

A computer noise model was used to predict noise emissions from the operation of the Eraring substation resulting from the augmentation and modification which forms part of the project. The project does not seek to modify the existing Bayswater substation and as such has not been assessed as part of the project.

Details of the existing and additional noise generating equipment to be used at the Eraring substation due to the project is provided in **Table 3-13**.

Table 3-13 Eraring substation noise generating equipment

Equipment	Quantity	Sound power level[1] (dBA)
Power transformer	9	105
Auxilliary transformer	2	85
Note 1: Per item. Based on maximum potential sound power levels provided by Transgrid		

The operational noise modelling was undertaken using the CONCAWE prediction algorithm within SoundPLAN v8.2 software.

4.0 Existing environment

The HTP corridor runs mostly through power station, mining and government land between Bayswater and Broke in the upper Hunter region. It then traverses the Pokolbin, Corrabare, Watagan and Olney State forests in the lower Hunter region (see **Figure 2-1**).

The project impact area encompasses a wide range of acoustic environments with varying ambient noise levels from quiet rural areas with limited industrial or road traffic noise, urban areas dominated by road traffic noise and areas with significant industrial (mining) noise.

The proposed new transmission line would connect the new Bayswater South switching station to the existing 500 kV transmission line near the Bayswater power station and the new Olney switching station to the existing 500 kV transmission line between Eraring and Kemps Creek.

4.1 Noise environment

The land use within the study area is characterised by a mix of transport corridors (road and rail), State forests areas, the Singleton Military Area, recreational areas both public and private and light and heavy industrial areas such as mine sites. There are also commercial and residential receivers.

The study area was divided into 14 noise catchment areas (NCAs) based on the types of sensitive receivers and ambient noise environment shown in shown in **Attachment B**. The NCAs are described in **Table 4-1**.

Table 4-1 Description of NCAs

NCA	Description
NCA01 – Lidell and Bayswater	NCA01 covers the area surrounding Lake Lidell the and the Bayswater power station. The ambient noise environment in this NCA has been informed by a noise study undertaken as noise monitoring conducted part of the Bayswater Turbine Upgrade Project for AGL in 2018 and subsequently adopted in the Lidell Battery and Bayswater Ancillary Works Project EIS (Jacobs, 2021)[1]. The noise monitoring off Hebden Road north of Lake Liddell in the Antiene development area indicated noise from the New England Highway was the dominant noise source and is representative of receivers in this NCA.
NCA02 - Jerrys Plains West and Howick	NCA02 covers the area generally to the west of the HTP corridor, to the south of Mount Arthur Coal Mine and northwest of Jerrys Plains. The ambient noise environment in this NCA has been informed by a noise study conducted as part of the Hunter Valley Operations Continuation Project (EMM, 2022). Noise monitoring was conducted approximately 1 km north of Jerrys Plains off the Golden Highway[2] and is representative of receivers in this NCA.

NCA	Description
NCA03 – Jerrys Plains	NCA03 covers the township of Jerrys Plains and other rural areas of Lemington off the Golden Highway to the north of United Wambo Mine. The ambient noise environment in this NCA has been informed by a noise study conducted as part of the Hunter Valley Operations Continuation Project (EMM, 2022). Noise monitoring was conducted within the township of Jerrys Plains and to the south of Jerrys Plains off the Golden Highway near Lemington Road[2].
NCA04 – Maison Dieu West	NCA04 covers rural areas off Maison Dieu Road west of Rix's Creek Coal Mine as well as the area of Warkworth. The ambient noise environment in this NCA has been informed by a noise study conducted as part of the Hunter Valley Operations Continuation Project (EMM, 2022). The results of noise monitoring conducted off Maison Dieu Road[2] has been adopted for receivers in this NCA.
NCA05 - Mount Thorley	NCA05 covers rural receiver areas of Gouldsville, Long Point and Mount Thorley. The ambient noise environment in this NCA has been informed by noise monitoring conducted as part of this assessment (L01).
NCA06 – Broke	NCA06 covers the township of Broke and surrounding rural receiver areas. No noise monitoring has been conducted in this NCA and the minimum NPfI background noise levels have been adopted. This is consistent with the findings of other noise impact assessments conducted for major coal mines in the area (i.e the Bulga Coal Complex located approximately 4 km north of Broke village) which noted that in the absence of mining, noise levels are low and typical of a rural environment.
NCA07 - Pokolbin	NCA07 covers the township of Pokolbin. The ambient noise environment in this NCA has been informed by noise monitoring conducted in Pokolbin off Gillards Road north of the intersection upgrade area as part of a Development Application to Cessnock City Council[3].This noise monitoring is considered representative of the noise levels near the intersection works area given the similar environment of scattered dwellings, wineries, and tourist accommodation developments.
NCA08 – HTP Central	NCA08 covers large rural areas without any significant noise from major roadways. The ambient noise environment in this NCA has been informed by noise monitoring conducted as part of this assessment at two monitoring locations, L02 and L04.
NCA09 – Millfield and Wollombi Road	NCA09 covers residential receivers near Wollombi Road and in the township of Millfield. The ambient noise environment in this NCA has been informed by noise monitoring conducted as part of this assessment at monitoring location L03.
NCA10 – Cessnock	NCA10 covers the built-up area of Cessnock. The only component of the project in this NCA is the intersection upgrade of Wollombi Road and Mt View Road. The ambient noise environment in this NCA has been informed by a noise study conducted as part of a Review of Environmental Factors for the Wollombi Road Upgrade Project (SLR, 2024)[4]. Noise monitoring was conducted on Wollombi Road to the west of the intersection upgrade area. Noise monitoring indicated that the dominant noise source was road traffic on Wollombi Road and is representative of receivers in this NCA.
NCA11 – Olney	NCA11 covers the area in the southern portion of the HTP corridor with little road traffic noise contribution from the M1 Motorway. The ambient noise environment in this NCA has been informed by noise monitoring conducted as part of this assessment at monitoring location L06.

NCA	Description
NCA12 – Cooranbong West	NCA12 covers the area between NCA11 and west of the M1 Motorway. The ambient noise environment in this NCA contains noise from the M1 motorway as well as the suburban and urban areas of Cooranbong. The ambient noise environment in this NCA has been informed by noise monitoring conducted off Freemans Drive as part of a Development Application to Lake Macquarie City Council[5]. Noise monitoring indicated that road traffic was the dominant noise source with other nose sources such as birds, dogs and commercial noise also present.
NCA13 – Eraring	NCA13 covers an area to the east of the M1 Motorway near Freemans Drive. The ambient noise environment in this NCA contains significant noise contribution from the M1 motorway. The ambient noise environment in this NCA has been informed by noise monitoring conducted as part of this assessment at monitoring location L05.
NCA14 – Dora Creek	NCA14 covers an area to the east of the M1 Motorway near Newport Road. The ambient noise environment in this NCA contains significant noise contribution from the M1 motorway as well as industrial noise. The ambient noise environment in this NCA has been informed by noise monitoring conducted off Gradwells Road in 2023 as part of a noise study forming part of the Cooranbong Entry Site Stockpile Extension Modification project (James Bailey & Associates, 2025)[6].

Note 1: SSD-8889679 noise assessment (*Lidell Battery and Bayswater Ancillary Works Project - Noise and Vibration assessment* report number IS334000_NVA dated February 2021 prepared by Jacobs Pty Ltd)

Note 2: SSD-11826621 noise assessment (*Hunter Valley Operations Continuation Project - Noise Impact Assessment* report number H1904008-1 dated 27 October 2022 prepared by EMM Pty Ltd)

Note 3: *Noise Impact Assessment – Proposed Tourist Accommodation and Function Centre – 226 Gillards Road Pokolbin NSW* project number 181576 dated February 2018 prepared by Spectrum Acoustics Pty Ltd undertaken to support a Development Application to Cessnock City Council

Note 4: *Acoustic Assessment – Wollombi Road Upgrade* report number 2223511_240313 dated 13 March 2024 prepared by RAPT Consulting Pty Ltd

Note 5: *Noise Assessment – Proposed Child Care Centre 695 Freemans Drive Cooranbong, NSW* report number MAC221596-01RP1V1 dated 2 August 2022 prepared by Muller Acoustic Consulting Pty Ltd

Note 6: SSD-5145 noise assessment (*Stockpile Extension Project – Noise Impact Assessment – Cooranbong Entry Site* report number 1200696-REP-C dated 24 January 2025 prepared by GHD Pty Ltd)

Unattended noise monitoring was completed during February and March of 2025 to determine the existing noise environment at NCA05, NCA08, NCA09, NCA11 and NCA13 and to set criteria to assess the potential impacts from the project. Noise monitoring data contained in publicly available noise assessments previously undertaken for other projects have been used to supplement measured noise levels for the remaining NCAs.

The ambient noise monitoring locations were selected with reference to the procedures and guidance outlined in the ICNG and NPfI to establish background noise levels across the study area and surrounding land uses. The measured existing noise levels are representative of receivers in each NCA that would likely be most affected by the construction and operation of the project.

The ambient noise levels for the project are summarised **Table 4-2** and are shown in **Attachment F**. Descriptions of each monitoring location and the measured noise environment, together with graphs of the daily measured noise levels, are provided in **Attachment F**.

Table 4-2 Summary of ambient noise levels

NCA	Location ID	Address or Locality	Noise level (dBA)[1,2]					
			Background noise (RBL)			Average noise (L_{Aeq})		
			Day	Evening	Night	Day	Evening	Night
NCA01	-	Hebden Road, Muswellbrook	37[3]	36[3]	36[3]	-	-	-
NCA02	-	2755 Jerrys Plains Road, Jerrys Plains	35[3,6] (33)	30[3,6] (28)	30[3,6] (27)	-	-	-
NCA03	-	Jerrys Plains Village and Moses Crossing	36[3]	33[3]	32[3]	-	-	-
NCA04	-	Maison Dieu	35[3] (31)	31[3,4] (32)	31[3,4] (33)	-	-	-
NCA05	L01	66 Long Point Road East, Gouldsville	38	35	33	65	51	48
NCA06	-	-	35[5]	30[5]	30[5]	-	-	-
NCA07		Palmers Lane, Pokolbin	35[3,6] (31)	31[3,4] (35)	30[3,6] (28)	48[3]	48[3]	41[3]
NCA08	L02	33 Mount Baker Road, Mount View	35[6] (29)	30[6] (28)	30[6] (25)	44	46	41
	L04	192 MF1 Road, Millfield	35[6] (32)	30[6] (25)	30[6] (22)	44	42	41
NCA09	L03	1611 Wollombi Road, Millfield	35[6] (34)	34	33	55	44	45
NCA10	-	91 Wollombi Road, Cessnock	51[3]	40[3]	30[3,6] (29)	-	-	-
NCA11	L06	295 Watagan Road, Martinsville	35[6] (33)	32	30	53	61	52
NCA12	-	695 Freemans Drive, Cooranbong	37[3]	35[3]	31[3]	47[3]	41[3]	41[3]
NCA13	L05	1262 Freemans Drive, Cooranbong	43	43[4] (44)	42	56	57	51
NCA14	-	Gradwells Road, Dora Creek	35[3]	35[3,4] (38)	35[3]	49[3]	44[3]	43[3]

NCA	Location ID	Address or Locality	Noise level (dBA)[1,2]					
			Background noise (RBL)			Average noise (L_{Aeq})		
			Day	Evening	Night	Day	Evening	Night

Note 1: The RBL and LAeq noise levels have been determined with reference to the procedures in the NPfI.

Note 2: Day: Monday to Saturday 7:00 am to 6:00 pm, Sunday and Public Holidays 8:00 am to 6:00 pm; Evening Monday to Sunday 6:00 pm to 10:00 pm; Night: Monday to Saturday 10:00 pm to 7:00 am, Sunday and Public Holidays 10:00 pm to 8:00 am.

Note 3: Data obtained from publicly available noise impact assessments as noted in **Table 4-1**.

Note 4: The monitored evening or night level was found to be higher than the daytime. In this situation the NPfI requires that the evening or night level be reduced to match the daytime. The monitored level is shown in brackets.

Note 5: The minimum RBLs in the NPfI are listed as 35 dBA in the daytime and 30 dBA in the evening and night-time. These minimum RBLs have been adopted for this NCA in the absence of other data.

Note 6: RBL adjusted to the minimum RBL. Minimum RBLs in the NPfI are listed as 35 dBA in the daytime and 30 dBA in the evening and night-time. The monitored level is shown in brackets.

4.2 Existing meteorological environment

4.2.1 Noise Policy for Industry meteorological conditions

In general terms, NPfI Fact Sheet D sets out procedures for establishing noise enhancing weather conditions, where two options are available to consider meteorological effects, as follows:

1. *Adopt the **noise-enhancing meteorological conditions** for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur - a conservative approach that considers source to receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night.*

Or

2. *Determine the **significance** of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.*

NPfI Fact Sheet D also contains several important notes, and in particular states:

> *Noise limits derived for consents and licences will apply under the meteorological conditions used in the environmental assessment process, that is, standard or noise-enhancing meteorological conditions. For 'very noise-enhancing meteorological conditions' (see glossary) a limit is set based on the limit derived under standard or noise-enhancing conditions (whichever is adopted in the assessment) plus 5 dB. In this way a development is subject to noise limits under all meteorological conditions.*
>
> *It should be noted that noise limit conditions will include the wind speed (scalar quantity without direction) under which noise limits will apply.*

4.2.2 Wind

Wind has the potential to increase noise levels at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases, the noise produced by the wind would obscure noise from most industrial and transport sources.

4.2.3 Temperature inversion

Temperature inversions, when they occur, have the ability to increase noise at a receiver. Temperature inversions occur predominantly at night during the winter months.

For the purpose of assessing the frequency of occurrence of temperature inversions during the winter months, the night-time period is from one hour before sunset to one hour after sunrise (taken to be 6.00pm to 7.00am).

4.2.4 Weather conditions for transmission line audible noise generation

The noise emission from high voltage transmission lines is expected to increase during wet weather conditions when water droplets form on the surface of the conductors.

Two weather scenarios were considered in the audible noise assessment (**Attachment E**) and are described as:

- Fair weather – maximum ambient temperature and altitude from historical weather data for the region.
- L50 (light rain or mist) – maximum altitude and L50 rain simulated at a rate of 0.86 millimetres per hour.

The fair weather scenario is considered to be representative of transmission line audible noise producing conditions most commonly occurring in the study area and is considered the 'typical' scenario.

Although heavy rain is expected to produce the highest potential noise emissions, the ambient noise environment is also expected to be notably elevated during heavy rain and would mask transmission line audible noise. It is assumed that applicable minimum background noise levels specified in the NPfI may occur during L50 conditions (light rain or mist). Therefore, L50 conditions representing light rain and mist are considered to be the controlling scenario in terms of potential transmission line audible noise impacts, with respect to the NPfI criteria.

The historical number of rain days in the study area has been reviewed based on climate records available from the Bureau of Meteorology (BOM) stations located at Lake Macquarie (Cooranbong) and Cessnock Airport, and is summarised in **Table 4-3**.

Table 4-3 Occurrence of rain days

Station	Station ID	Years in dataset	Percentage of rain days (≥1 mm)			
			Summer	Autumn	Winter	Spring
Lake Macquarie (Cooranbong)	061412	2008 to March 2025	29.8%	29.1%	22.0%	25.2%
Cessnock Airport	061260	1968 to March 2025	24.1%	21.4%	15.7%	21.0%

Table 4-3 shows that rain days in the study area have historically been observed for between 21 and 30 per cent of days, depending on the location and season, with the highest proportion of rain days during Summer and Autumn.

The historical rain days include periods of both light and heavy rain where rainfall totals equal or exceed 1 mm in a 24-hour period. It is expected that L50 conditions (light rain or mist) would form a smaller subset within these rain days. Further, it is expected that the number of days for which L50 (light rain or mist) conditions occur during the night-time period with the lowest background noise levels would be a smaller subset again.

The NPfI defines significant meteorological effects that should be considered in noise impact assessments by occurrence for at least 30% of a given assessment period in a season. It is noted that this definition applies to the occurrence of temperature inversions and noise enhancing wind conditions in the NPfI, so the definition is not directly applicable to the effect of rain on transmission line audible noise generation.

Considering the percentage of rain days in the area, L50 conditions (light rain or mist) are not considered to represent the prevailing meteorological conditions and would not typically be required as an operational noise assessment scenario based on the intent of the NPfI. However, to provide a conservative approach, the assessment of operational transmission line noise during L50 (light rain or mist) conditions has been included in the assessment to represent the potential worst-case scenario for transmission line audible noise.

4.2.5 NPfI Noise modelling meteorological parameters for other operational noise sources (switching stations)

To provide a conservative approach, the standard and noise enhancing meteorological conditions (NPfI Table D1) have been adopted for the assessment of other operational noise sources such as the new switching stations are presented in **Table 4-4**.

Table 4-4 NPfI Table D1 Standard and noise enhancing meteorological conditions

Meteorological conditions	Meteorological parameters
Standard	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m above ground level (AGL)
Noise-enhancing	Day/evening: stability categories A-D with light winds (up to 3 m/s at 10 m AGL) Night: 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
Note: Where a range of conditions is nominated, the meteorological condition delivering the highest predicted noise level should be adopted for assessment purposes. However, feasible and reasonable noise limits in consents and licences derived from this process would apply under the full range of meteorological conditions nominated under standard or noise-enhancing conditions as relevant. All wind speeds are referenced to 10m AGL. Stability categories are based on the Pasquill-Gifford stability classification scheme.	

The adopted NPfI standard and noise enhancing meteorological conditions can be further defined for noise modelling purposes of switching stations during the night-time period as presented in **Table 4-5**.

Table 4-5 Meteorological parameters considered for noise predictions

Category	Period	Temperature (ºC)	Humidity (%)	Wind speed (m/s)	Wind direction	Stability class
Standard	Night	10	90	0.5	Source to receiver	D
Noise enhancing	Night	10	90	3	Source to receiver	D
		10	90	2		F

5.0 Assessment of impacts

5.1 Construction assessment impacts

5.1.1 Summary of residential noise management levels

The residential Noise Management Levels (NMLs) for the assessment of project construction have been determined using the ambient noise levels shown in **Table 4-2** and are shown in **Table 5-1**.

Table 5-1 Residential receiver construction NMLs

NCA	NML ($L_{Aeq15minute}$ – dBA)				Sleep disturbance screening criteria (highest of 52 dBA or RBL + 15 dB)
	Standard construction (RBL +10 dB)	Out-of-hours (RBL + 5 dB)			
	Day	Day[1]	Evening	Night	Night
NCA01 – Lidell and Bayswater	47	42	41	41	52
NCA02 - Jerrys Plains West and Howick	45	40	35	35	52
NCA03 – Jerrys Plains	46	41	38	37	52
NCA04 – Maison Dieu West	45	40	36	36	52
NCA05 - Mount Thorley	48	43	40	38	52
NCA06 – Broke	45	40	35	35	52
NCA07 - Pokolbin	45	40	36	35	52
NCA08 – HTP Central	45	40	35	35	52
NCA09 – Millfield and Wollombi Road	45	40	39	38	52
NCA10 – Cessnock	61	56	45	35	52
NCA11 – Olney	45	40	37	35	52
NCA12 – Cooranbong West	47	42	40	36	52
NCA13 – Eraring	53	48	48	47	57
NCA14 – Dora Creek	45	40	40	40	52

Note 1: Day out-of-hours is 7am to 8am and 1pm to 6pm on Saturday, and 8am to 6pm on Sunday and public holidays.

The following assessment shows the predicted construction noise impacts, which have been assessed based on the exceedance of the noise management levels. Exceedances of the NMLs are presented as per the CNVG exceedance categories in **Table 5-2**. The CNVG is a suitable reference guideline for the management of construction noise impacts from the project.

Table 5-2 Exceedance bands and impact colouring

Subjective Classification	Exceedance of Noise Management Level		Impact Colouring
	Day	Out of Hours[1]	
Negligible	No exceedance	No exceedance	
Noticeable	-	1 to 5 dB	
Clearly Audible	1 to 10 dB	6 to 15 dB	
Moderately Intrusive	11 to 20 dB	16 to 25 dB	
Highly Intrusive	> 20 dB	> 25 dB	

Note 1: Day out of hours is 7am to 8am on Saturday and 8am to 6pm on Sunday and public holidays.
Evening out of hours is 6pm to 10pm Monday to Sunday
Night out of hours is 10pm to 7am Mondays to Saturday and 10pm to 8am for Sundays and public holidays.

For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted, as the noise levels presented in this report are based on each scenario occurring at the work site boundary which is the closest point to each sensitive receiver.

The assessment is generally considered conservative as the calculations also assumed several items of construction equipment are in use at the same time within individual scenarios. In reality, there would frequently be periods when construction noise levels are much lower than the worst-case levels predicted as well as times when no equipment is in use.

The assessed scenarios represent one possible way that the project could be constructed and may not necessarily be the same methodology that the construction contractors engaged to construct the project would use. The representative scenarios cover a range of noise producing activities, including highly noise intensive equipment, and are therefore considered representative of the worst-case construction noise scenario.

The assessment in this report presents the predicted noise impacts prior to the application of mitigation. Implementation of mitigation measures as proposed **Section 6.0** would reduce the predicted construction noise levels.

5.1.2 Construction noise impacts from construction support sites, laydown areas, substations, and switching stations

The assessed construction support sites (some with temporary worker accommodation), laydown areas, substation and switching stations are summarised in **Table 5-3**.

Table 5-3 Construction support sites, accommodation sites, laydown sites, substations and switching stations

Project component	Locality	Approximate distance to closest sensitive receiver	Receiver Type
Construction support sites			
Freemans Drive construction support and worker accommodation site	Cooranbong	<10 m (58 m to receiver not on same parcel of land)	Residential
Wollombi Road construction support site	Millfield	48 m	Residential
Gouldsville Road construction support and worker accommodation site	Gouldsville	36 m	Residential
Pikes Gully road construction support site	Howick	6,000 m	Residential
Hebden Road support and worker accommodation site	Muswellbrook	800 m	Lake Lidell Recreation Area
Laydown areas			
Wollombi Forest Road laydown area	Ravensdale	1,200 m	Casuarina Camping Area
Crumps Road laydown area	Corrabare	750 m	Residential
Crumps Road helicopter site		1,300 m	Residential
North Road laydown area	Millfield	460 m	Residential
Wollombi Road laydown area		70 m	Residential
Mount View Ridge laydown area		1,300 m	Residential
Campbell Springs Trail laydown area	Cedar Creek	2,000 m	Residential
Campbell Springs Trail laydown area		450 m	Residential
Broken Back Trail A laydown area	Broke	760 m	Residential
Broken Back Trail B laydown area		1,020 m	Residential
Archerfield Road laydown area	Warkworth	330 m	Residential
Lemington Road laydown area	Lemington	90 m	Residential
Substation and switching stations			
Olney switching station	Ravensdale	1,400 m	Wishing Well Picnic Area
Bayswater South switching station	Muswellbrook	7,000 m	Lake Lidell Recreation Area
Eraring substation	Dora Creek	1,200 m	Residential

The number of residential receivers where NML exceedances are predicted in each relevant NCA during the daytime for the construction support sites, laydown areas, substation and switching stations is summarised in Table 5-4. The number of residential receivers where NML exceedances are predicted during the night-time for the OOH operation of the construction support sites with accommodation is summarised in Table 5-5. A discussion on the results is presented after the tables.

The worst-case construction compound and combined worker accommodation facility and construction compound noise impacts are also shown in **Attachment G.1** during the daytime and **Attachment G.2** for night-time 'accommodation facility operation'.

A summary of the number of 'other sensitive' receivers where NML exceedances are predicted during the daytime for the construction support sites, laydown areas, substation and switching stations is summarised in **Table 5-6**.

Table 5-4 Daytime residential NML exceedances - construction support sites, laydown areas, substation and switching stations

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
NCA03	**Construction support sites**				
	Earthworks	-	-	-	-
	Concrete works	-	-	-	-
	Support site operation	-	-	-	-
	Laydown areas				
	Earthworks	-	2	-	1
	Laydown area operation	-	1	-	-
	Substation and switching stations				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-
NCA04	**Construction support sites**				
	Earthworks	-	-	-	-
	Concrete works	-	-	-	-
	Support site operation	-	-	-	-
	Laydown areas				
	Earthworks – without rock breaker	-	2	-	-
	Laydown area operation	-	-	-	-
	Substation and switching stations				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-
NCA08	**Construction support sites**				
	Earthworks	-	-	-	-

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
	Concrete works	-	-	-	-
	Support site operation	-	-	-	-
	Laydown areas				
	Earthworks – without rock breaker	-	7	-	-
	Laydown area operation	-	-	-	-
	Substation and switching stations				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-
NCA09	**Construction support sites**				
	Earthworks – without rock breaker	-	4	-	
	Concrete works	-	2	-	
	Support site operation	-	-	-	
	Laydown areas				
	Earthworks	-	21	12	1
	Laydown area operation	-	7	-	-
	Substation and switching stations				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-
NCA13	**Construction support sites**				
	Earthworks	-	3	2	-
	Concrete works	-	3	1	-
	Support site operation	-	1	-	-
	Laydown areas				
	Earthworks – without rock breaker	-	-	-	-
	Laydown area operation	-	-	-	-
	Substation and switching stations				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater irrespective of NML exceedance level).
Note 2: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**
Note 3: No impacts above the NML are predicted in NCA01, NCA02, NCA05, NCA06, NCA07, NCA10, NCA11, NCA12 and NCA14.

Table 5-5 Night-time residential NML exceedances - construction support sites, and accommodation facility operation

NCA[2]	Scenario	Number of residential receivers							
		With NML exceedance[1]				With sleep disturbance exceedance			
		1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB
Hebden Road support and accommodation site									
NCA01	Accommodation facility – OOH operation	-	-	-	-	-	-	-	-
Gouldsville Road support and accommodation site									
NCA04	Accommodation facility – OOH operation	-	-	-	-	-	-	-	-
NCA05		-	-	-	-	-	-	-	-
Freemans Drive support and accommodation site									
NCA12	Accommodation facility – OOH operation	-	-	-	-	-	-	-	-
NCA13		-	-	-	-	2	-	-	-
NCA14		-	-	-	-	-	-	-	-

Note 1: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**.
Note 2: No impacts above the NML or sleep disturbance level are predicted in NCA03, NCA06, NCA07, NCA08, NCA09, NCA10, NCA11

Table 5-6 Other sensitive daytime NML exceedances - construction support sites, laydown areas, substation, and switching stations

Scenario	Number of 'other sensitive' receivers			
	HNA[1]	With NML exceedance[2]		
		1-10 dB	11-20 dB	>20 dB
Construction support sites				
Earthworks – without rock breaker	-	-	-	-
Concrete works	-	-	-	-
Support site operation	-	-	-	-

Scenario	Number of 'other sensitive' receivers			
	HNA[1]	With NML exceedance[2]		
		1-10 dB	11-20 dB	>20 dB
Laydown areas				
Earthworks – without rock breaker	-	1	-	-
Laydown area operation	-	-	-	-
Substation and switching stations				
Earthworks -including rock breaker	-	-	-	-
Earthworks – without rock breaker	-	-	-	-
Concrete works	-	-	-	-
Note 1: Highly Noise Affected level not applicable to 'other sensitive' receivers Note 2: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 5-2**				

The above assessment shows:

- the predicted impacts are generally limited to residential receivers closest to each site
- noise levels from the OOH operation of the accommodation facilities are predicted to exceed the sleep disturbance screening level at 2 locations however no exceedance of the sleep disturbance screening level is predicted and are unlikely to cause awakening reactions
- 1 'other sensitive' receiver (Millfield Cemetery) is predicted to have 'clearly audible' (1-10 dB) impacts.

5.1.3 Construction noise impacts from access track construction, and intersection upgrades

The locations of access tracks are spread across the project impact area. The project would establish new access tracks as well as upgrade existing tracks to facilitate access to the often-remote transmission lines, transmission line towers and switching stations. Upgrades of intersections to facilitate heavy plant and equipment movements as well as delivery of transmission tower components may also be required.

The number of residential receivers where NML exceedances are predicted during the daytime construction of access tracks and intersection upgrades is summarised in **Table 5-7**. A summary of the number of 'other sensitive' receivers where NML exceedances are predicted during the daytime for the access tracks and intersection upgrades is summarised in **Table 5-8**.

Results presented in the tables are colour coded as per the exceedance bands shown **Table 5-2**. A discussion on the results is presented after the tables.

The worst-case intersections upgrades construction noise impacts are shown in **Attachment G.3** and **Attachment G.4** for typical and intensive construction scenarios respectively. Noise impacts from the access track construction works are shown in and **Attachment G.5** and **Attachment G.6** for minor and major construction scenarios respectively.

Table 5-7 Daytime residential NML exceedances - access tracks, and intersection upgrades

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
NCA02	**Access Tracks**				
	Earthworks – including rock breaker	-	1	2	-
	Earthworks – without rock breaker	-	2	-	-
NCA03	**Access Tracks**				
	Earthworks – including rock breaker	**1**	4	5	2
	Earthworks – without rock breaker	**1**	6	2	-
	Earthworks – minor	**1**	1	-	-
	Intersection upgrades				
	Intersection works – typical	**1**	7	2	-
	Intersection works – intensive	**1**	4	2	-
NCA04	**Access Tracks**				
	Earthworks – including rock breaker	**1**	9	7	1
	Earthworks – without rock breaker	-	4	4	1
	Earthworks – minor	-	2	-	1
	Intersection upgrades				
	Intersection works – typical	-	-	-	-
NCA05	**Access Tracks**				
	Earthworks – including rock breaker	**2**	11	3	4
	Earthworks – without rock breaker	**2**	4	3	1
	Earthworks – minor	-	1	-	-
	Intersection upgrades				
	Intersection works – typical	-	6	2	-
	Intersection works – intensive	-	-	-	-
NCA06	**Access Tracks**				
	Earthworks – including rock breaker	-	5	1	-
	Earthworks – without rock breaker	-	2	-	-
	Intersection upgrades				
	Intersection works – typical	-	7	-	-
	Intersection works – intensive	-	-	-	-
NCA08	**Access Tracks**				
	Earthworks – including rock breaker	-	54	7	1

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
	Earthworks – without rock breaker	-	19	4	1
	Intersection upgrades				
	Intersection works – typical	-	-	-	-
NCA09	**Access Tracks**				
	Earthworks – including rock breaker	-	7	1	-
	Earthworks – without rock breaker	-	3	-	-
	Intersection upgrades				
	Intersection works – typical	-	1	-	-
	Intersection works – intensive	**-**	2	-	-
	Intersection upgrade – Wollombi Road with Hayes Road and Mt View Road				
	Intersection works – typical	**7**	78	34	20
	Intersection upgrade – Wollombi Road and Mt View Road				
	Intersection works – typical	**7**	10	2	-
NCA11	**Access Tracks**				
	Earthworks – including rock breaker	**3**	51	25	3
	Earthworks – without rock breaker	**2**	44	8	3
	Earthworks – minor	**-**	2	-	-
	Intersection upgrades				
	Intersection works – typical	-	14	5	5
NCA12	**Access Tracks**				
	Earthworks – including rock breaker	-	34	7	-
	Earthworks – without rock breaker	-	15	3	-
	Earthworks – minor	-	9	5	2
	Intersection upgrades				
	Intersection works – typical	-	9	4	1
	Intersection works – intensive	-	6	7	2
	Intersection upgrade – Martinsville Road and Freemans Drive				
	Intersection works – typical	**2**	49	16	3
	Intersection works – intensive	**3**	74	25	6
NCA13	**Access Tracks**				
	Earthworks – including rock breaker	-	3	-	-
	Earthworks – without rock breaker	-	-	-	-

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
	Earthworks – minor	-	2	1	-
	Intersection upgrades				
	Intersection works – typical	**1**	1	-	-
	Intersection works – intensive	**1**	4	-	-
NCA14	**Access Tracks**				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Earthworks – minor	-	2	-	-

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater irrespective of NML exceedance level).
Note 2: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**
Note 3: No impacts above the NML are predicted in NCA01, NCA07 and NCA10

Table 5-8 Other Sensitive NML exceedances - access tracks and intersection upgrades

Scenario	Number of 'other sensitive' receivers			
	HNA[1]	With NML exceedance[2]		
		1-10 dB	11-20 dB	>20 dB
Access tracks				
Earthworks -including rock breaker	-	2	-	2
Earthworks – without rock breaker	-	-	-	2
Earthworks - minor	-	-	-	-
Intersection Upgrades				
Intersection works – typical	-	1	1	-
Intersection works – intensive	-	-	-	-

Note 1: Highly Noise Affected level not applicable to 'other sensitive' receivers
Note 2: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**

The above assessment shows that the predicted impacts are generally limited to sensitive receivers closest to the access track and intersection upgrade areas, with highly noise affected receivers located immediately adjacent to proposed work areas. It is understood that typically receivers would only experience high noise levels for one to two days as construction occurs in proximity to the receivers before moving to other parts of the project.

5.1.4 Construction noise impacts from construction activities within the HTP corridor and stringing sites

Construction activities within the HTP corridor and stringing sites for the transmission lines would typically include:

- site establishment work including connection to the relevant access track, service relocation and vegetation clearance
- civil work including earthwork, construction of tower pads, construction of footings, steel fabrication, concrete pours, erection of transmission line structures and stringing work at work sites within the HTP corridor for the new double circuit 500 kV transmission lines
- clearing of vegetation within the HTP corridor where it may impact on transmission line clearance requirements between the new Olney switching station and Bayswater Power Station.

The number of residential receivers where NML exceedances are predicted during the daytime for the construction is summarised in Table 5-9. The number of residential receivers where NML exceedances are predicted during the night-time for the potential OOH operation of stringing sites near Wollombi Road, Putty Road and Cessnock is summarised in Table 5-10. A discussion on the results is presented after the tables.

The worst-case construction noise impacts from construction activities within the HTP corridor and stringing sites are also shown in **Attachment G.7** during the daytime and **Attachment G.8** for night-time stringing activities.

A summary of the number of 'other sensitive' receivers where NML exceedances are predicted during the daytime for the construction support sites, laydown areas, substations and switching stations is summarised in **Table 5-11**.

Table 5-9 Daytime residential NML exceedances – construction activities within the HTP corridor and stringing sites

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
NCA02	**HTP corridor**				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Vegetation clearing	-	-	-	-
	Tower sites				
	Earthworks – including rock breaker	-	-	1	-
	Earthworks – without rock breaker	-	1	-	-
	Concrete works	-	1	-	-
	Tower assembly	-	1	-	-
	Stringing Sites				
	Stringing	-	-	-	-
NCA03	**HTP corridor**				

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
	Earthworks – including rock breaker	**1**	2	3	3
	Earthworks – without rock breaker	**1**	5	1	2
	Vegetation clearing	**1**	4	1	3
	Tower sites				
	Earthworks – including rock breaker	**1**	2	4	2
	Earthworks – without rock breaker	**1**	5	3	-
	Concrete works	**1**	5	2	1
	Tower assembly	**1**	3	3	-
	Stringing Sites				
	Stringing	**1**	3	2	-
NCA04	**HTP corridor**				
	Earthworks – including rock breaker	1	7	4	3
	Earthworks – without rock breaker	1	3	4	-
	Vegetation clearing	1	1	5	1
	Tower sites				
	Earthworks – including rock breaker	**1**	6	7	-
	Earthworks – without rock breaker	-	3	4	1
	Concrete works	-	4	3	1
	Tower assembly	-	4	3	1
	Stringing Sites				
	Stringing	-	-	-	-
NCA05	**HTP corridor**				
	Earthworks – including rock breaker	-	17	3	-
	Earthworks – without rock breaker	-	3	2	-
	Vegetation clearing	-	9	3	-
	Tower sites				
	Earthworks – including rock breaker	-	17	3	-
	Earthworks – without rock breaker	-	2	1	-
	Concrete works	-	3	-	-
	Tower assembly	-	3	-	-
	Stringing Sites				
	Stringing	**-**	3	-	-

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
NCA06	**HTP corridor**				
	Earthworks – including rock breaker	-	5	1	-
	Earthworks – without rock breaker	-	2	-	-
	Vegetation clearing	-	4	-	-
	Tower sites				
	Earthworks – including rock breaker	-	5	1	-
	Earthworks – without rock breaker	-	2	-	-
	Concrete works	-	2	-	-
	Tower assembly	-	1	-	-
	Stringing Sites				
	Stringing	-	2	-	-
NCA08	**HTP corridor**				
	Earthworks – including rock breaker	-	18	1	-
	Earthworks – without rock breaker	-	3	-	-
	Vegetation clearing	-	6	-	-
	Tower sites				
	Earthworks – including rock breaker	-	18	-	-
	Earthworks – without rock breaker	-	3	-	-
	Concrete works	-	2	-	-
	Tower assembly	-	1	-	-
	Stringing Sites				
	Stringing	-	-	-	-
NCA09	**HTP corridor**				
	Earthworks – including rock breaker	-	7	-	
	Earthworks – without rock breaker	-	1	-	-
	Vegetation clearing	-	3	-	-
	Tower sites				-
	Earthworks – including rock breaker	-	7	-	
	Earthworks – without rock breaker	-	1	-	-
	Concrete works	-	-	-	-
	Tower assembly	-	-	-	-
	Stringing Sites				-

NCA[3]	Scenario	Number of residential receivers			
		HNA[1]	With NML exceedance[2]		
			1-10 dB	11-20 dB	>20 dB
	Stringing	-	-	-	
NCA11	**HTP corridor**				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Vegetation clearing	-	-	-	-
	Tower sites				-
	Earthworks – including rock breaker	-	-	-	
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-
	Tower assembly	-	-	-	-
	Stringing Sites				-
	Stringing	-	10	1	
NCA12	**HTP corridor**				
	Earthworks – including rock breaker	-	-	-	-
	Earthworks – without rock breaker	-	-	-	-
	Vegetation clearing	-	-	-	-
	Tower sites				-
	Earthworks – including rock breaker	-	-	-	
	Earthworks – without rock breaker	-	-	-	-
	Concrete works	-	-	-	-
	Tower assembly	-	-	-	-
	Stringing Sites				-
	Stringing	-	5	-	

Note 1: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater irrespective of NML exceedance level).

Note 2: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**

Note 3: No impacts above the NML predicted in NCA01, NCA02, NCA07, NCA10, NCA13 and NCA14.

Table 5-10 Night-time residential NML exceedances – OOH stringing sites

Scenario	Number of residential receivers							
	With NML exceedance[1]				With sleep disturbance exceedance			
	1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB
Stringing sites crossing M1 Pacific Motorway								
Stringing	18	8	-	-	2	-	-	-
Stringing sites crossing Wollombi Road								
Stringing	2	-	-	-	-	-	-	-
Stringing sites crossing Cessnock Road								
Stringing	4	1	1	-	2	-	-	-
Stringing sites crossing Putty Road								
Stringing	3	-	1	-	-	1	-	-
Note 1: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**								

Table 5-11 Other sensitive NML exceedances – daytime construction activities within the HTP corridor and stringing sites

Scenario	Number of 'other sensitive' receivers			
	HNA[1]	With NML exceedance[2]		
		1-10 dB	11-20 dB	>20 dB
HTP corridor				
Earthworks -including rock breaker	-	1	-	-
Earthworks – without rock breaker	-	1	-	-
Vegetation clearing	-	1	-	-
Tower sites				
Earthworks -including rock breaker	-	-	-	-
Earthworks – without rock breaker	-	-	-	-
Concrete works	-	-	-	-
Tower assembly	-	-	-	-
Stringing sites				
Stringing	-	-	-	-
Note 1: Highly Noise Affected level not applicable to 'other sensitive' receivers Note 2: Exceedance is based on worst-case predicted noise levels. Impact colouring is based on categories shown in **Table 5-2**				

The above assessment shows:

- the predicted impacts are generally limited to residential receivers closest to each site

- maximum noise levels from the potential OOH use of the stringing sites are predicted to exceed the sleep disturbance screening level at up to 5 receivers. The highest predicted noise level at any residence is less than 65 dBA. As per the advice in the RNP as detailed in **Section 3.5.1,** OOH operation of the stringing sites across Wollombi Road, Cessnock Road and Putty Road are unlikely to cause sleep disturbances.

5.1.5 Extended construction hours

The required offset distance to any residential receiver location to meet the night-time NML (i.e the most stringent time period for extended construction hours) is shown in **Table 5-12**.

Table 5-12 Offset distance from construction activities to meet NML at residential receivers

NCA	Night-time NML (dBA)	Offset distance required to meet NML (m)				
		Vegetation Clearing	Earthworks	Earthworks (without breaker)	Concrete works	Tower assembly
NCA1	41	1574	2033	1358	1123	923
NCA2, NCA06, NCA07, NCA08, NCA10, NCA11	35	2540	3164	2233	1891	1588
NCA03	37	2182	2751	1906	1601	1334
NCA04, NCA12	36	2356	2953	2065	1742	1457
NCA05, NCA09	38	2017	2558	1756	1469	1220
NCA13	47	914	1220	776	630	509
NCA14	40	1713	2199	1482	1231	1014

Construction activities during extended construction hours would only be conducted where construction noise levels would not exceed the NML at any noise sensitive receiver and in consultation with relevant stakeholders.

5.1.6 Aircraft noise from potential helipads

Several of the proposed construction support sites would potentially include a helipad to enable helicopter use during construction. Helicopter L_{Amax} noise levels have been predicted for all potential helipad locations with the following assumptions:

- arrival and departure may occur in any direction (ie assessment is representative of the maximum noise from helicopter movements in all directions)
- helicopter takeoff and landings have a 30 degree flight angle
- helicopters are climbing to or descending from a height of 305 m (1,000 ft) above ground level (AGL)
- potential helipad locations are indicatively assumed to be around the centroids of each construction compound and combined worker accommodation facility and construction compound.

The predicted L_{Amax} noise level contours for all construction support sites with potential helipads are shown in **Attachment G.9**. The presented contours are representative of the maximum level predicted from both helicopter arrival and departure.

The potential helipad locations are listed in **Table 5-13**, including a summary of nearby residential receivers and predicted noise levels.

Table 5-13 Potential helipad locations and noise levels

Site name	Approximate distance to closest residential receiver	Number of receivers with potential aircraft L_{Amax} noise level	
		>75 dBA	>85 dBA
Hebden Road support and accommodation site	1,080 m	-	-
Pikes Gully Road support site	6,500 m	-	-
Gouldsville Road support and accommodation site	240 m	-	-
Freemans Drive support and accommodation site	<10 m	5	-

Helicopter L_{Amax} noise levels from arrival and departure at construction support sites are predicted to be above 85 dBA at the residential receivers nearest to the potential helipad locations at the Freemans Drive support and accommodation site. The predicted helicopter L_{Amax} noise levels at Hebden Road, Pikes Gully Road and Gouldsville Road support sites are unlikely to cause any significant impacts to the noise amenity in the area due to receivers being sufficiently distant. Use of these helipad locations should be prioritised as they are more distant from sensitive receivers and unlikely to cause high L_{Amax} noise levels during regular movements throughout construction.

Helicopters may also be based overnight at nearby airports such as Cessnock Aerodrome. Any noise impact at sensitive receivers close to airports is expected to be minimal in comparison to normal airport operation and would be managed with existing airport procedures. Flight paths around airports are expected to be managed in consultation with Airservices Australia and the Civil Aviation Safety Authority (CASA).

The proposed mitigation measures to minimise and manage the potential noise impacts are discussed in **Section 6.0**, and include planning arrival and departure paths to avoid nearby sensitive receivers where possible.

5.1.7 Aircraft noise from flights outside the HTP corridor

Helicopters would be required to fly from the nominated helipad to and from the HTP corridor work sites. This component of helicopter use would typically include flight over areas outside of the project impact area. Since flight paths are not known at this stage and would be subject to external direction and approval from CASA and Airservices Australia, this section presents a summary of indicative L_{Amax} noise levels predicted for sensitive receivers near helicopter flight paths.

Based on other projects of this nature, it is understood that helicopters would generally be flown at a minimum height of 305 m (1,000 ft) AGL over towns and 152 m (500 ft) AGL over unpopulated areas when travelling outside of the project impact area. The ground offset distances at which various L_{Amax} noise levels are predicted during regular flight are shown in **Table 5-14**.

Table 5-14 LAmax helicopter noise levels versus ground offset distance

LAmax noise level	Ground offset distance where noise level is predicted[1]	
	152 m (500 ft) flight	305 m (1000 ft) flight
60 dBA	950 m	1,150 m
65 dBA	700 m	700 m
70 dBA	450 m	350 m
75 dBA	250 m	-
80 dBA	150 m	-

Note 1: Ground offset is the 2D distance at ground level from the flight path centreline. Distances are indicative and are rounded to the nearest 50 m for display.

The predicted LAmax noise levels show that helicopter flight outside of the project impact area is considered unlikely to cause significant annoyance or impact the noise amenity of sensitive receivers. Helicopter noise from flights outside of the project impact area are expected to be relatively short-term and would likely be apparent for less than a minute at any individual sensitive receiver underneath the flight path.

The proposed mitigation measures to minimise and manage the potential noise impacts are discussed in **Section 6.0** and include alternating flight paths to avoid repeated helicopter noise at the same sensitive receivers where possible.

5.1.8 Aircraft noise from flights within the HTP corridor

Aircraft use within the HTP corridor would include helicopters and drones for stringing work. Aircraft may also be used to install final components such as conductor spacers on the newly installed transmission lines.

Typically, aircraft would progressively fly draw wires for each conductor and overhead earth wire through the transmission line structures between each stringing site.

The predicted noise levels for helicopter flights within the HTP corridor are based at a height of 52 m (170 ft) AGL, which has been selected as being representative of the height required to access the lower conductors of the transmission line tower. The LAmax noise level contours are shown in **Attachment G.9**.

The number of sensitive receivers where various LAmax noise levels are predicted during aircraft flight at 52 m (170 ft) AGL within the transmission line corridor are shown in **Table 5-15**.

Table 5-15 Number of receivers with LAmax helicopter noise levels from corridor flight

LAmax noise level	Number of receivers experiencing predicted LAmax noise level
	Helicopter flight at 52 m (170 ft) AGL
60 dBA – 65 dBA	18
65 dBA – 70 dBA	8
70 dBA – 75 dBA	3
75 dBA – 80 dBA	6
80 dBA – 85 dBA	4

LAmax noise level	Number of receivers experiencing predicted LAmax noise level
	Helicopter flight at 52 m (170 ft) AGL
Greater than 85 dBA	3

The number of sensitive receivers outside of the HTP corridor that would experience the predicted LAmax noise from helicopter flights within the HTP corridor is expected to vary from 3 receivers experiencing noise levels greater than 85 dBA to 18 receivers experiencing noise levels between 60 dBA and 65 dBA. The proposed mitigation measures to minimise and manage the predicted impacts are discussed in **Section 6.0**

5.1.9 Construction road traffic noise impacts

The construction traffic volumes have been compared to the existing traffic volumes on all proposed construction traffic routes. The construction traffic volumes and worst-case potential noise increase are shown **Attachment D**. A summary of the results is shown in **Table 5-16**.

Table 5-16 Summary of construction road traffic noise

Road / Access Route	> 2.0 dB increase	Approximate offset distance (m) to comply with RNP Criteria
Freeway, arterial, sub arterial roads		
Freemans Dr east of Mount Faulk Road, Cooranbong	Yes	60
Wollombi Road west of Middle Road, Pelton	Yes	28
Broke Road south of Bulga Surface Operations access road, Mount Thorley	Yes	25
Cessnock Road east of Oakley Lane, Singleton Military Area	Yes	22
Freemans Drive south of Martinsville Road, Martinsville	No	n/a
Martinsville Road east of Pringles Road, Martinsville	Yes	19
New England Highway west of Lemington Road, Ravensworth	No	n/a
Golden Highway east of Gouldsville Road, Gouldsville	No	n/a
Local Roads		
Watagan Road, Martinsville	Yes	218
AGL Bayswater Power Station site access – west of New England Highway	No	n/a
Lemington Road, Howick	Yes	318
Hayes Road (Tower 20 to 50 access route) – sealed road section	Yes	176
Hayes Road (Tower 20 to 50 access route) – unsealed road section	Yes	883

Road / Access Route	> 2.0 dB increase	Approximate offset distance (m) to comply with RNP Criteria
Mount View Road and Mt Baker Road (Tower 53 to 59 access route) – sealed road section	Yes	110
Mt Baker Road (Tower 53 to 59 access route) – unsealed road section	Yes	551
Pokolbin Mt Rd (Tower 60 to 72 access route) – sealed road section	Yes	176
Pokolbin Mt Rd (Tower 60 to 72 access route) – unsealed road section	Yes	883
Archerfield Rd - (Tower 142 to 162 access route) – sealed road section	Yes	176
Archerfield Rd - (Tower 142 to 162 access route) – unsealed road section	Yes	883
Pikes Gully Rd - (Tower 183 to 204 and OHEW access route)	Yes	110

The construction road traffic noise impact assessment shows:

- on major roads such as the New England Highway, Golden Highway and Freemans Drive near Cooranbong, construction traffic would not increase existing road traffic noise levels by more than 2 dB
- construction traffic on arterial roads would likely result in a noticeable increase in noise levels (>2 dB) due to low existing traffic volumes on these roads. However, compliance with the RNP criteria is predicted for all arterial / sub arterial roads at offset distances greater than 60 m from the roadway
- construction traffic would likely result in a noticeable increase in noise levels (>2 dB) on all local roads with the exception of the AGL Bayswater Power Station site access road, due to low existing traffic volumes on these roads compared to the proposed construction traffic volume.

The construction road traffic noise impact assessment is based on the peak construction workforce mobilising on each route, therefore it represents worst-case scenario. The peak construction workforce is predicted to occur in 2028. There would be times during construction when less vehicle movements are required, resulting in reduced road traffic noise impacts.

The proposed mitigation measures to minimise and manage the predicted impacts are discussed in **Section 6.0**.

5.1.10 Construction vibration impacts

5.1.10.1 Residential receivers

Minimum working distances for the vibration intensive equipment required to complete the work while remaining below vibration levels for cosmetic damage and human comfort (see **Section 3.10**) are provided in **Table 3-12**. The number of receivers that would be within the minimum working distances of 3-5 tonne and 8-10 tonne vibratory rollers are shown in **Table 5-17**. The construction vibration impacts from the project and location of potentially impacted receivers are shown in **Attachment H.1** and **Attachment H.2.**

Table 5-17 Overview of vibration impacts

Works area	Number of receivers within recommended working distance[1]	
	Cosmetic damage	Human comfort
Construction support sites, substations, laydown sites and HTP corridor	4 (3 receivers within the project impact area)	19
Access tracks and intersection upgrades	6	39
Note 1: Based on worst-case use of a 3-5 tonne or 8-10 tonne vibratory roller as relevant.		

The above assessment shows:

- a total of 10 receivers closest to construction areas would be within the minimum working distance for cosmetic damage, however 3 of these receivers would be within the project impact area.
- a total of 58 receivers would be within the human comfort minimum working distance.

These predictions represent a worst-case situation where a 3-5 tonne or 8-10 tonne vibratory roller were relevant is in use at the boundary of the project impact area.

The use of a 2-4 tonne vibratory roller in place of the larger vibratory rollers proposed would result in a reduction of impacted receivers within the cosmetic damage minimum working distances to 4, with 3 located within the project impact area. The number of residential receivers within the minimum working distance for human comfort would be reduced to 17.

The proposed mitigation measures to minimise and manage the predicted impacts are discussed in **Section 6.0**.

5.1.10.2 Heritage items

Heritage buildings and structures should be considered on a case-by-case basis but as noted in BS 7385, should not be assumed to be more sensitive to vibration, unless structurally unsound. An assessment of vibration impacts on heritage items based on the use of 3-5 tonne and 8-10 tonne vibratory rollers and the assessment is summarised in **Table 5-18**.

Table 5-18 Vibration impacts to heritage items

Item Name	Location	Distance to nearest structure[1]	Vibration impact and discussion
Oakley Estate	Singleton Military Area	45 m	Outside of minimum safe working distance for heritage item
Warringah Stud/Old Myrtle	Singleton Military Area	65 m	Outside of minimum safe working distance for heritage item
Catholic Church and Cemetery	Martinsville Rd, Cooranbong	20 m	Adjacent to intersection works. If deemed structurally unsound a 2-4 tonne vibratory roller would need to be used rather than the up to 5 tonne roller proposed when within 25 m of the structure. The up to 5 tonne roller can be used if deemed structurally sound.
Former Union Church	Martinsville Road, Martinsville	35 m	Outside of minimum safe working distance for heritage item

Item Name	Location	Distance to nearest structure[1]	Vibration impact and discussion
Millfield General Cemetery	Crump St, Millfield	45 m	Outside of minimum safe working distance for heritage item
Bellevue Vineyard and Winery	Oakey Creek Rd, Pokolbin	68 m	Outside of minimum safe working distance for heritage item
Archerfield and outbuildings	Off Comleroi Rd, Warkworth	70 m	Outside of minimum safe working distance for heritage item
Note 1: Approximate minimum horizontal distance from the project impact area to the nearest structure of the heritage listed item.			

All heritage items would be located outside of the safe working distance for structurally unsound heritage items, with the exception of the Catholic Church and Cemetery.

The proposed mitigation measures to minimise and manage the predicted impacts are discussed in **Section 6.0**.

5.1.10.3 High pressure gas pipeline

Minor access track upgrades are predicted to occur within 25 m of the Newcastle – Sydney high pressure gas pipeline. The use of a 3 tonne to 5 tonne vibratory roller is predicted to result in PPV vibration levels of less than 3 mm/s at the pipe location. This is well below the 20 mm/s limit, and as such vibration intensive works are not predicted to impact the buried pipeline.

5.1.10.4 Aboriginal objects

A total of 39 Aboriginal objects are within the adopted minimum 10 m safe working distance for Aboriginal heritage items. Of these, 21 are within the project impact area. The construction vibration impacts from the project on Aboriginal items are shown in **Attachment H.3**. It is noted that the Aboriginal heritage items are diverse in nature and not all may be particularly sensitive to vibration. Direct and indirect impacts to all identified Aboriginal objects and sites of high significance and their immediate environment (≥55 m) within the project impact area will be avoided. Appropriate criterion for these items can be revised based on performance outcomes and field observations of the heritage item condition. Refer to *Technical Report 2 - Aboriginal heritage impact assessment* for further detail.

The proposed mitigation measures to minimise and manage the predicted potential impacts on aboriginal heritage items are discussed in **Section 6.0**.

5.1.11 Cumulative construction noise impacts

It is noted the ICNG does not include provisions for the cumulative assessment of construction noise from different projects. Notwithstanding, a qualitative assessment of potential cumulative construction noise from other major projects in the study has been conducted in **Table 5-19**.

Table 5-19 Potential cumulative construction impacts

Major Project	Potential cumulative noise construction impacts
New England REZ Transmission Project	Construction of the Stage 1 New England REZ Transmission Project (consisting of transmission line and associated infrastructure from Bayswater Power Station) has the potential to coincide with construction of

Major Project	Potential cumulative noise construction impacts
	the project. Should construction of the two projects coincide, cumulative construction noise impacts would be limited to receivers north of Lake Liddell in NCA01. This would be minimal given the significant distance between Bayswater Power Station and the associated project access tracks.
Liddell Future Land Use and Enabling Works and Liddell Battery and Bayswater Ancillary Works	The noise impact assessment for the Liddell Battery and Bayswater Ancillary Works project indicates that construction noise levels at the nearest receivers in NCA01 would be in the order of 26 dBA to 33 dBA. Given the relatively low level of predicted construction noise, potential cumulative noise impacts are likely to be minimal.
Bayswater Power Station Upgrade	Should construction of the two projects coincide, cumulative construction noise impacts would be limited to receivers north of Lake Liddell in NCA01. The impacts would be minimal given the significant distance between Bayswater Power Station and associated project access tracks.
Hunter Valley Operations continuation projects (HVO North Open Cut Coal Continuation Project and HVO South Open Cut Coal Continuation Project)	HVO Phase 1 construction activities such as the relocation of Lemington Road, transmission line relocations and other associated mine infrastructure works may coincide with construction of access tracks, construction support sites and the HTP corridor in NCA01, NCA02, NCA03, NCA04 and NCA05. HVO Phase 1 construction activities are not expected to coincide with construction works in NCA01, NCA02 and NCA03. Based on the results shown in *Hunter Valley Operations Continuation Project - Noise Impact Assessment* report number H1904008-1 dated 27 October 2022 prepared by EMM Pty Ltd, HVO construction works are expected to result in minor exceedances in the order of 4 dB to 11 dB above the NMLs for some receivers in NCA04 and NCA05. If HTP construction works are expected to coincide with HVO construction works in the vicinity of receivers in NCA04 and NCA05, additional assessment (including development of reasonable and feasible mitigation and management controls) would need to be undertaken.
Maison Dieu Solar Farm	Construction activities from the Maison Dieu Solar farm provided in *Noise and Vibration Impact Assessment – Maison Dieu Solar Farm* document number MAC221674-01RP1V6 dated 9 May 2024 prepared by Muller Acoustic Consulting Pty Ltd are predicted to be up to 59 dBA, exceeding NMLs by up to 14 dB at receivers in NCA04. HTP construction noise levels are predicted to be up to approximately 45 dBA at the same location, which has the potential to result in cumulative construction noise levels of 45 dBA to 59 dBA if construction works coincide. If HTP construction works are expected to coincide with Maison Dieu construction works in the vicinity of receivers in NCA04, additional assessment (including development of reasonable and feasible mitigation and management controls) would need to be undertaken.
Wollombi Road Upgrades	Wollombi Road Upgrades construction works in the vicinity of Wollombi Road and Mount View Road are predicted to be in the order of 71 dBA to 82 dBA, resulting in highly noise affected receivers. Exceedances of the NML from HTP construction activities are predicted to exceed NMLs by 1 to 10 dB and as such would not lead to significant cumulative impacts.
Hunter-Central Coast REZ Transmission Line	From the information contained within *Environmental Noise Impact Assessment Hunter Renewable Energy zone (REZ) Project – Kurri Kurri STSS, Sandy Creek STSS & Antiene STSS* document number R\8002-1.1R dated 28 April 2025 prepared by Day Design Pty Ltd for the Hunter-Central Coast REZ Transmission Line project noise from construction of the transmission liens and associated infrastructure may coincide with the project in NCA02 to NCA05. If HTP construction works are expected to

Major Project	Potential cumulative noise construction impacts
	coincide with Hunter-Central Coast REZ Transmission Line construction works in the vicinity of receivers in NCA02 and NCA05, additional assessment (including development of reasonable and feasible mitigation and management controls) would need to be undertaken.
Eraring Battery Energy Storage System	From the information contained within *Eraring Power Station Battery Energy Storage System Noise Impact Assessment Report* document number S36580_NIA dated 14 October 2021 prepared by Jacobs Pty Ltd for the Eraring Battery Energy Storage System project, construction works associated with the Eraring Battery Energy Storage System are predicted to exceed the relevant NMLs in NCA13 and NCA14 by a minor 1 dB to 2 dB. Should HTP construction works coincide with the construction of the Eraring Battery Energy Storage System, cumulative noise impacts are not expected to be significant.

5.2 Operational noise impacts

5.2.1 Residential receiver project noise trigger levels

The Project Noise Trigger Levels (PNTLs) for operational industrial noise from the project at residential receivers are summarised in **Table 5-20** and are based on the background noise levels provided in **Table 4-2**. The PNTL is the most stringent of the intrusive and amenity trigger level for each period and is shaded green.

Table 5-20 Project Noise Trigger Levels

NCA or receiver type	Period	Noise Level (dBA)				
		Recommended Amenity Noise Level (L_{Aeq})	Measured Noise Level		Project Noise Trigger Level $L_{Aeq(15minute)}$	
			RBL[1]	$L_{Aeq(period)}$	Intrusive[3]	Amenity[4,5]
NCA01	Day	55	37	-	**42**	53
	Evening	45	36	-	**41**	43
	Night	40	36	-	41	**38**
NCA03	Day	50	36	-	**41**	48
	Evening	45	33	-	**38**	43
	Night	40	32	-	**37**	38
NCA04	Day	50	35[2]	-	**40**	48
	Evening	45	31	-	**36**	43
	Night	40	31	-	**36**	38
NCA05	Day	50	38	65	**43**	48
	Evening	45	35	51	**40**	43
	Night	40	33	48	**38**	38
NCA09	Day	50	35[2]	55	**40**	48
	Evening	45	34	44	**39**	43
	Night	40	33	45	**38**	38

NCA or receiver type	Period	Noise Level (dBA)				
		Recommended Amenity Noise Level (L_{Aeq})	Measured Noise Level		Project Noise Trigger Level $L_{Aeq(15minute)}$	
			RBL[1]	$L_{Aeq(period)}$	Intrusive[3]	Amenity[4,5]
NCA11	Day	50	35[2]	53	**40**	48
	Evening	45	32	61	**37**	43
	Night	40	30	52	**35**	38
NCA12	Day	55	37	47	**42**	53
	Evening	45	35	41	**40**	43
	Night	40	31	43	**36**	38
NCA13	Day	60	43	56	**48**	58
	Evening	50	43	57	**48**	48
	Night	45	42	51	47	**43**
NCA14	Day	55	35	49	**40**	53
	Evening	45	35	44	**40**	43
	Night	40	35	43	40	**38**
All other NCAs (NCA02, NCA06, NCA08)	Day	50	35[2]	-	**40**	48
	Evening	45	30[2]	-	**35**	43
	Night	40	30[2]	-	**35**	38

Note 1: RBL = Rating Background Level. See Table 4-2

Note 2: The NPfI minimum RBL values have been used due to the measured RBLs being equal or lower than the minimum values.

Note 3: The intrusive PNTL is the RBL + 5 dB

Note 4: The recommended amenity noise levels have been reduced by 5 dB due to other sources of industrial noise being present, or potentially present in the area in the future, in accordance with the NPfI.

Note 5: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.

5.2.2 Operational noise impacts from transmission lines

Operational noise from the operation of high voltage transmission lines (also referred to as audible noise) is primarily attributed to the ionisation of air in a small region around the conductors. The electrical discharge from the conductors, known as corona discharge, causes the small surrounding region to become conductive, resulting in the emission of a broadband hum or crackling noise.

Under fair weather conditions (**Section 4.2.4**), noise levels are predicted to be under 35 dBA at the edge of the HTP corridor and as such would be compliant at all receivers. The operational noise impacts from the transmission lines under worst-case scenario i.e. L50 conditions (light rain or mist) have been assessed based on predicted noise levels following interpolation of the transmission line noise curve presented in the audible noise report (**Attachment E**). Predictions have been compared against the night-time PNTL as this is the most stringent operational criteria in all NCAs. The number of receivers with exceedance of the night-time PNTL in each relevant NCA across the length of the HTP corridor is presented in **Table 5-21** and shown in **Attachment I**.

Table 5-21 Transmission line operational noise assessment

Transmission line	Number of residential receivers with night-time exceedance		
	≤ 2 dB	≥ 3 but ≤ 5 dB	> 5 dB
NCA01	-	-	-
NCA02	-	-	-
NCA03	-	3	1
NCA04	1	3	1
NCA05	1	-	-
NCA06	-	-	-
NCA07	-	-	-
NCA08	-	-	-
NCA09	-	-	-
NCA11	-	-	-

Note 1: Predicted level is ≤ 2 dB above the PNTL
Note 2: Predicted level is ≥ 3 but ≤ 5 dB above the PNTL
Note 3: Predicted level is > 5 dB above the PNTL

The above assessment shows that during L50 conditions (light rain or mist), which is expected to be the infrequently occurring worst-case condition for audible noise impacts, 10 of the residential receivers closest to the HTP corridor are predicted to experience noise levels from the transmission lines exceeding the most stringent night-time PNTL.

No other noise sensitive receivers are predicted to have transmission line noise levels above the relevant PNTLs.

5.2.3 Significance of residual impacts

The NPfI defines residual noise impacts where noise from a development remains above the PNTLs after all feasible and reasonable source and pathway noise mitigation have been considered.

Given the transmission lines (and hence the noise source) would be significantly elevated above the ground, noise barriers and other pathway noise mitigation measures would provide limited benefit in reducing noise levels at potentially impacted receivers. **Table 5-22** summarises the NPfI guidance on the significance of residual noise impacts and examples of potential receiver-based treatments.

Table 5-22 NPfI significance of residual noise impacts and treatment examples

Predicted exceedance of PNTL	Predicted level relative to the amenity noise level	Significance	Example of potential treatment
≤ 2 dBA	-	Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.

Predicted exceedance of PNTL	Predicted level relative to the amenity noise level	Significance	Example of potential treatment
≥ 3 but ≤ 5 dBA	Less than the recommended amenity noise level or greater than the recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1 dB.	Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
≥ 3 but ≤ 5 dBA	Greater than recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB.	Moderate	As for 'marginal', but also upgraded facade elements, such as windows, doors or roof insulation, to further increase the ability of the building facade to reduce noise levels.
> 5 dBA	Less than or equal to the recommended amenity noise level.		
> 5 dBA	Greater than the recommended amenity noise level.	Significant	May include suitable commercial agreements where considered feasible and reasonable.
Note 1: Reproduced from NPfI Table 4.1 and Table 4.2.			

The residential receivers identified to have potential transmission line operational noise exceedances are summarised in the NPfI significance categories in **Table 5-23.**

Table 5-23 Significance of potential residual transmission line operational noise impacts

Transmission line scenario	Number of residential receivers with potential night-time impacts of significance[1]			
	Negligible	Marginal	Moderate	Significant
L50 (light rain or mist)	2	-	6	2
Note 1: Potential impact significance based on the NPfI categories as outlined in **Table 5-22**.				

The above assessment shows during light rain or mist L50 conditions (which is expected to be the worst-case condition for audible noise impacts) the significance of the noise impact is:

- considered to be 'significant' at 2 residential receivers
- considered to be 'moderate' at 6 residential receivers
- considered to be 'negligible' at 2 residential receivers.

It is noted that 1 of the potentially significantly impacted residential receivers would be within the HTP corridor. Additionally, this assessment is based on the horizontal distance between the HTP corridor and sensitive receivers and does not consider intervening terrain and sound propagation factors that are expected to reduce the noise levels at greater distances from the transmission line. Hence the significance of the impacts summarised in **Table 5-23** should be regarded as indicative and is expected to be reduced when further detailed design of the transmission line is undertaken.

The proposed mitigation measures to minimise and manage the potential noise impacts are discussed in **Section 6.0**.

5.2.4 Operational noise impacts from switching stations

Predicted maximum noise levels from the operation of the Olney switching station are below 35 dBA L_{Amax} under noise enhancing meteorological conditions at all residential receivers. This is significantly below the sleep disturbance noise criteria of 52 dBA and as such operation of the switching stations are not predicted to cause sleep disturbances at any residential receiver. Given that the operational impacts from the operation of the switching station during the more stringent night-time period is not predicted to cause impact at any residential receiver, impacts at other periods (i.e the daytime and evening) are also not predicted to occur.

Operational noise from the Bayswater South switching station under noise enhancing meteorological conditions is predicted to be less than 30 dBA $L_{Aeq(15minute)}$ at the nearest residential receivers off Hebden Road and Edderton Road. This is significantly below the relevant PNTLs of 38 dBA for NCA1 and 35 dBA for NCA2.

5.2.5 Operational noise impacts from Eraring substation

The assessment assumes that all noise generating equipment operates in a continuous steady state nature on a 24/7 basis. All noise sources are modelled at a height of two metres above ground level.

Operational noise from the existing Eraring substation including the augmentation and modification of the substation for the project was assessed under noise enhancing meteorological conditions. At the nearest residential receivers in NCA14 off Gradwells Road and Border Street, the noise level is predicted to be up to 37 dBA. This is below the most stringent night-time PNTL for NCA14 of 38 dBA. Notwithstanding, predicted compliance with the PNTLs proposed mitigation measures with a view to minimising potential noise impacts from the operation of the Eraring substation are discussed in **Section 6.1.2**.

6.0 Management

6.1 Noise mitigation and management overview

Potential noise and vibration impacts have been identified in the construction and operational impact assessments in **Section 5.1** and **Section 5.2** respectively. Where exceedances are identified, reasonable and feasible mitigation measures would be used to manage potential impacts. This report recommends in-principle mitigation measures and where further assessment would be undertaken.

6.1.1 Construction noise mitigation overview

The NMLs and safe working distances identified in this report have been applied to determine where measures for the control of potential construction noise and vibration impacts are required. The project should apply all feasible and reasonable work practices to meet the NMLs, where possible, and inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels, duration of noise and vibration generating construction work, and contact details during construction.

Specific construction mitigation measures recommended for the project are listed in **Section 6.2**.

6.1.2 Operational noise mitigation overview

The typical hierarchy for mitigation and management of industrial noise sources is as follows:

- reducing noise emissions at the source (ie noise source control)
- reducing noise in transmission to the receiver (ie noise path control)
- reducing noise at the receiver (ie at-receiver control).

Specific operational mitigation measures recommended for the project are listed in **Section 6.2**.

6.2 Specific mitigation and management measures

Mitigation measures proposed to avoid or minimise impacts to noise during construction and operation of the project are listed in **Table** 6-1. These measures would be included in the construction NVMP and operational management plans for the project.

Table 6-1 Proposed mitigation measures – noise

ID No.	Issue	Mitigation measure	Timing	Applicable location(s)
Construction noise and vibration				
NV1	General noise and vibration	A Construction Noise and Vibration Management Plan (CNVMP) will be prepared to provide the framework and mechanisms for the management and mitigation of all potential noise and vibration construction impacts from the project. The CNVMP will include: • confirmation of nearby sensitive receivers • confirmation of work, construction equipment and hours of work would be completed and quantify resulting impacts at sensitive receivers. • criteria for the project and approval conditions • procedures and mitigation measures for potential impacts during out-of-hours work • requirements for noise and vibration monitoring • details of how community consultation in relation to noise and vibration would be completed • procedures for handling complaints • details on how respite would be applied where ongoing high impacts are expected at certain receivers.	Detailed design Construction	Project impact area and sensitive receivers
NV2	Prolonged construction noise impact from fixed work areas	Noise path control, such as hoarding or earth bunds, will be investigated and implemented where required. Positioning of site structures will be considered to act as barriers between noisy work and receivers where practical.	Detailed design Construction	Construction support sites, laydown areas, substations and switching stations where receivers are predicted to be noise

ID No.	Issue	Mitigation measure	Timing	Applicable location(s)
				affected and near fixed work areas with long work durations
NV3	Out of hours construction works	An out of hours (OOH) work protocol that details how the project will identify, assess and approve out of hours work outside standard construction hours will be developed and implemented. The protocol will include provisions to: • carry out additional assessments for work proposed outside standard construction hours, to confirm noise levels at potentially affected sensitive receivers and determine suitable mitigation measures to minimise noise levels • notify and engage with potentially noise affected receivers about upcoming work outside standard construction hours and address any associated complaints • identify appropriate respite for noise affected receivers (where required).	Detailed design Construction	Stringing transmission lines across main roads (M1 Pacific Motorway, Wollombi Road, Cessnock Road, Putty Road) Other works that may need to be conducted out of standard construction hours
NV4	Construction noise impacts	Where construction is likely to result in exceedances of NMLs at sensitive receivers, mitigation and management measures will be implemented where practicable and appropriate. This will include (but is not limited to) the following measures: • select quieter plant and equipment and use alternative construction methods to minimise noise levels • plan and schedule concurrent noisy activities to minimise the number of items of noisy plant operating at one time and cumulative noise levels • install screens or use barriers to mitigate noise from stationary noise sources • maximise the offset distance between noisy plant and sensitive receivers • orient noisy plant and equipment away from sensitive receivers • use noise source controls, such as residential class mufflers, to reduce noise from all regularly used plant including cranes, excavators and trucks • use non-tonal reversing alarms in place of traditional beeper reversing	Construction	Project impact area

ID No.	Issue	Mitigation measure	Timing	Applicable location(s)
		alarms during OOH where noise impacts are predicted • turn off machinery when not in use • confirm equipment is maintained in accordance with manufacture's requirements to minimise generation of excessive noise • operate machinery in a manner which reduces occurrence of maximum noise level events, such as excavator bucket impacts, material drop heights, steel on steel impacts and dragging materials across hard surfaces • provide awareness training regarding noise mitigation measures to be implemented as part of regular toolbox meetings • notify and consult with potentially noise affected receivers about upcoming noisy activities • confirm that noise affected receivers outside standard construction hours and highly noise affected sensitive receivers are managed with consideration to the CNVG additional mitigation measures such as notifications, verification, and respite where appropriate.		
NV5	Construction noise validation	Monitoring will be carried out at representative locations during noise intensive activities that have the potential to cause noise exceedances at sensitive receivers, to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures have been implemented.	Construction	Project impact area
NV6	Noise levels from construction traffic	All construction vehicle movements will adhere to the following measures: • out-of-hours vehicle movements will be minimised where possible • construction delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible • use of engine compression brakes will be avoided at night and in residential areas • site access points and access tracks will be located as far as practical away from sensitive receivers	Construction	Public roads and access tracks

ID No.	Issue	Mitigation measure	Timing	Applicable location(s)
		• traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements • construction inductions will include driver behaviour requirements to minimise vehicle noise emissions.		
NV7	Vibration	Where vibration intensive work is required within the recommended minimum working distances and is considered likely to exceed the cosmetic damage criteria: • different construction methods with lower source vibration levels will be investigated and implemented, where feasible • confirm any vibration-sensitive heritage structures that could be impacted by the proposed works including confirming the structural integrity of the structure and applying appropriate vibration criteria • vibration monitoring will be undertaken at the start of work to determine actual vibration levels at the receiver • work will be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria. • direct and indirect impacts to all identified aboriginal objects and sites of high significance and their immediate environment (≥55 metres) within the project impact area will be avoided.	Construction	Project impact area
NV8	Construction aircraft noise	Management measures will be implemented to minimise aircraft noise at sensitive receivers where practicable and appropriate, including: • notifying nearby sensitive receivers of upcoming work involving aircraft. This will include use of helipads within construction support sites, flight paths outside of the project impact area and stringing or other work within the HTP corridor. Notification will include scheduled dates, locations, indicative hours and a description of the proposed work. • prioritising use of helipad locations at the construction support sites with the maximum distance offset from	Construction	HTP corridor and construction support sites.

ID No.	Issue	Mitigation measure	Timing	Applicable location(s)
		sensitive receivers (Hebden Road and Pikes Gully support sites). • varying flight paths between helipads and the HTP corridor to avoid repeated helicopter noise at sensitive receivers. • operating aircraft in accordance with Airservices Australia *Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise* (2002) and the Helicopter Association International (HAI) Fly Neighbourly Guide.		
Operational noise				
NV9	Operational transmission line noise	Operational transmission line noise impacts will be reviewed during detailed design, once the transmission line placement, conductor arrangement and any property acquisitions are known. For each residence where potential operational noise levels are predicted to exceed the PNTL, noise monitoring to confirm actual operational noise levels will be carried out at representative locations following commencement of project operation. The noise monitoring will occur during representative L50 weather/atmospheric conditions conducive to generating noise from corona discharge. For residences where the monitoring identifies corona discharge levels above PNTLs, consultation will be undertaken with the landowner of the affected residence to identify solutions. Once the appropriate solutions have been agreed with the landowner, these will be implemented as soon as reasonably practical.	Operation	Transmission line (HTP corridor)
NV 10	Operational switching station and substation noise	Operational switching station and substation noise impacts will be reviewed during detailed design. The design will consider the following measures with a view to minimising noise impacts: • selection of equipment with consideration of operating sound power levels where feasible • incorporation of transformer and reactor barriers where reasonable and feasible.	Detailed design and operation	Bayswater South and Olney switching stations Eraring substation

7.0 Conclusion

This report has been prepared to address the project Secretary's environmental assessment requirements in relation to the assessment of noise and vibration impacts of the project. The report describes the existing noise environment surrounding the project and outlines the methodology and assessment of impacts from the construction and operation of the project. The assessment provides a conservative assessment of noise levels and where impacts are predicted, appropriate mitigation measures have been recommended to mitigate and manage the potential impacts.

7.1 Construction

The project involves the construction of a new overhead 500 kilovolt (kV) transmission line of around 110 kilometres connecting the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring in the Hunter region of New South Wales (NSW).

Representative work scenarios detailing typical plant and equipment have been developed to assess the potential construction noise impacts of the project. The assessment identifies noise impacts during daytime and out of hours periods, as required. Impacts are also identified at various 'other sensitive' receivers in the study area, including commercial, educational, medical and place of worship receivers.

The assessment has predicted construction noise impacts from potential construction support sites, laydown sites, as well as upgraded intersections and access tracks.

Transmission line construction within the HTP corridor is generally predicted to have high noise impacts, but the impacts are only expected when work is at the transmission line structures closest to each receiver and would be relatively short-term.

Where construction activities are in proximity to sensitive receivers, potential noise impacts range from negligible to clearly audible with some of the closest receivers having highly intrusive impacts or classified as being highly noise affected during the highest impact work such as earthworks during site establishment and when transmission line construction is closest to each receiver.

Construction road traffic noise has been assessed and compared to the existing traffic on all proposed routes to be used for access between the construction support sites, temporary worker accommodation, laydown areas, the transmission line corridor and switching stations to determine the relative increase and total road traffic noise levels. Notable increases in road traffic noise (ie greater than 2.0 dB) are predicted on some arterial roads and all local roads with low existing traffic volumes.

The predicted helicopter noise from arrivals and departures at potential helipads show that high L_{Amax} noise levels are predicted at residential receivers close to the potential helipad in the Freemans Drive construction support site. The predicted helicopter arrival and departure noise levels also show that the potential Hebden Road, Pikes Gully Road and Gouldsville Road construction support helipad locations would be unlikely to cause any significant impacts to the noise amenity of surrounding sensitive receivers due to sensitive receivers being sufficiently distant. Where helipads are required close to sensitive receivers, the potential for noise impacts can be minimised by planning arrival and departure paths to avoid sensitive receivers where possible.

Helicopter flights outside of the project impact area are considered unlikely to cause significant annoyance or impact the noise amenity of sensitive receivers due the relatively height, duration and frequency of these flight paths.

Construction vibration has been assessed based on the vibration intensive equipment identified in the construction scenarios, including hydraulic hammers and vibratory rollers. The recommended minimum working distances for human comfort and cosmetic damage have been considered. 58 receivers are located within the recommended working distance of the project for human comfort with a further 10 receivers within the minimum working distance for cosmetic damage.

All heritage buildings and structures are outside of the recommended minimum safe distance, with the exception of the Catholic Church and Cemetery located off Martinsville Road in Cooranbong.

The project would apply all feasible and reasonable mitigation to reduce the potential construction impacts, considering potential cumulative construction impacts should they be likely to occur. Best practice measures have been recommended in this report. Specific strategies would be determined as the project progresses and a NVMP is developed.

7.2 Operational

Operational noise has been assessed at the proposed switching stations and Eraring substation, with noise levels predicted to comply with the relevant noise criteria at all receivers.

Audible noise from the operation of the transmission lines has been assessed. The assessment has considered the effect of weather conditions on audible noise emission, with up to 10 receivers expected to potentially experience audible noise impacts above the relevant most stringent night-time criteria during light rain, misty conditions when increased noise emissions can occur.

Operational transmission line noise impacts will continue to be considered as the project progresses and confirmed with noise monitoring post construction. Due to the limited path control and source control, individual receiver agreements are expected to be the most feasible and reasonable mitigation option where operational noise impacts remain.

8.0 References

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Attachment A Acoustic terminology

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

14 July 2025

1. Sound Level or Noise Level

The terms ‘sound’ and ‘noise’ are almost interchangeable, except that ‘noise’ often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. the human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. the decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

the symbols SPL, L or LP are commonly used to represent Sound Pressure Level. the symbol LA represents A-weighted Sound Pressure Level. the standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. ‘A’ Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an ‘A-weighting’ filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. the table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private Office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as ‘linear’, and the units are expressed as dB(lin) or dB.

3. Sound Power Level

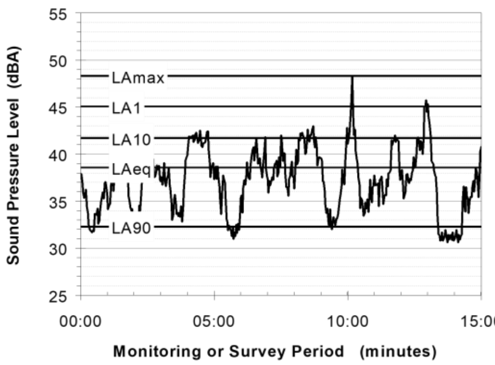
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

the relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. for example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

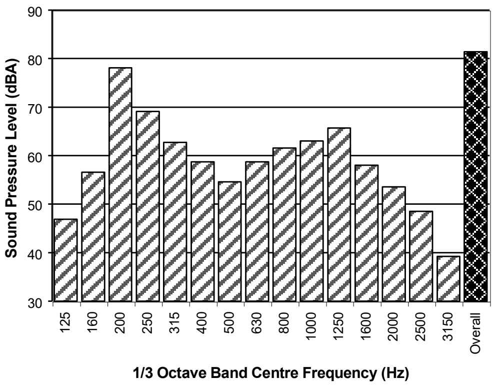
The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)

Narrow band (where the spectrum is divided into 400 or more bands of equal width)

the following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than ‘broad band’ noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and Off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of ‘peak’ velocity or ‘rms’ velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as ‘peak particle velocity’, or PPV. The latter incorporates ‘root mean squared’ averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

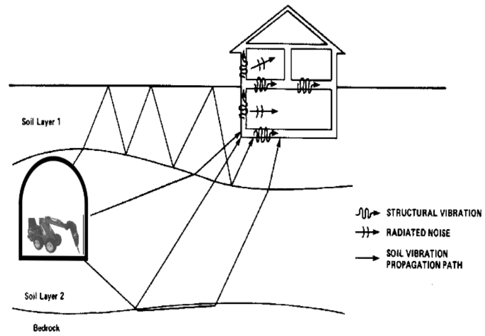
People are able to ‘feel’ vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as ‘normal’ in a car, bus or train is considerably higher than what is perceived as ‘normal’ in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed ‘structure-borne noise’, ‘ground-borne noise’ or ‘regenerated noise’. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term ‘regenerated noise’ is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Attachment B Project and sensitive receiver map

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

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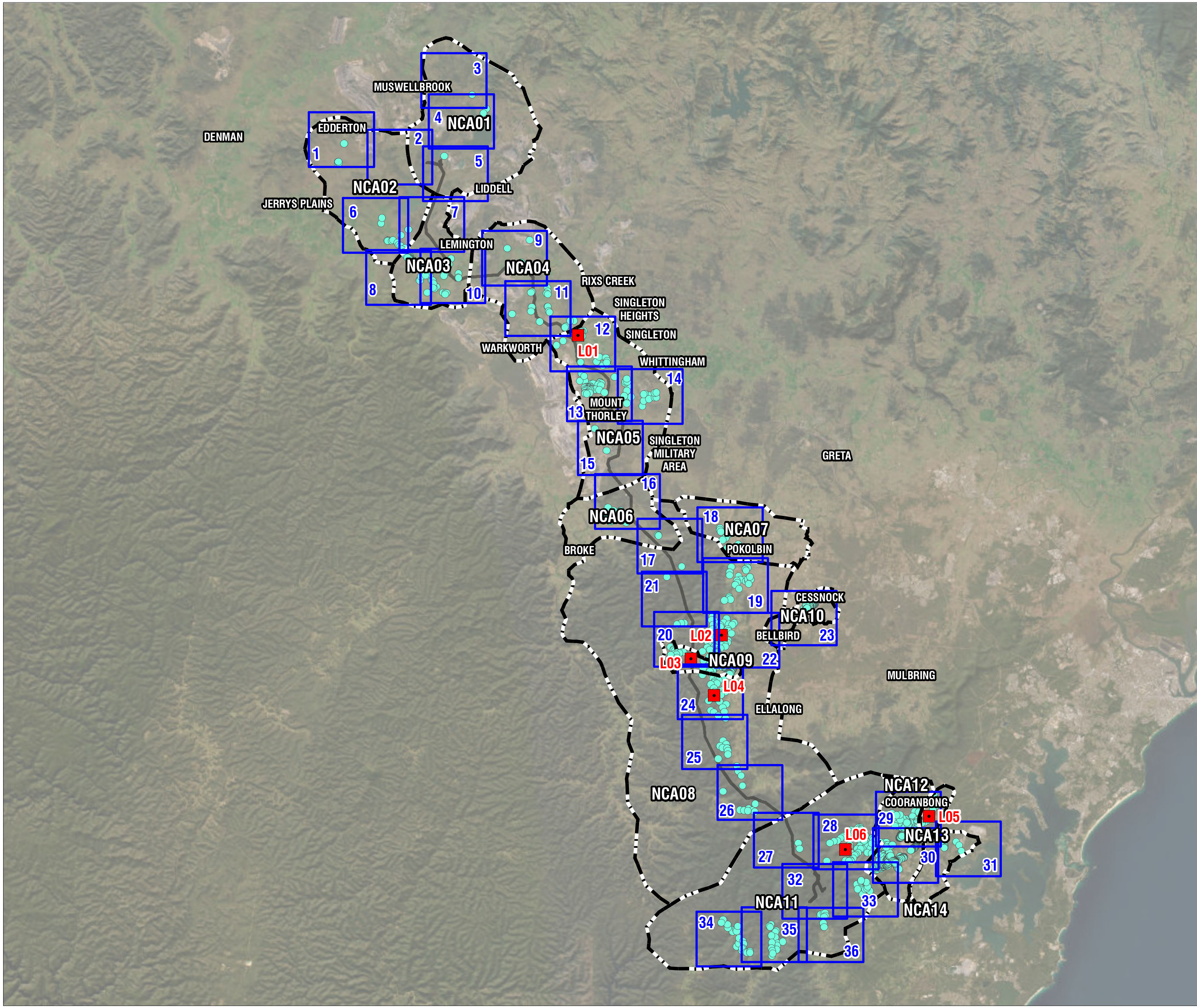


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND

- Mapsheet and mapsheet number
- NCA boundary
- Noise monitoring location
- Sensitive receiver

0 5 10 km

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:550,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

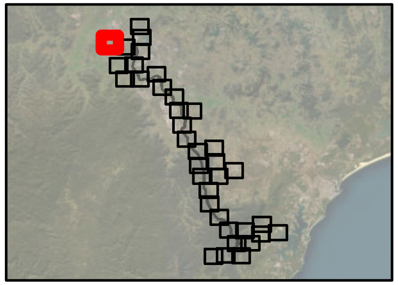
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Sensitive Receivers

- Residential



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Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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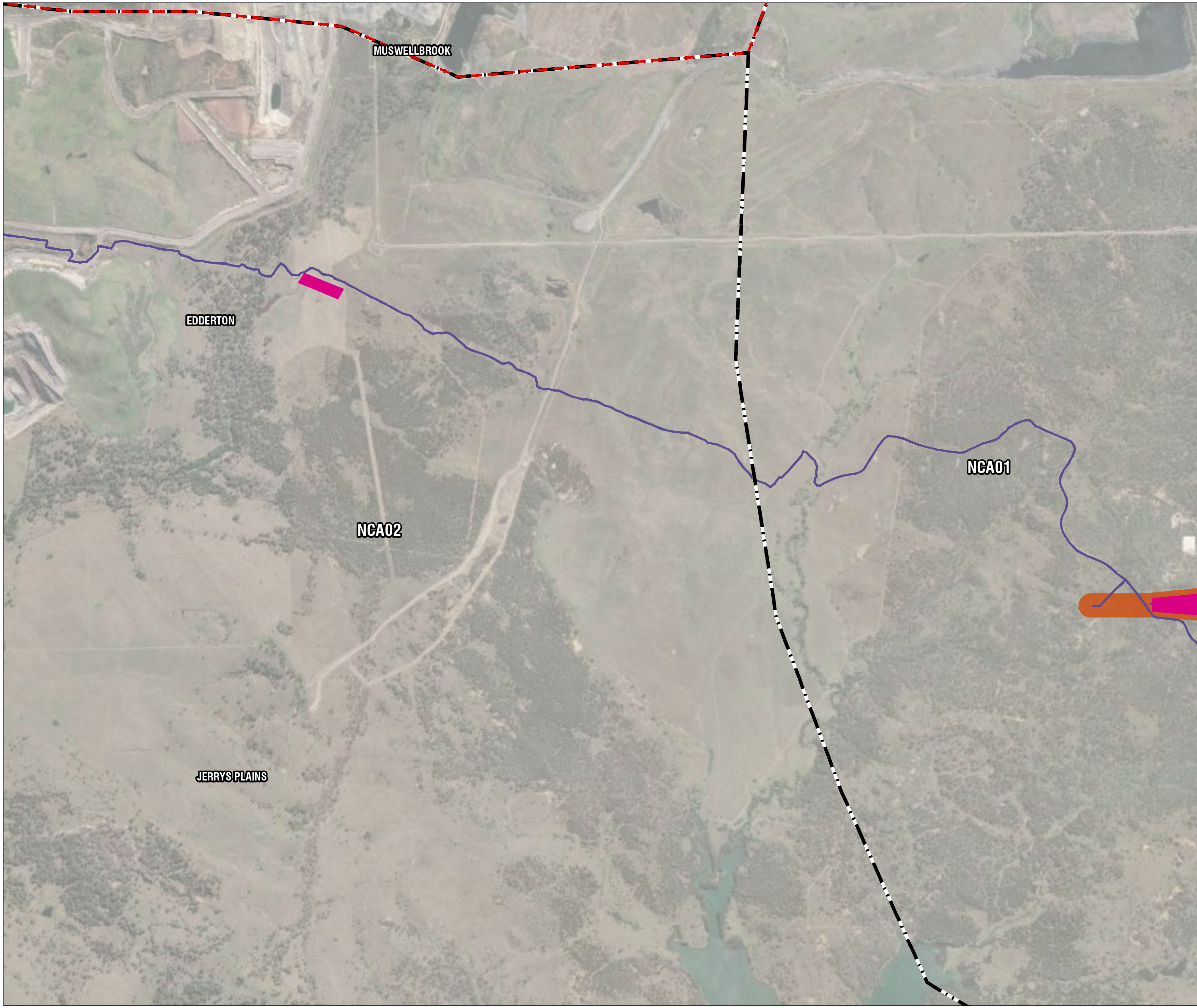


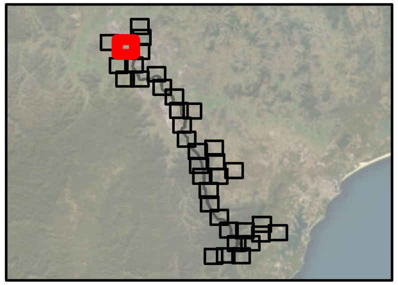
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Stringing station



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Date:	10-Jul-2025
Drawn by:	LF

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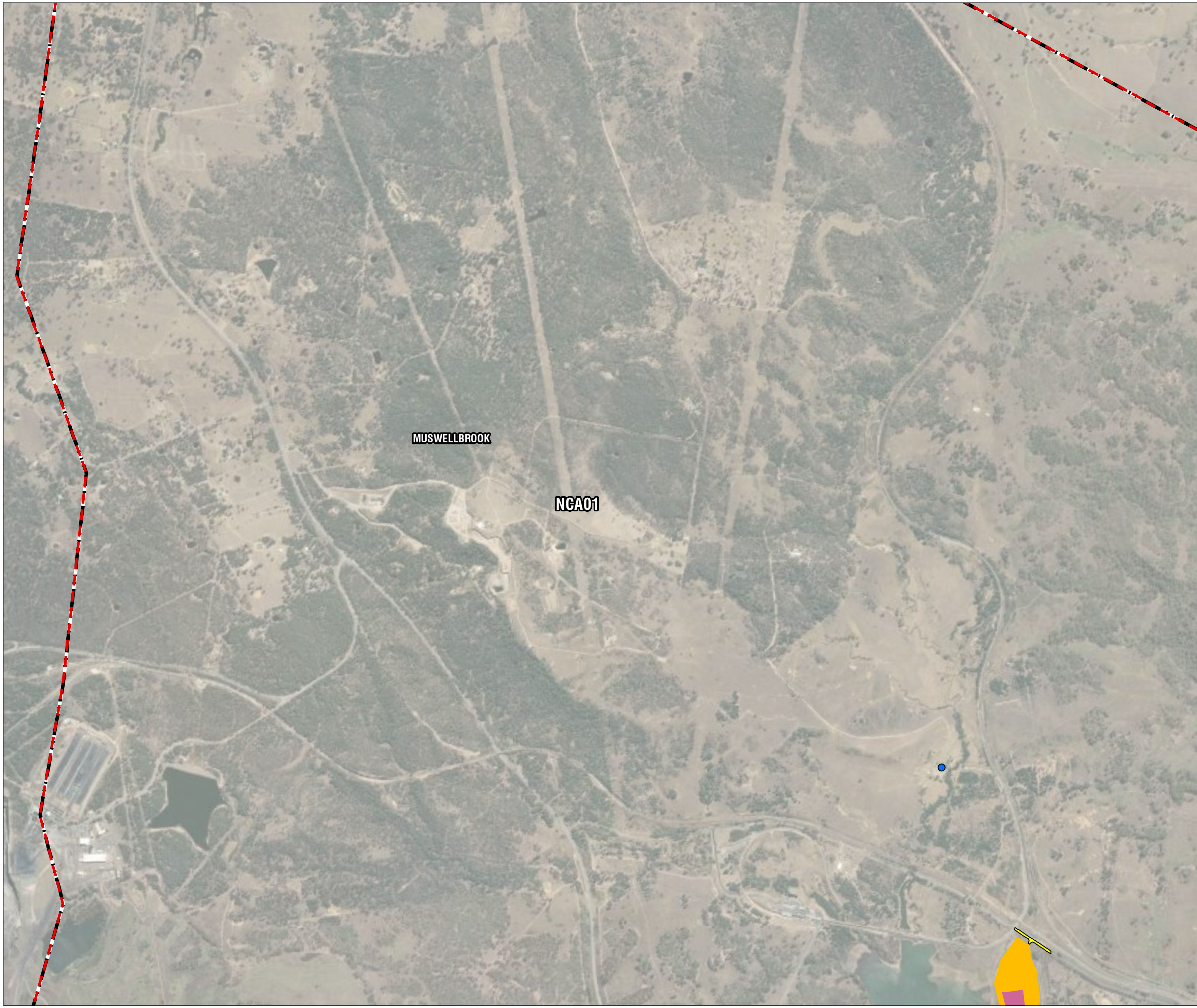

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Construction support site
- Intersection
- Accommodation site

Sensitive Receivers

- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
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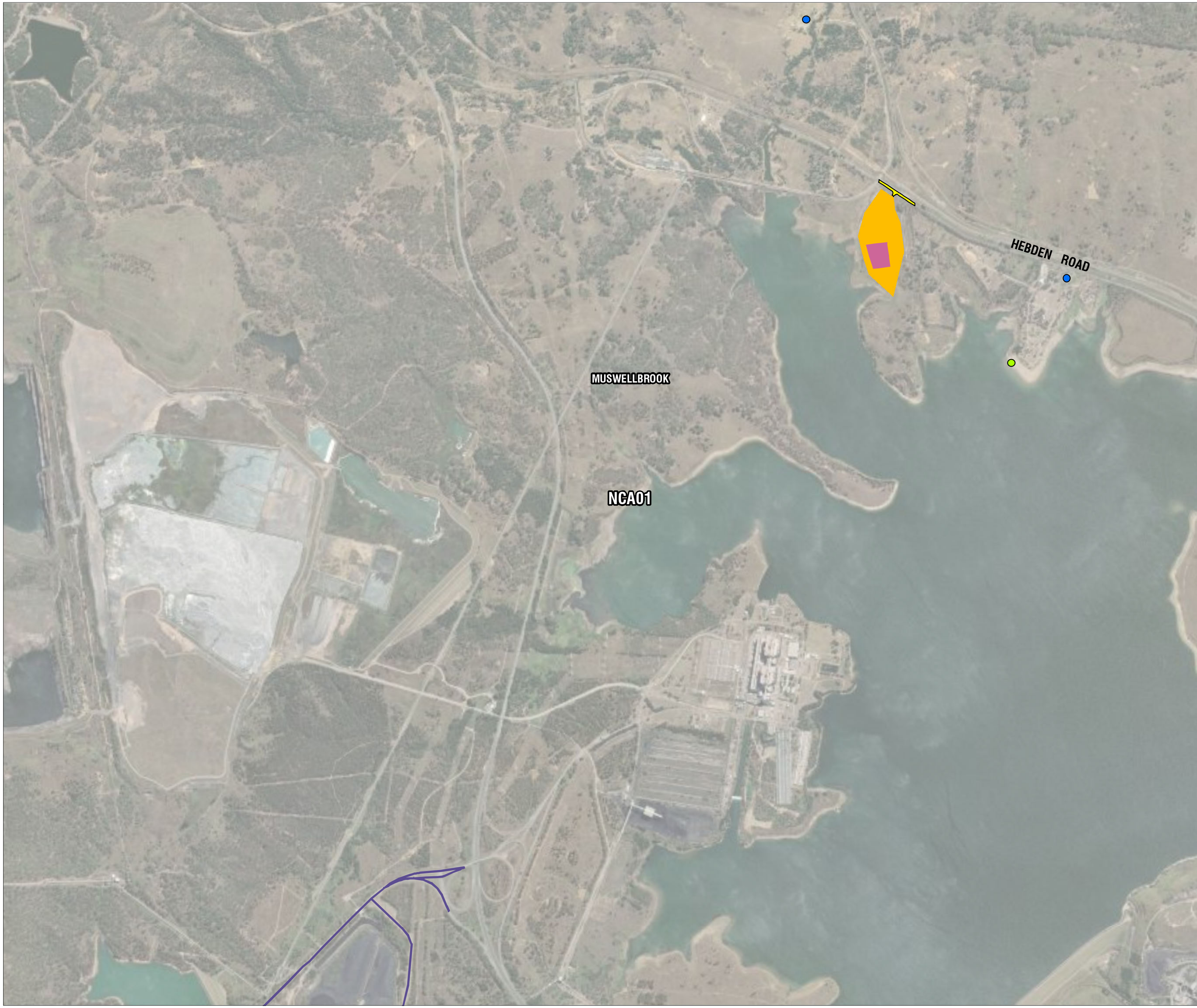


HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

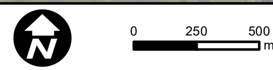
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Construction support site
- Intersection
- Accommodation site

Sensitive Receivers

- Other (Passive recreation)
- Residential



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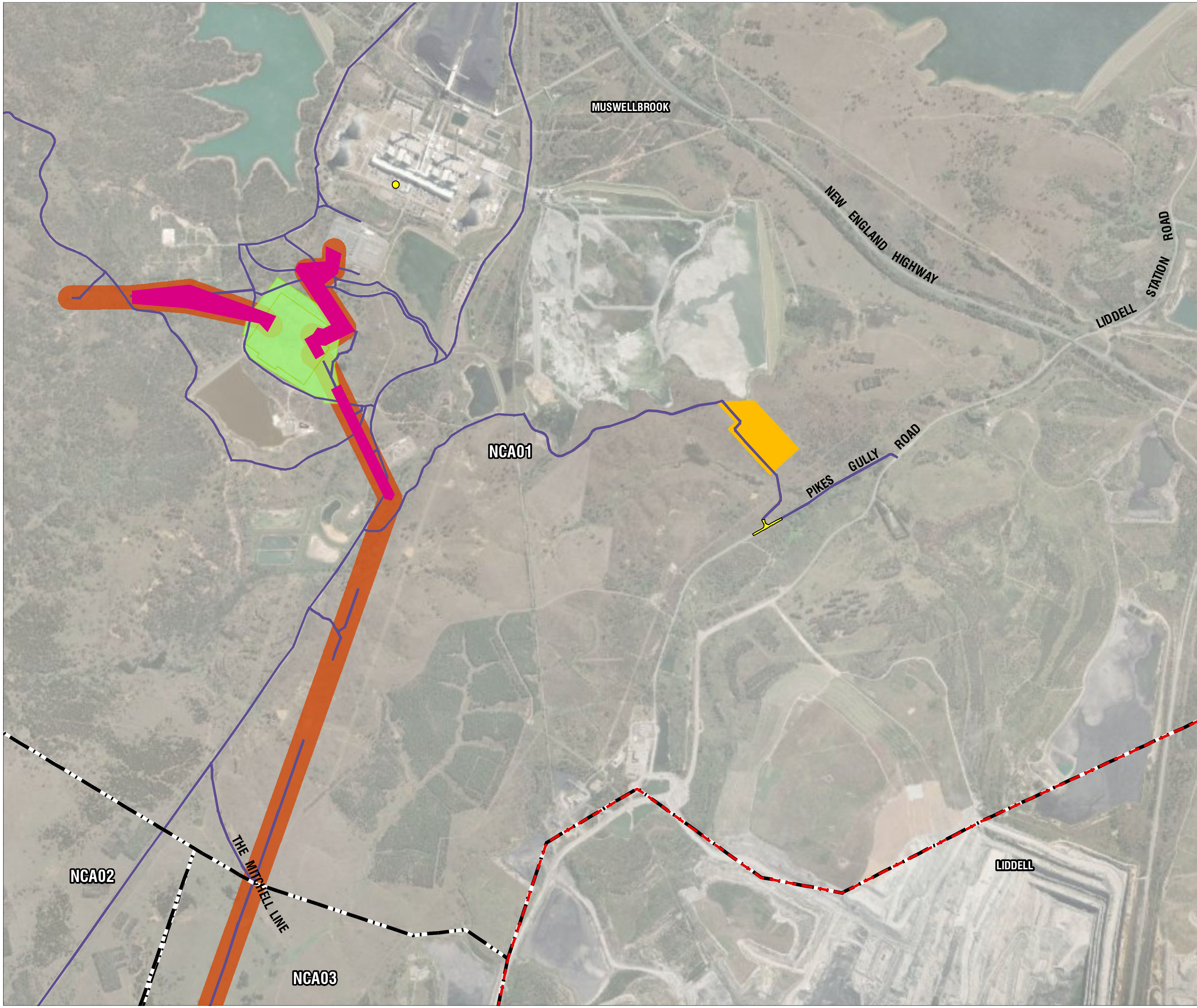


HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

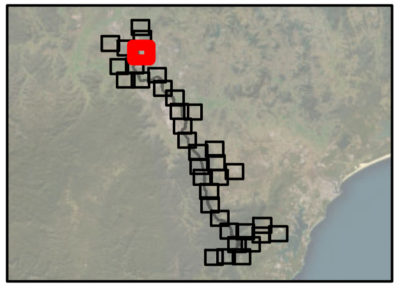
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection
- Stringing station
- Switching station

Sensitive Receivers

- Industrial



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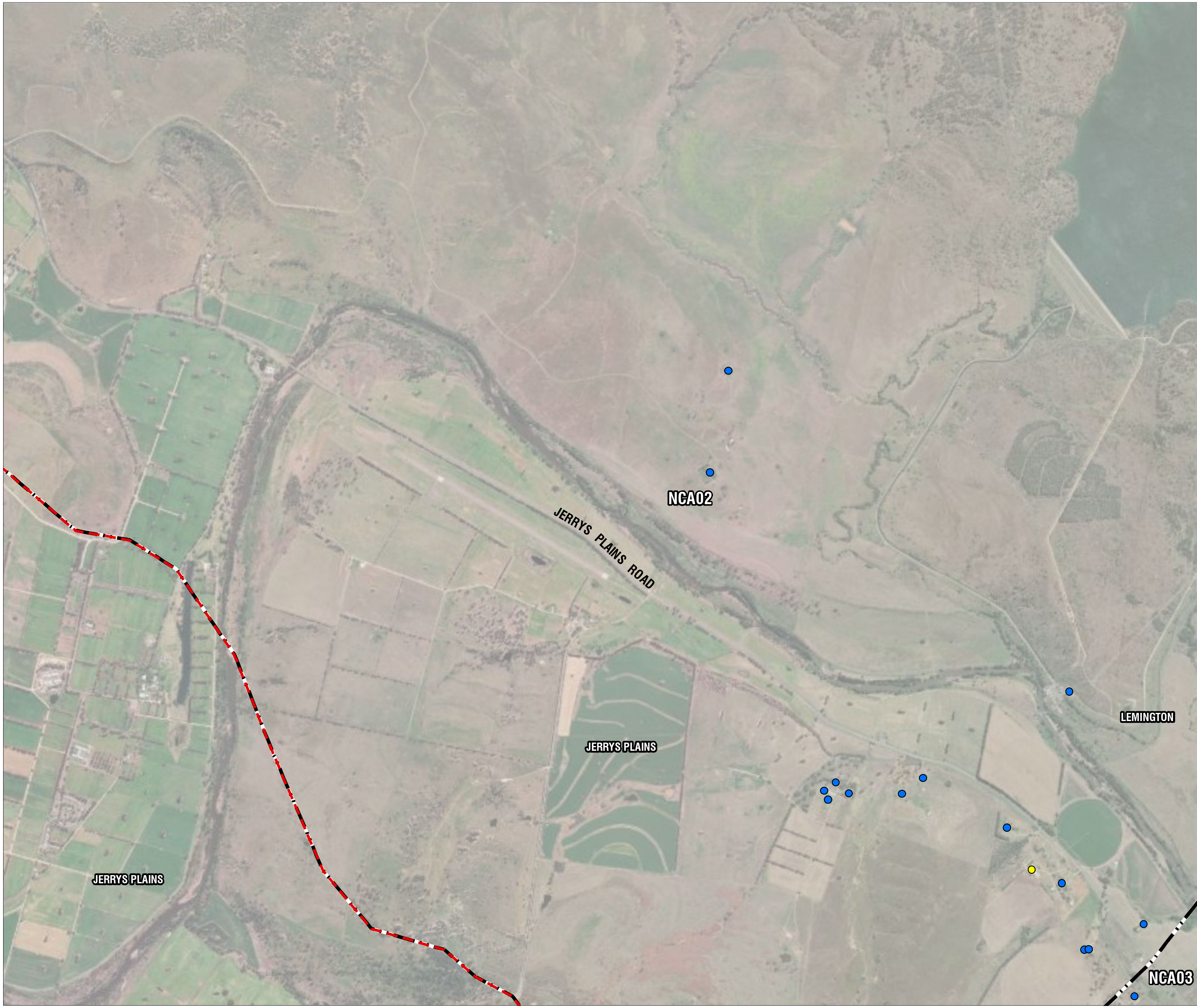


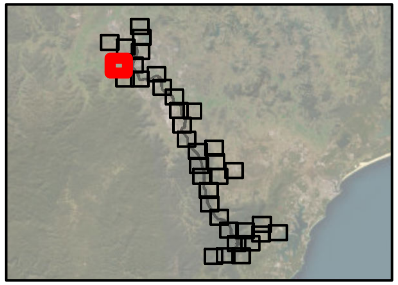
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

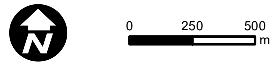
PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND

Study area
NCA boundary
Sensitive Receivers
Industrial
Residential





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Project Number:	630.032094
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Drawn by:	LF

SLR

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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

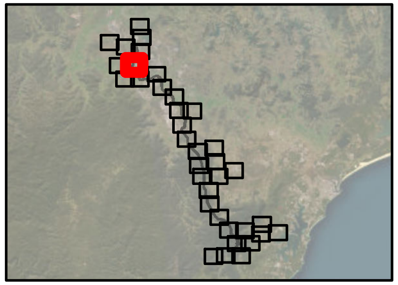
ATTACHMENT B

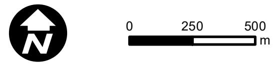
LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Stringing station

Sensitive Receivers

- Industrial
- Residential





Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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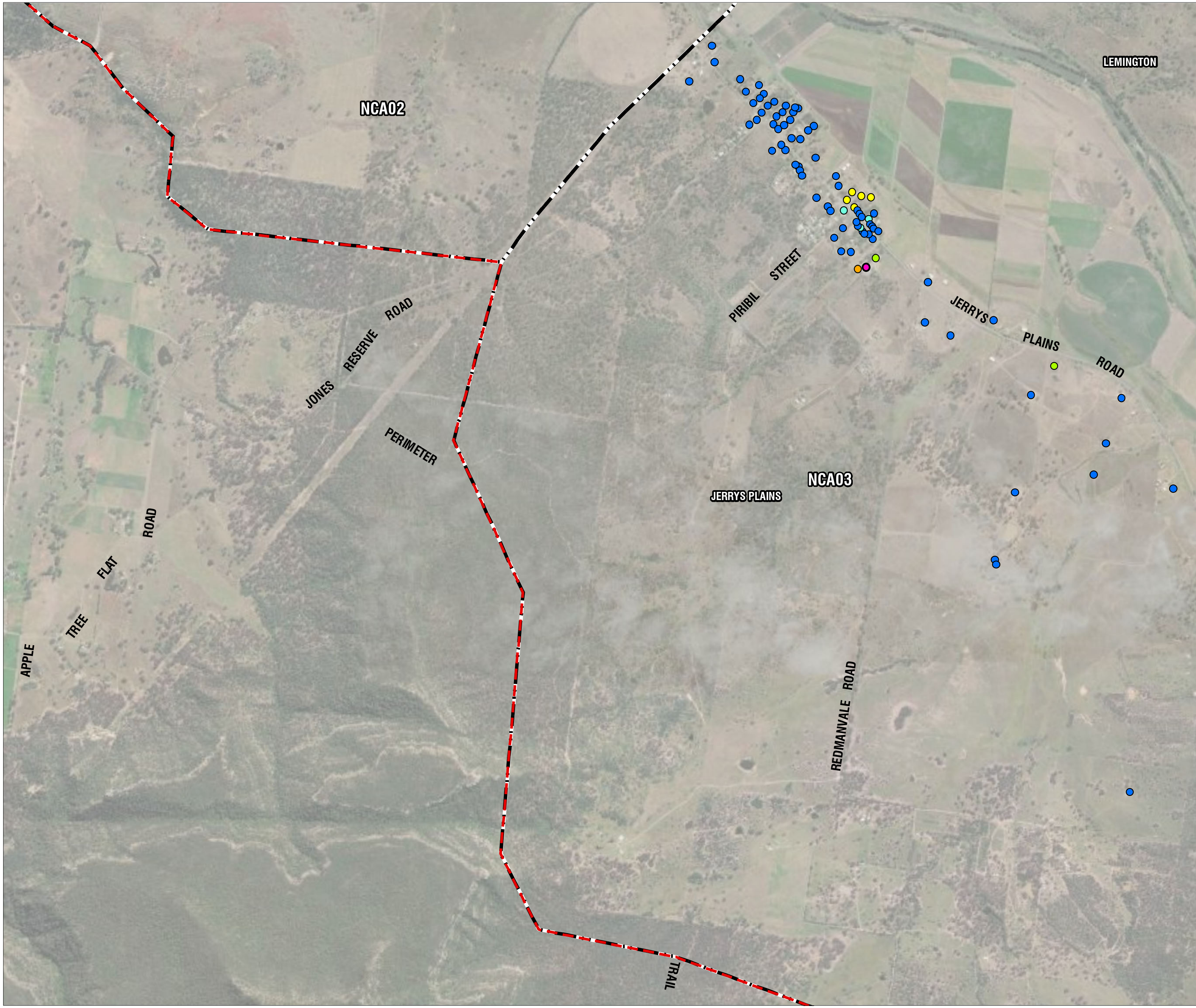
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

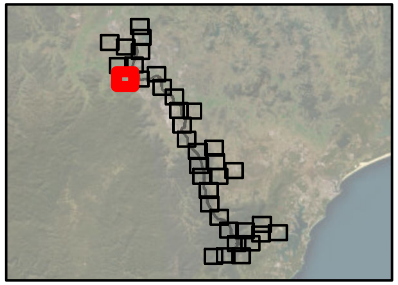


LEGEND

- Study area
- NCA boundary

Sensitive Receivers

- Commercial
- Industrial
- Other (Active recreation)
- Other (Education)
- Other (Passive recreation)
- Residential



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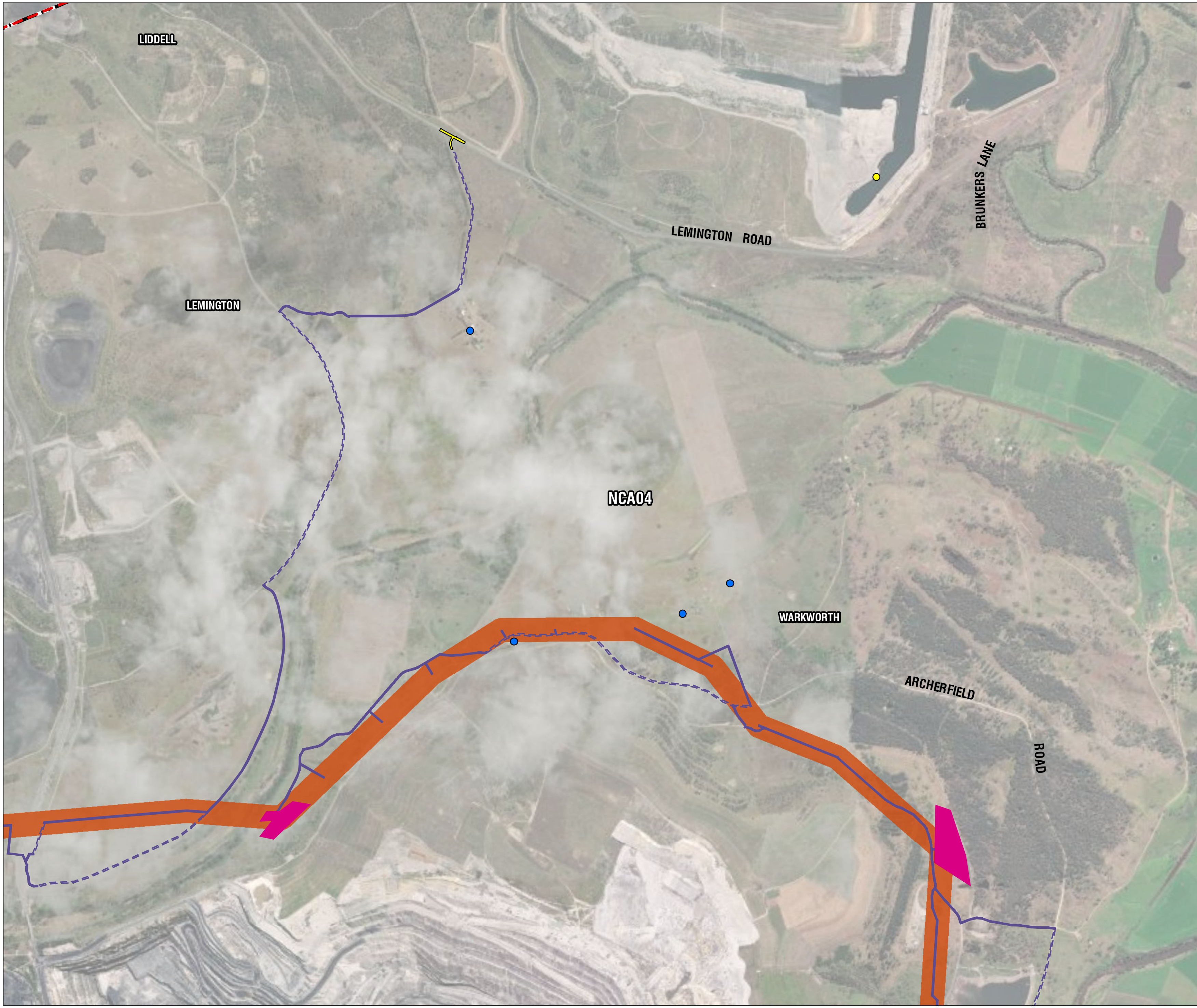
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

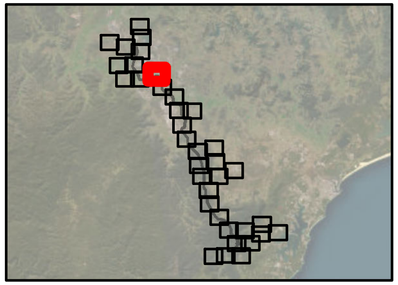
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection
- Stringing station

Sensitive Receivers

- Industrial
- Residential



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Coordinate System:	GDA2020 MGA Zone 56
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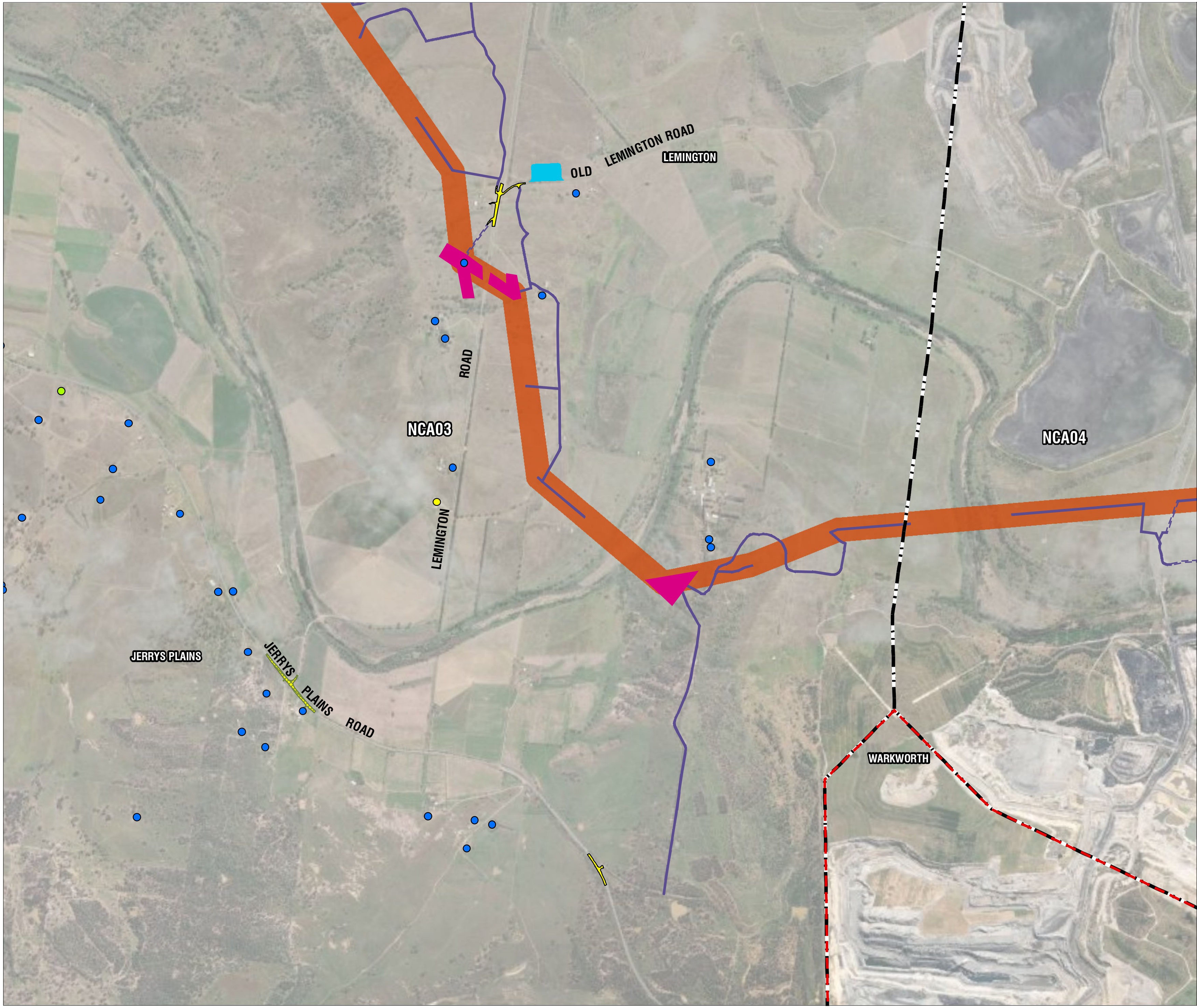
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

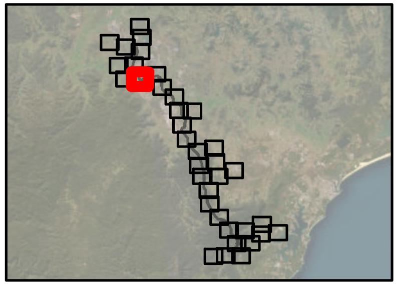
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection
- Intersection (Intensive)
- Stringing station

Sensitive Receivers

- Industrial
- Other (Passive recreation)
- Residential



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Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

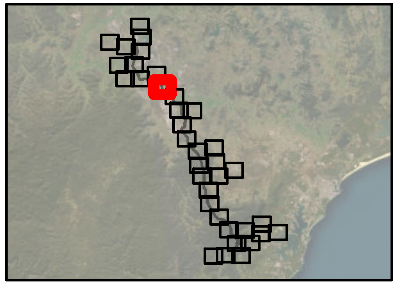
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection
- Stringing station

Sensitive Receivers

- Industrial
- Residential



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Project Number:	630.032094
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Drawn by:	LF

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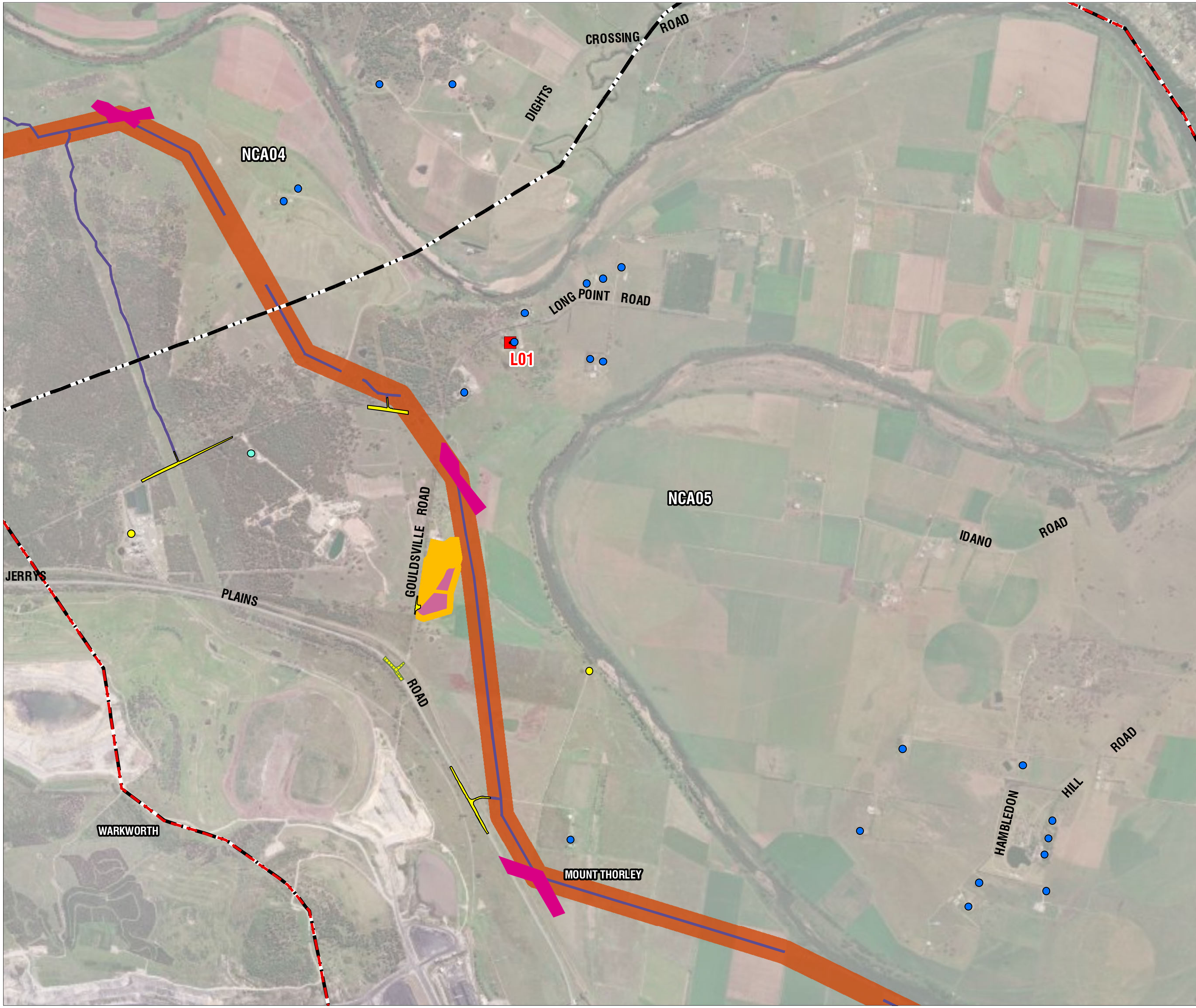


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Noise monitoring location
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection
- Intersection (Intensive)
- Stringing station
- Accommodation site

Sensitive Receivers

- Commercial
- Industrial
- Residential

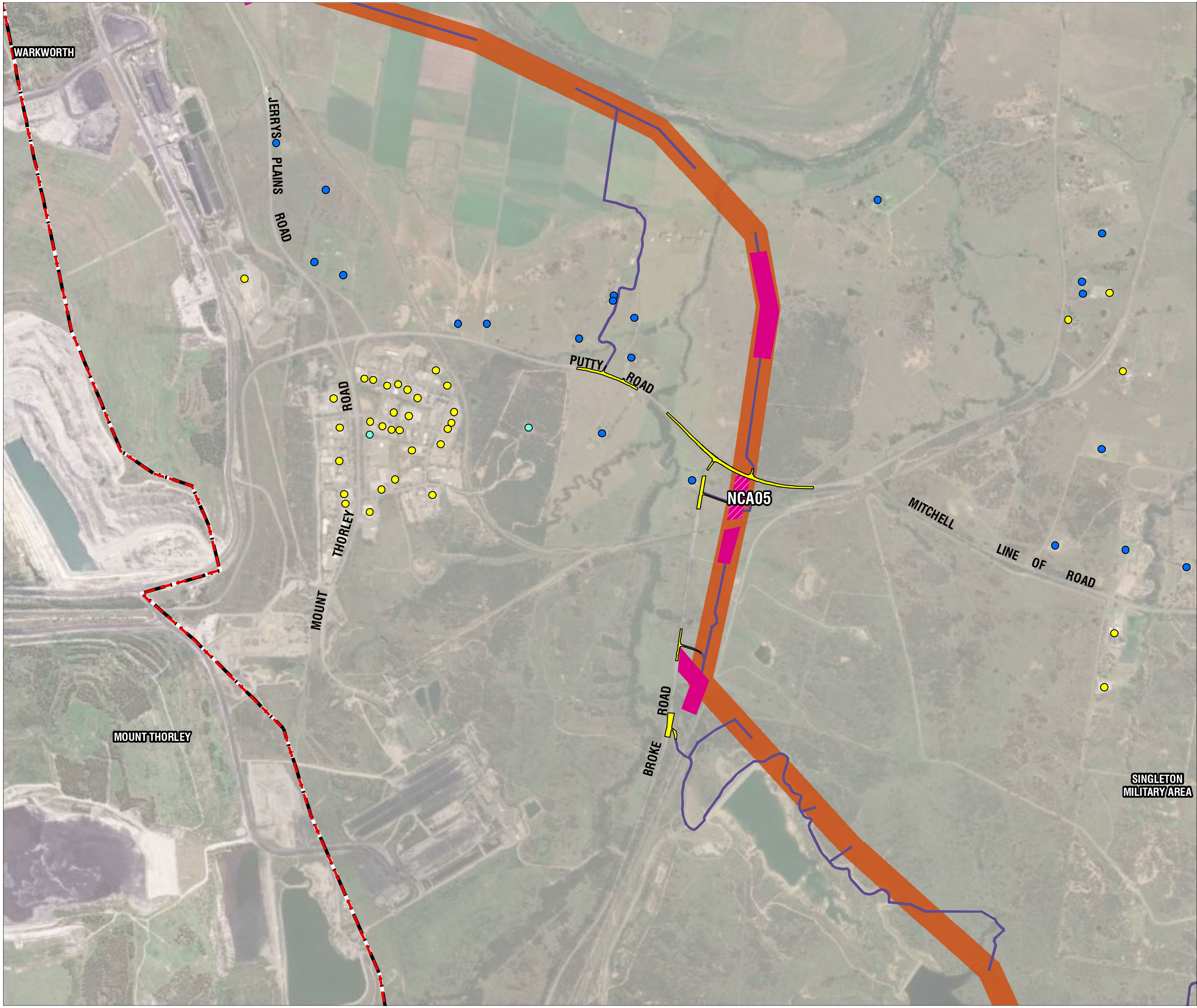
0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B



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Project Number:	630.032094
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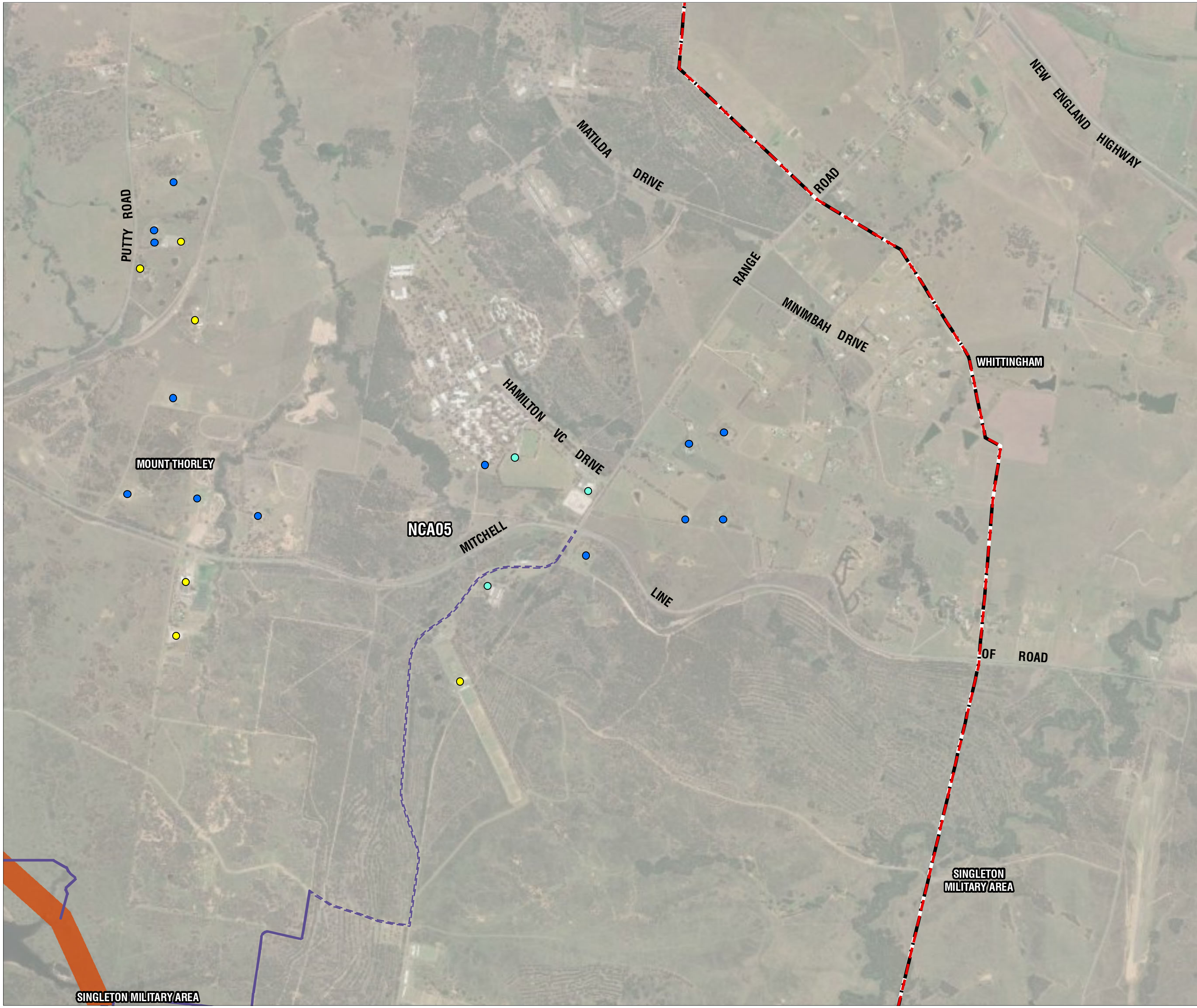
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

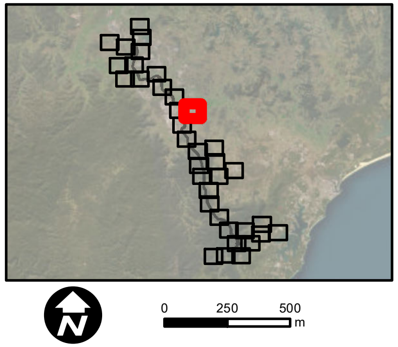
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)

Sensitive Receivers

- Commercial
- Industrial
- Residential



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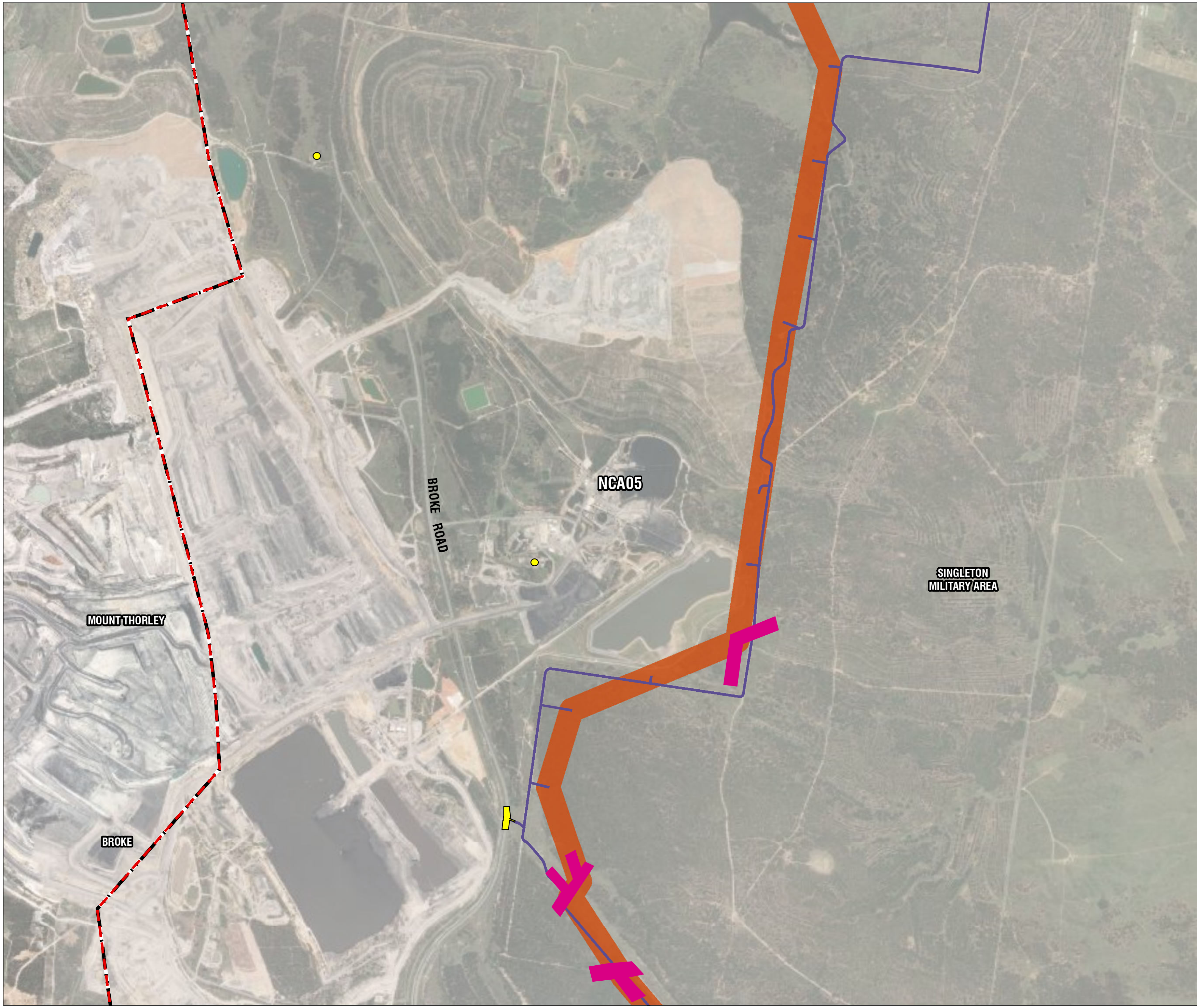


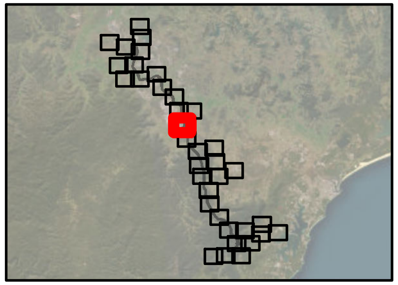
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Intersection
- Stringing station

Sensitive Receivers
- Industrial



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Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
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Drawn by:	LF

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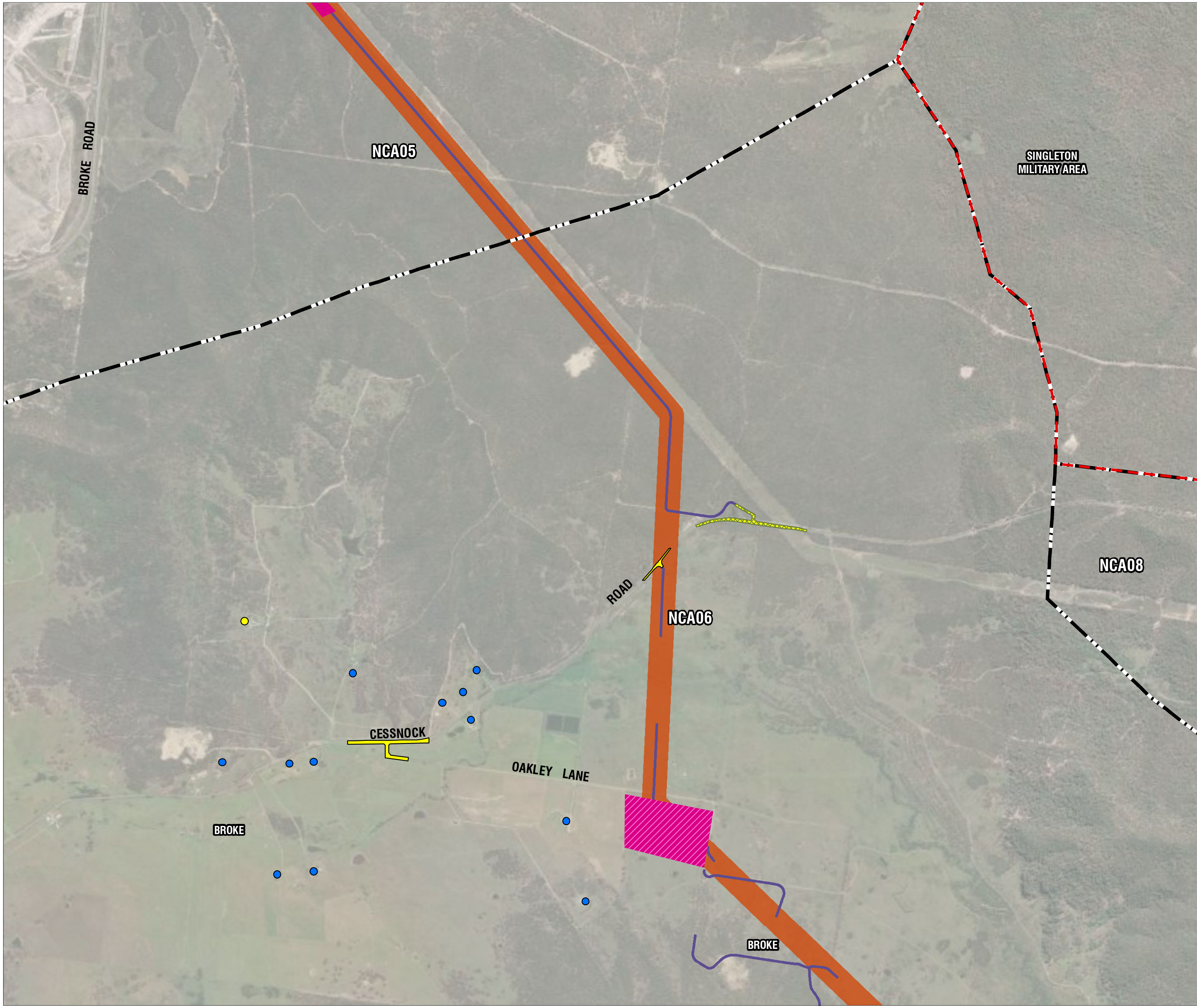
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

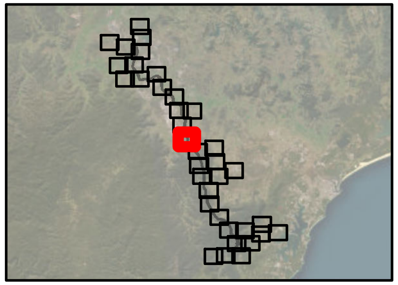


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Intersection
- Intersection (Intensive)
- Stringing station
- Stringing station OOH

Sensitive Receivers

- Industrial
- Residential



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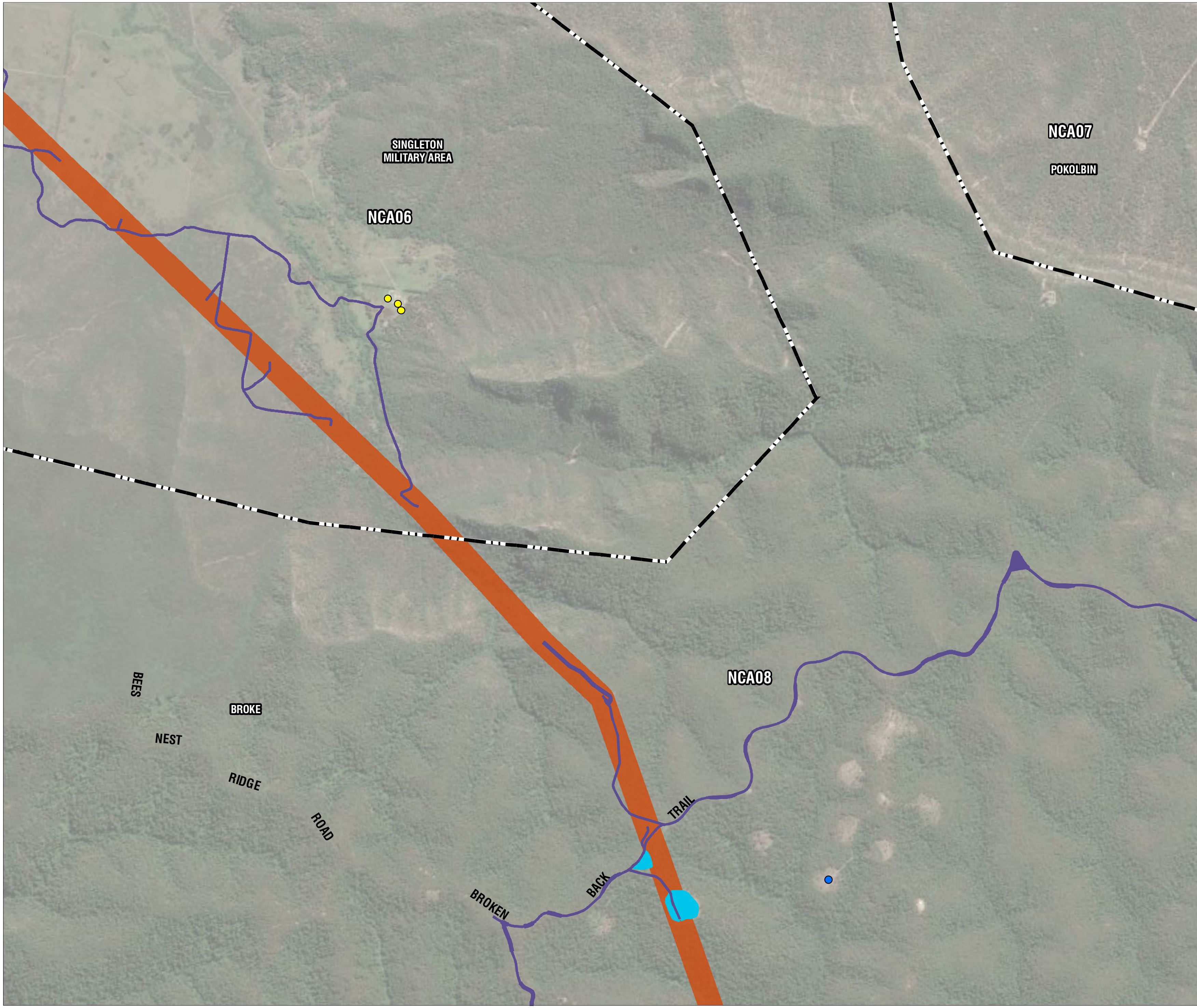

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
Page 17 of 36

ATTACHMENT B

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area

Sensitive Receivers
- Industrial
- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

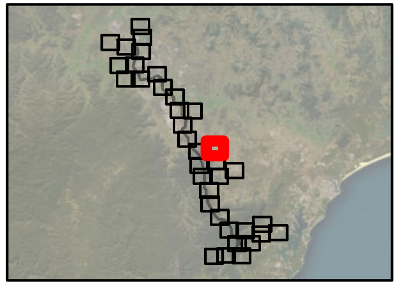
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (major)

Sensitive Receivers

- Commercial
- Industrial
- Other (Hotel)
- Residential



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Coordinate System:	GDA2020 MGA Zone 56
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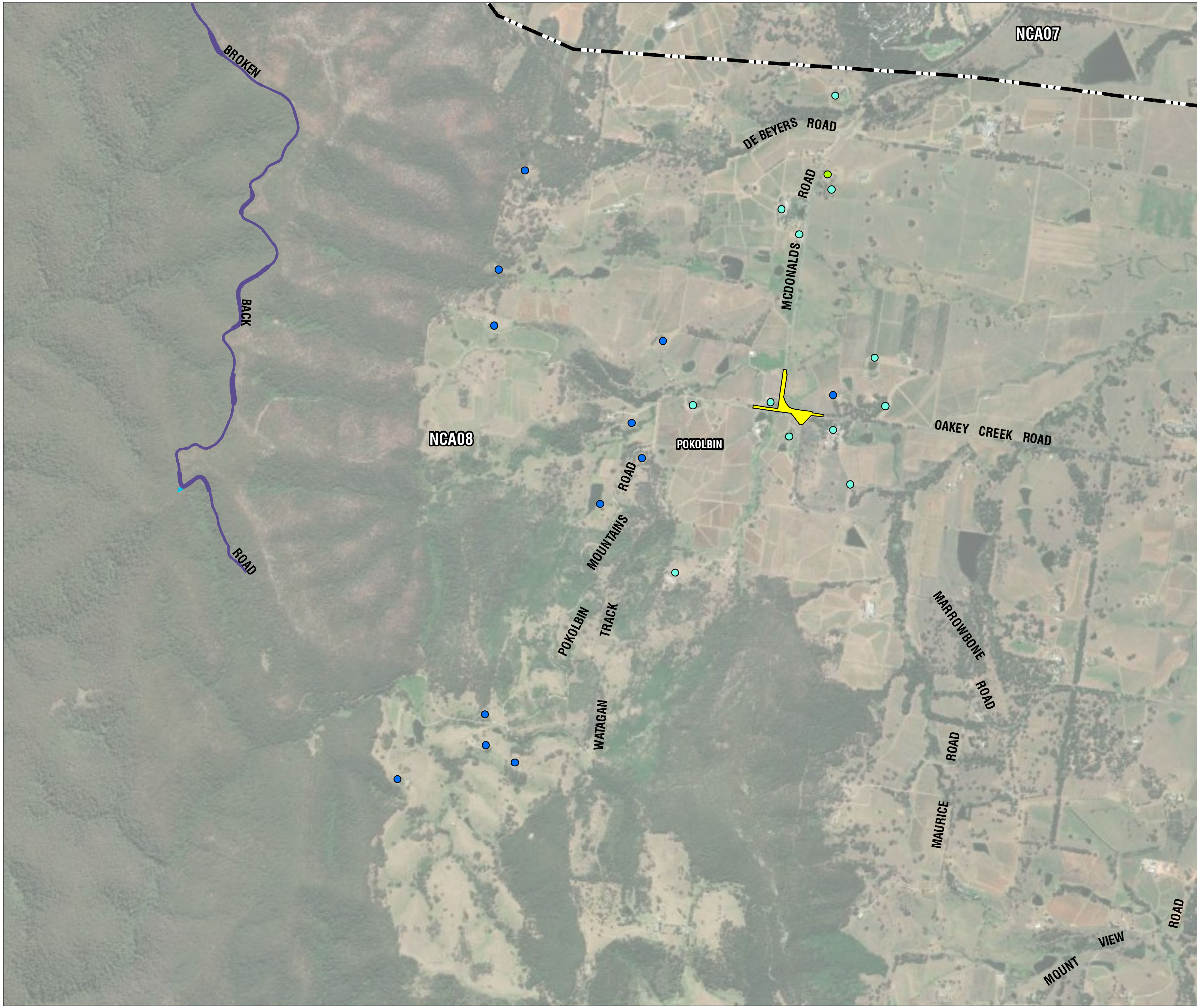


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

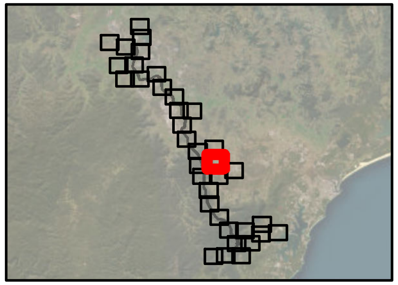
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Laydown area
- Intersection

Sensitive Receivers

- Commercial
- Other (Passive recreation)
- Residential



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Coordinate System:	GDA2020 MGA Zone 56
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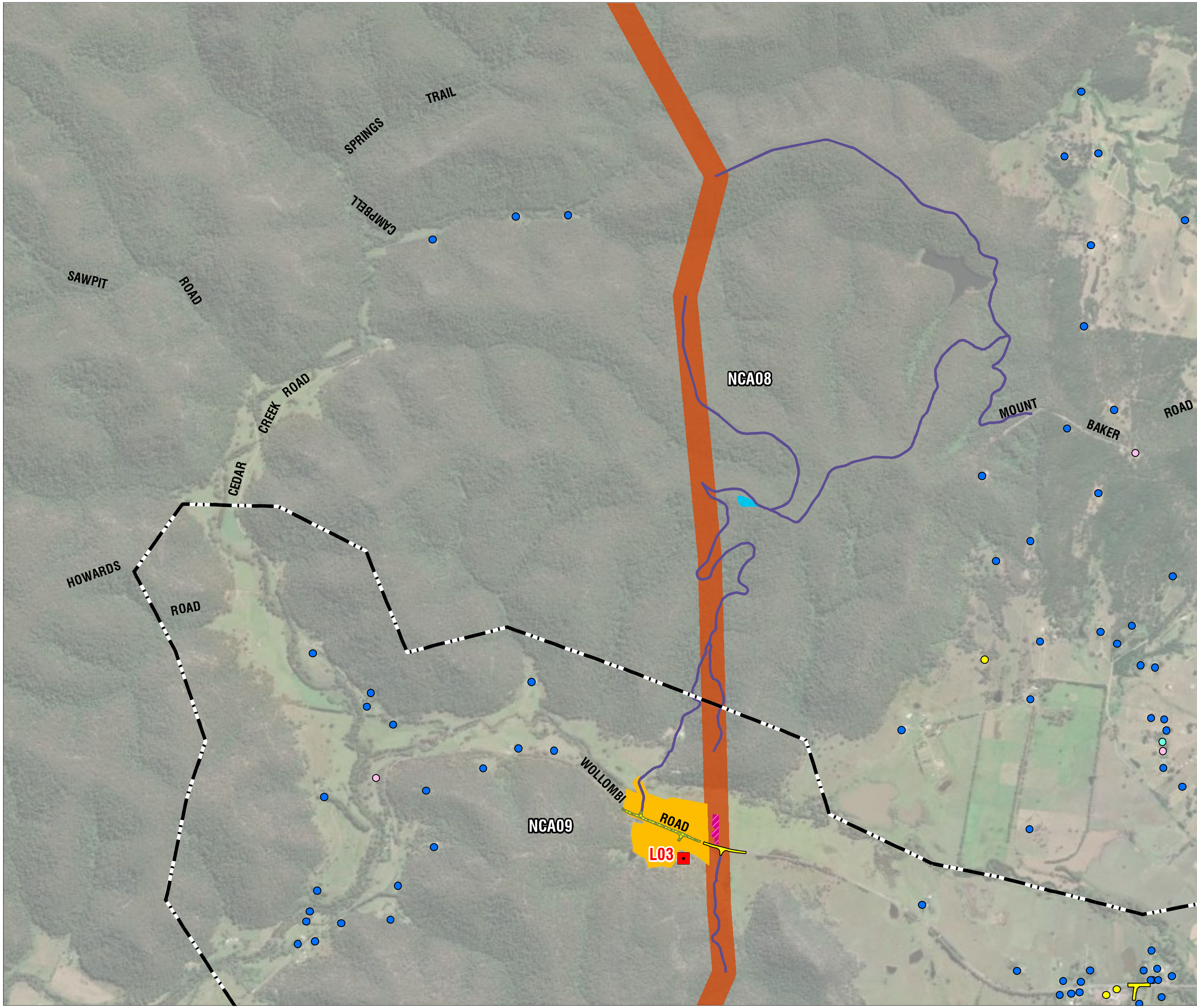

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

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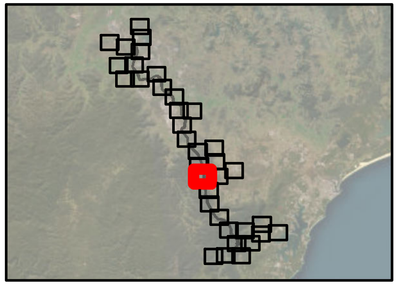
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Noise monitoring location
- HTP corridor
- Access tracks (major)
- Laydown area
- Construction support site
- Intersection
- Intersection (Intensive)
- Stringing station
- Stringing station OOH

Sensitive Receivers

- Commercial
- Industrial
- Other (Hotel)
- Residential



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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

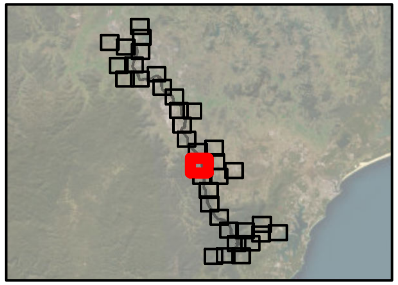
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Stringing station

Sensitive Receivers

- Other (Hotel)
- Residential



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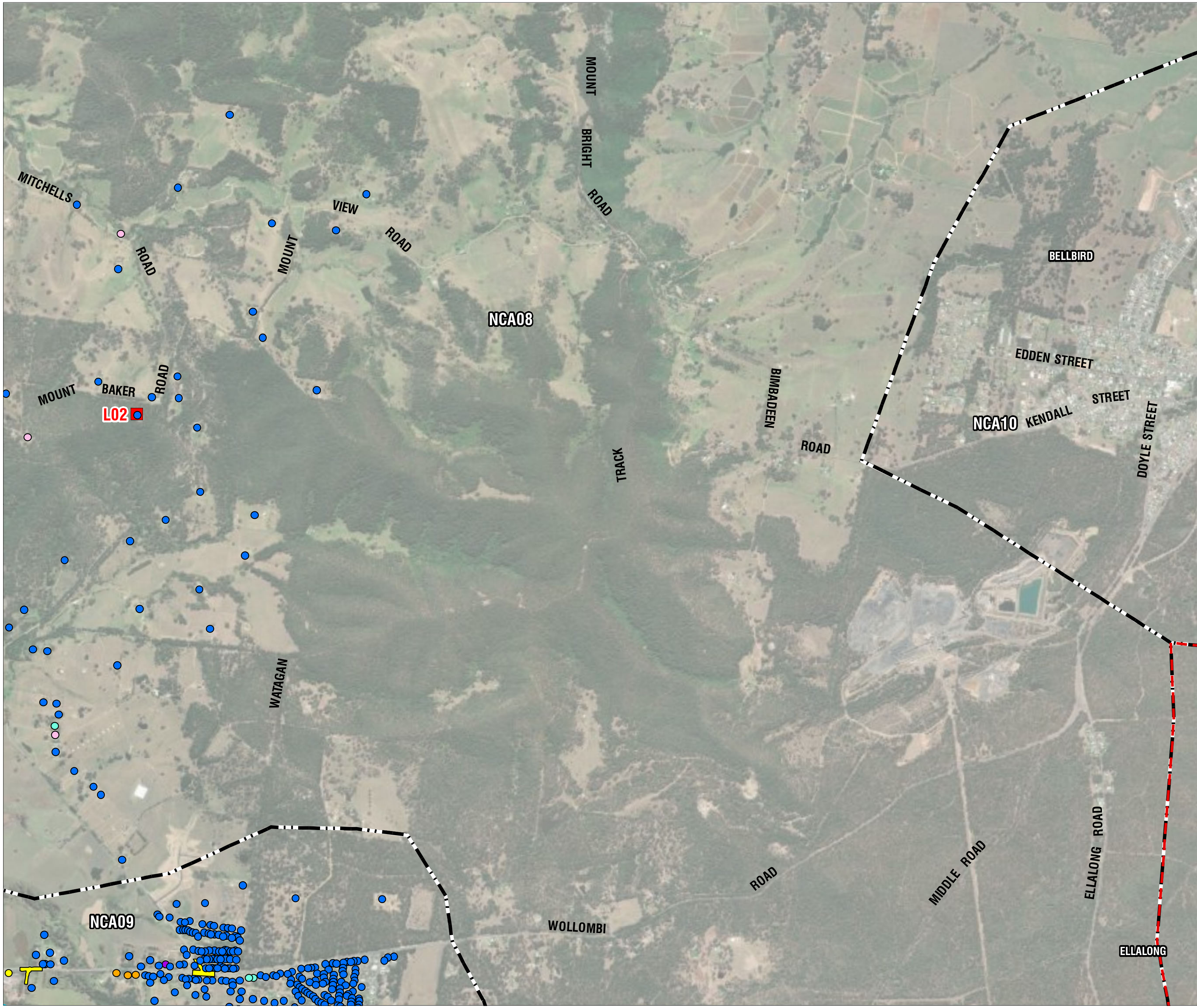
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

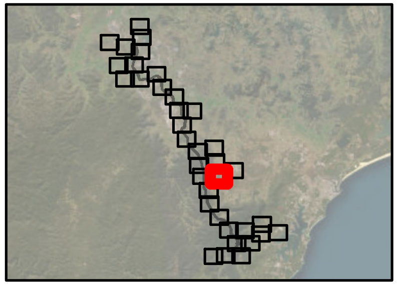


LEGEND

- Study area
- NCA boundary
- Noise monitoring location
- Laydown area
- Intersection

Sensitive Receivers

- Commercial
- Industrial
- Other (Education)
- Other (Hotel)
- Other (Place of worship)
- Residential



0 250 500 m

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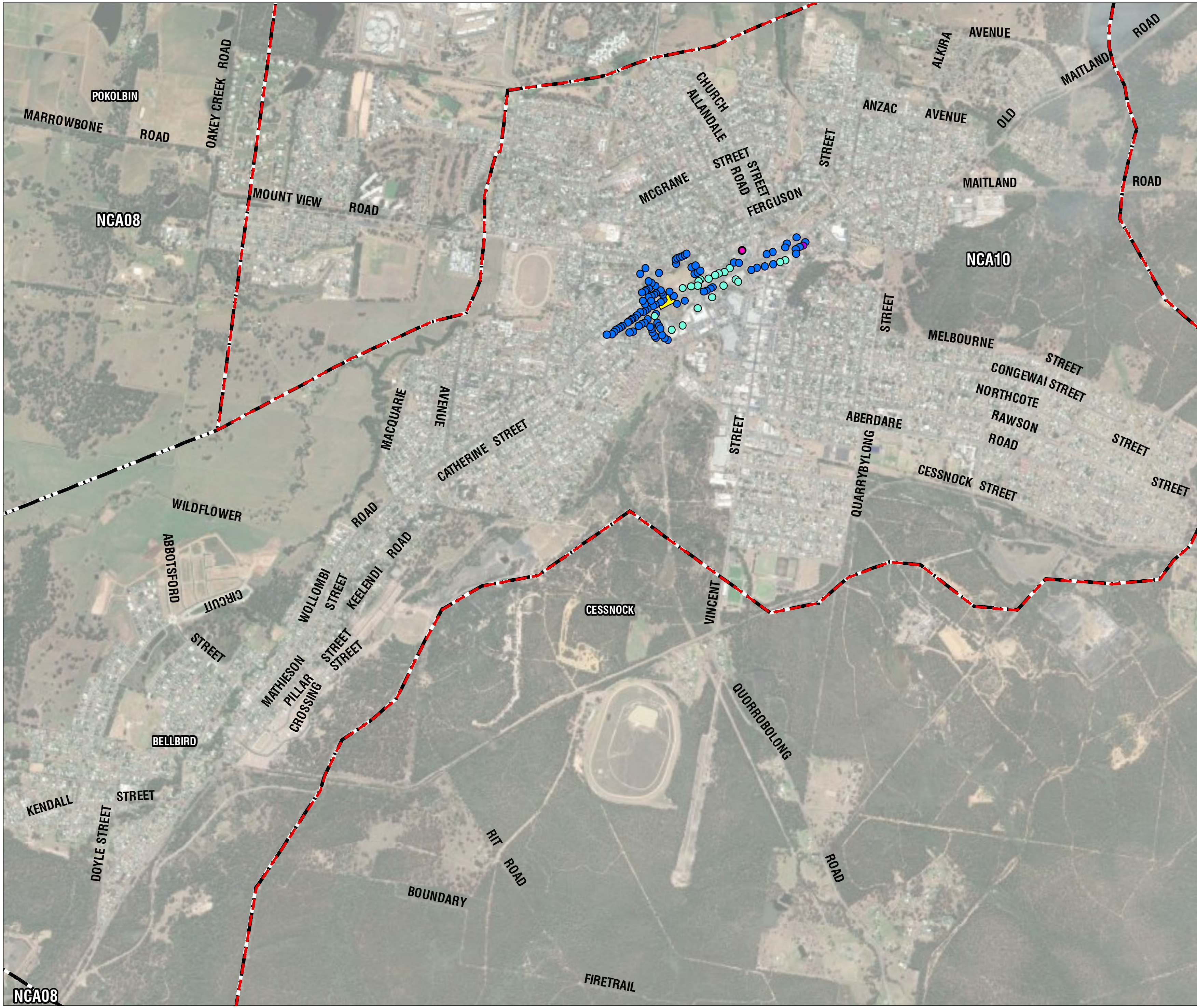


HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

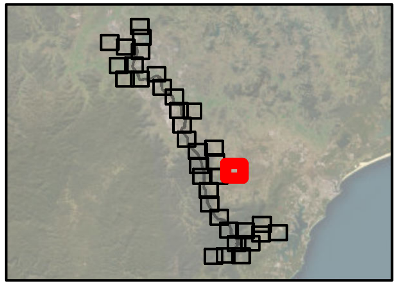
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Intersection

Sensitive Receivers

- Commercial
- Other (Active recreation)
- Other (Place of worship)
- Residential



0 250 500
m

Coordinate System:	GDA2020 MGA Zone 56
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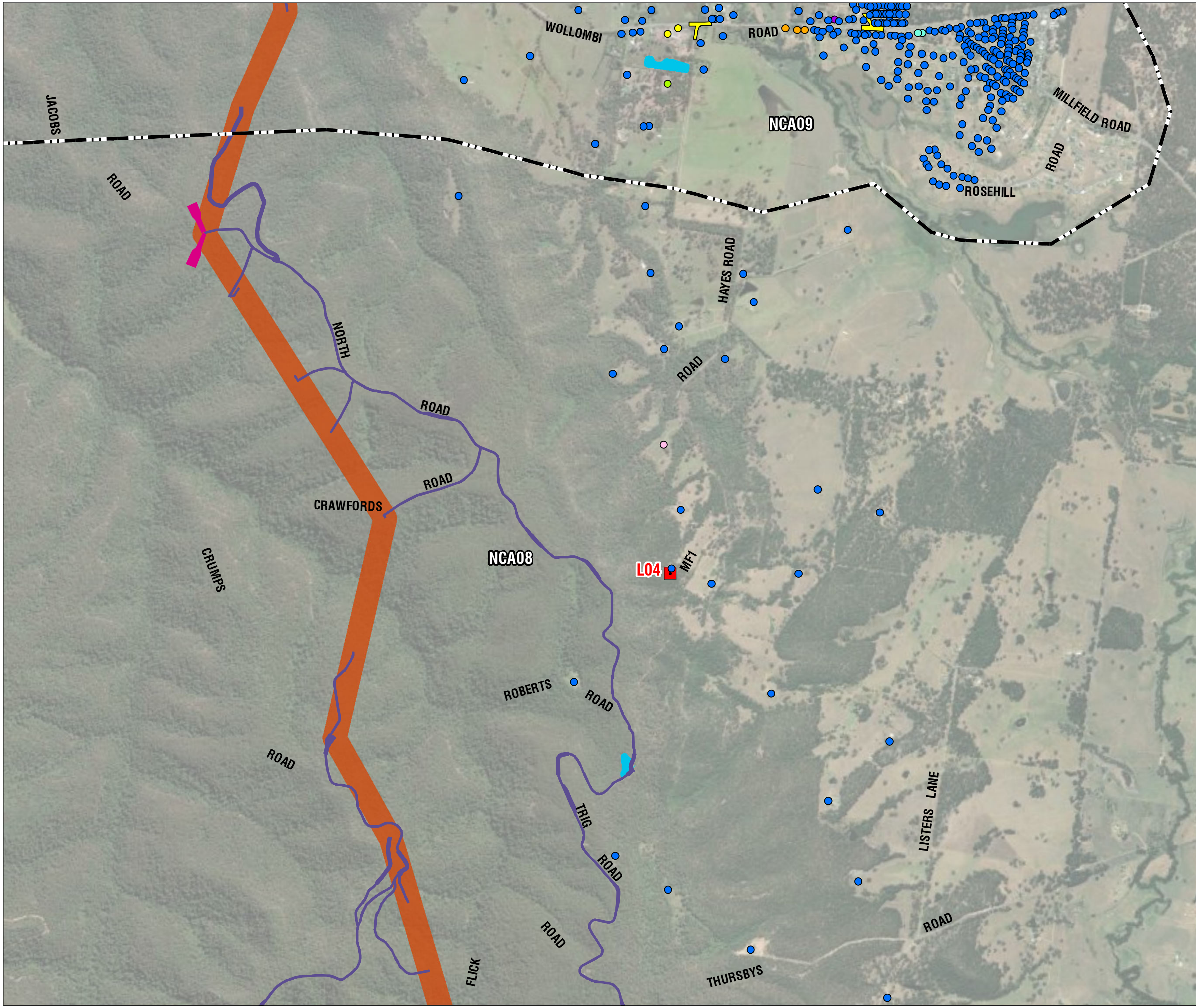

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

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ATTACHMENT B

LEGEND
- Study area
- NCA boundary
- Noise monitoring location
- HTP corridor
- Access tracks (major)
- Laydown area
- Intersection
- Stringing station

Sensitive Receivers
- Commercial
- Industrial
- Other (Education)
- Other (Hotel)
- Other (Passive recreation)
- Other (Place of worship)
- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
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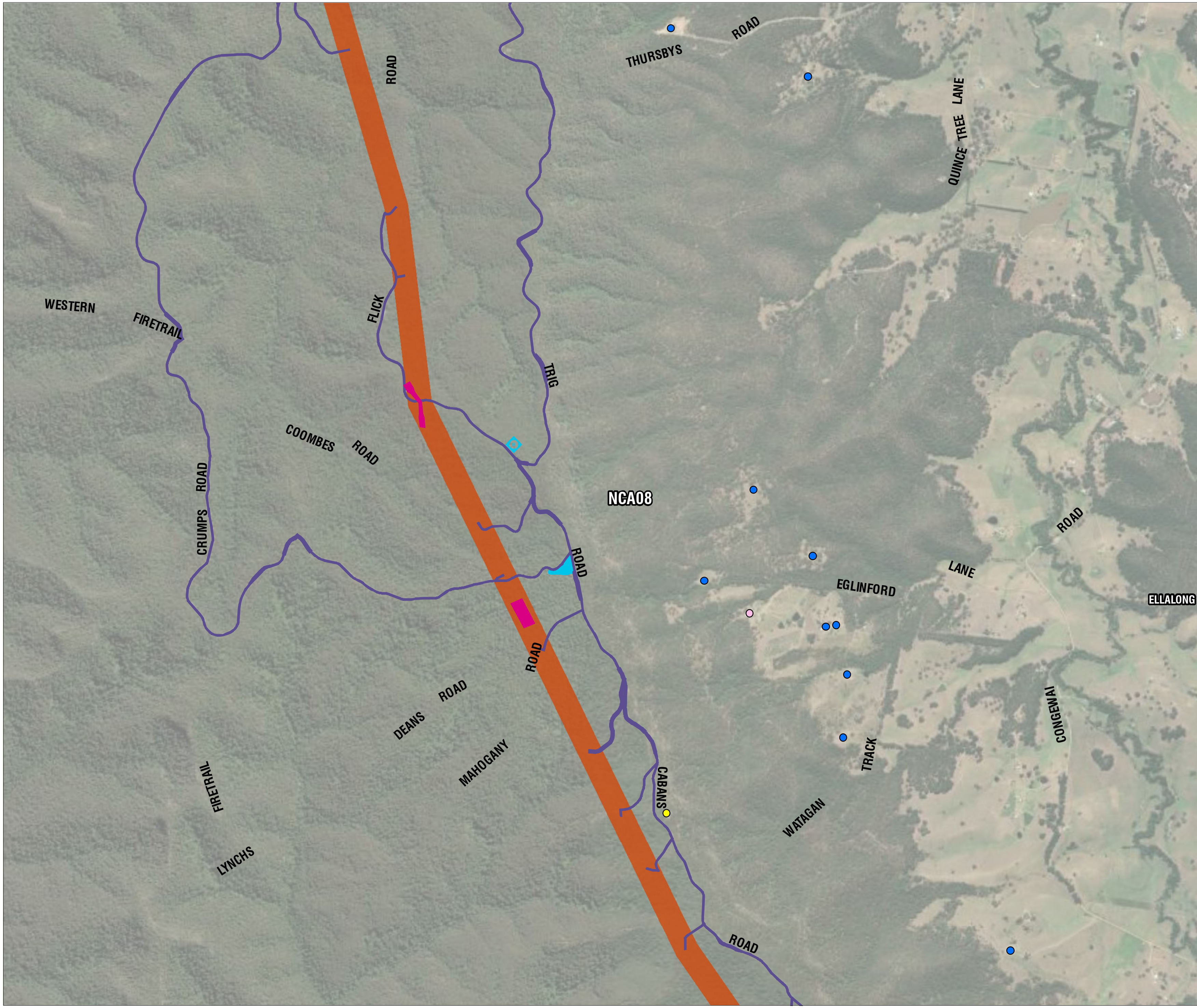
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B



LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Stringing station

Sensitive Receivers

- Industrial
- Other (Hotel)
- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
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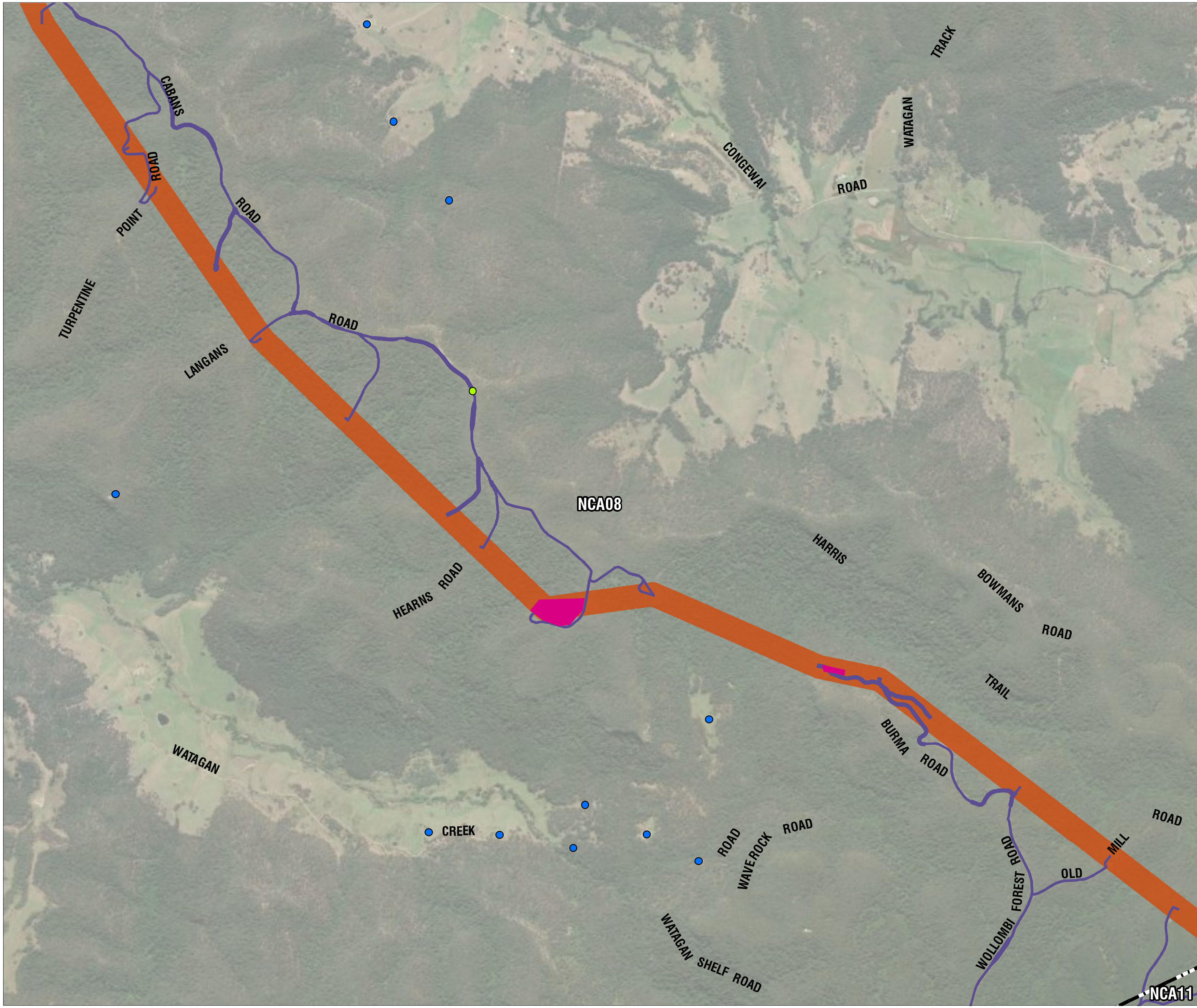
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

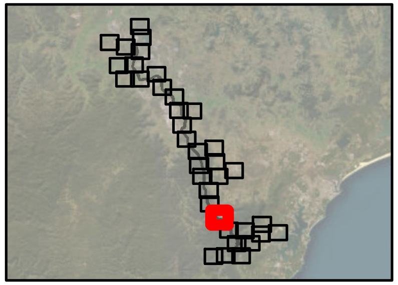


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Stringing station

Sensitive Receivers

- Other (Passive recreation)
- Residential



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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

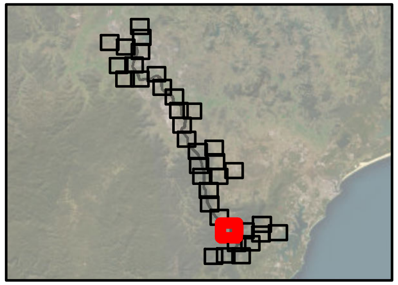
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection
- Stringing station

Sensitive Receivers

- Other (Passive recreation)



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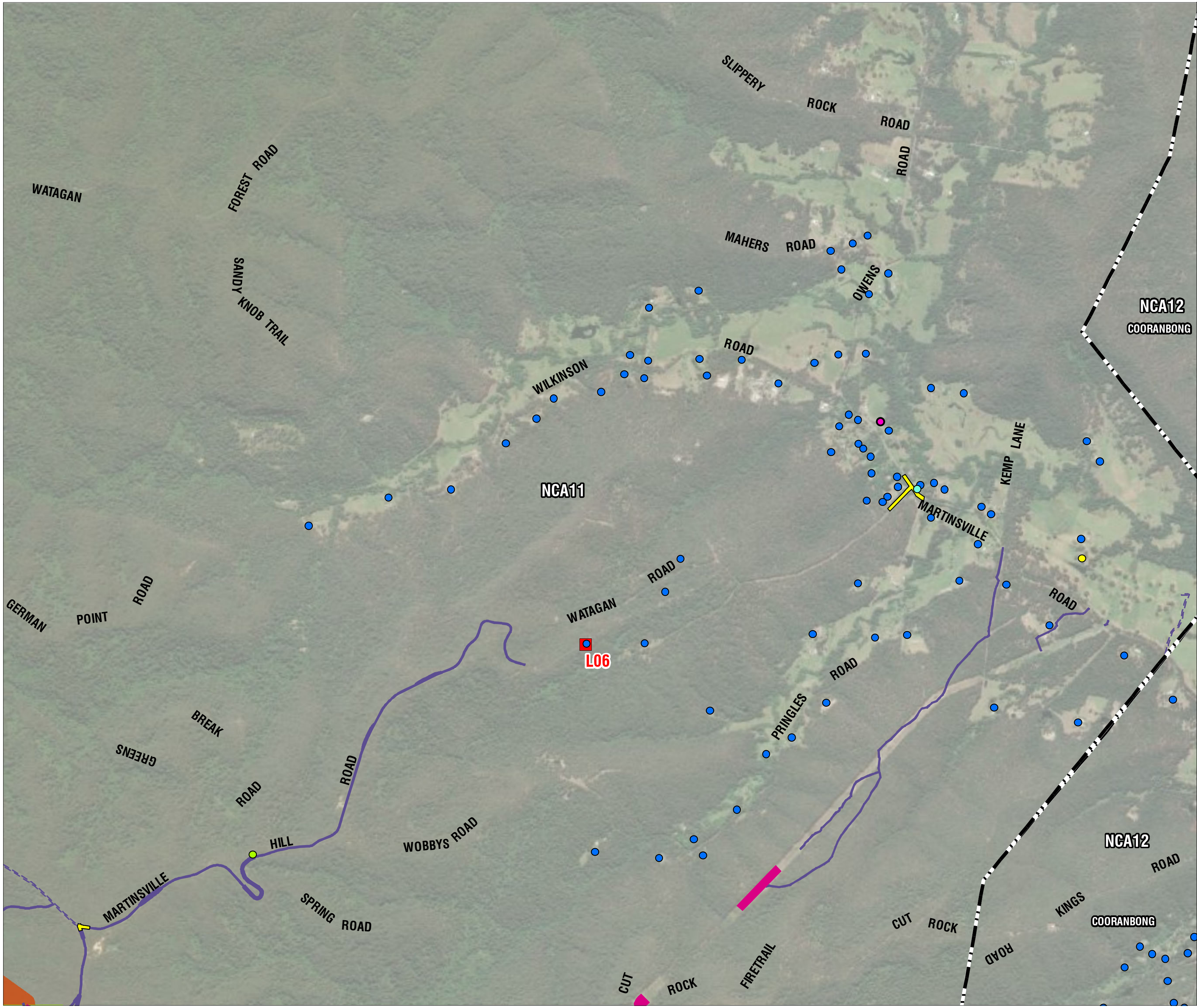

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Noise monitoring location
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection
- Stringing station
- Switching station

Sensitive Receivers

- Commercial
- Industrial
- Other (Active recreation)
- Other (Passive recreation)
- Residential

Coordinate System:	GDA2020 MGA Zone 56
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Project Number:	630.032094
Date:	10-Jul-2025
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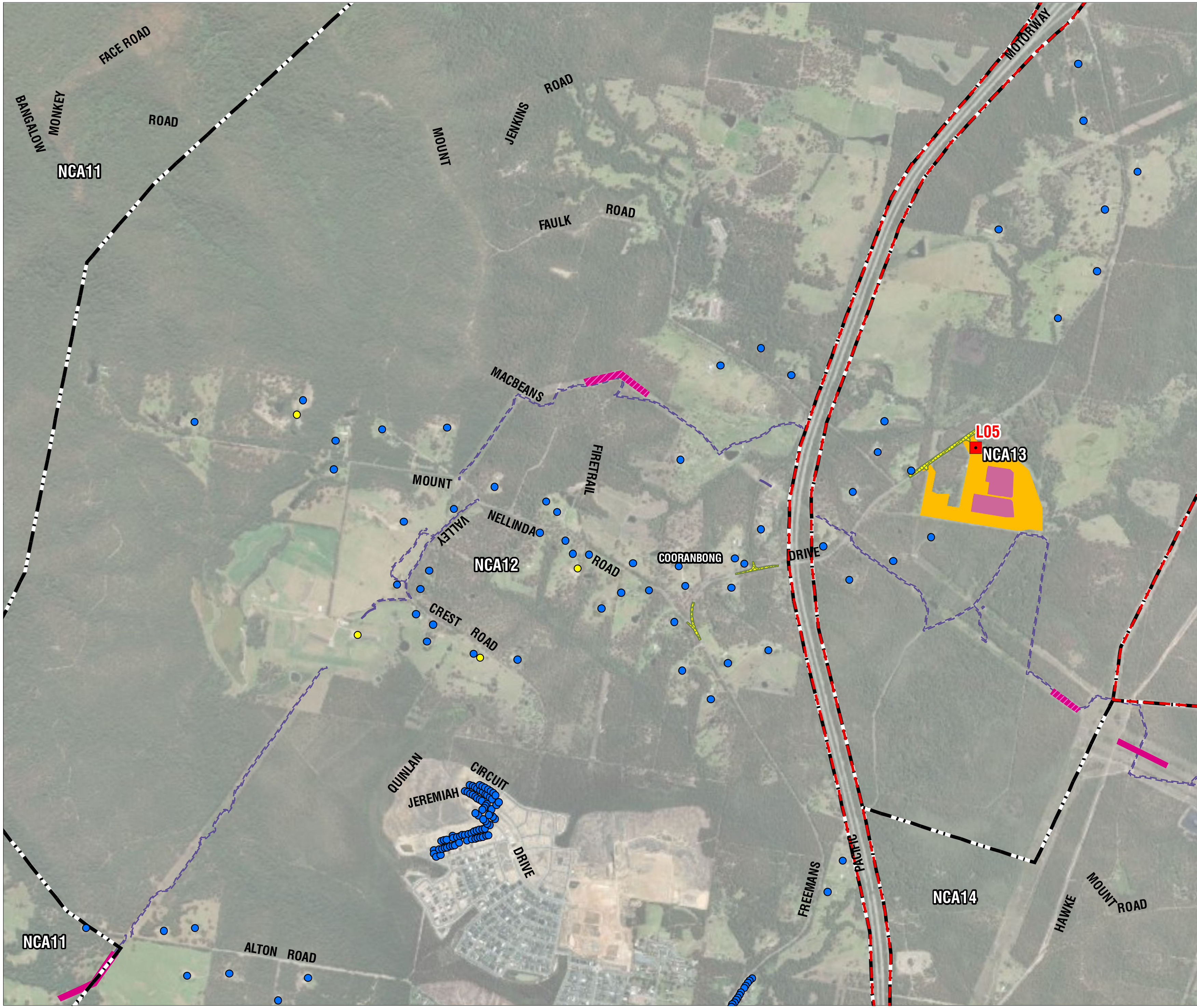
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B



LEGEND

- Study area
- NCA boundary
- Noise monitoring location
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection
- Intersection (Intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

Sensitive Receivers

- Industrial
- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
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Drawn by:	LF

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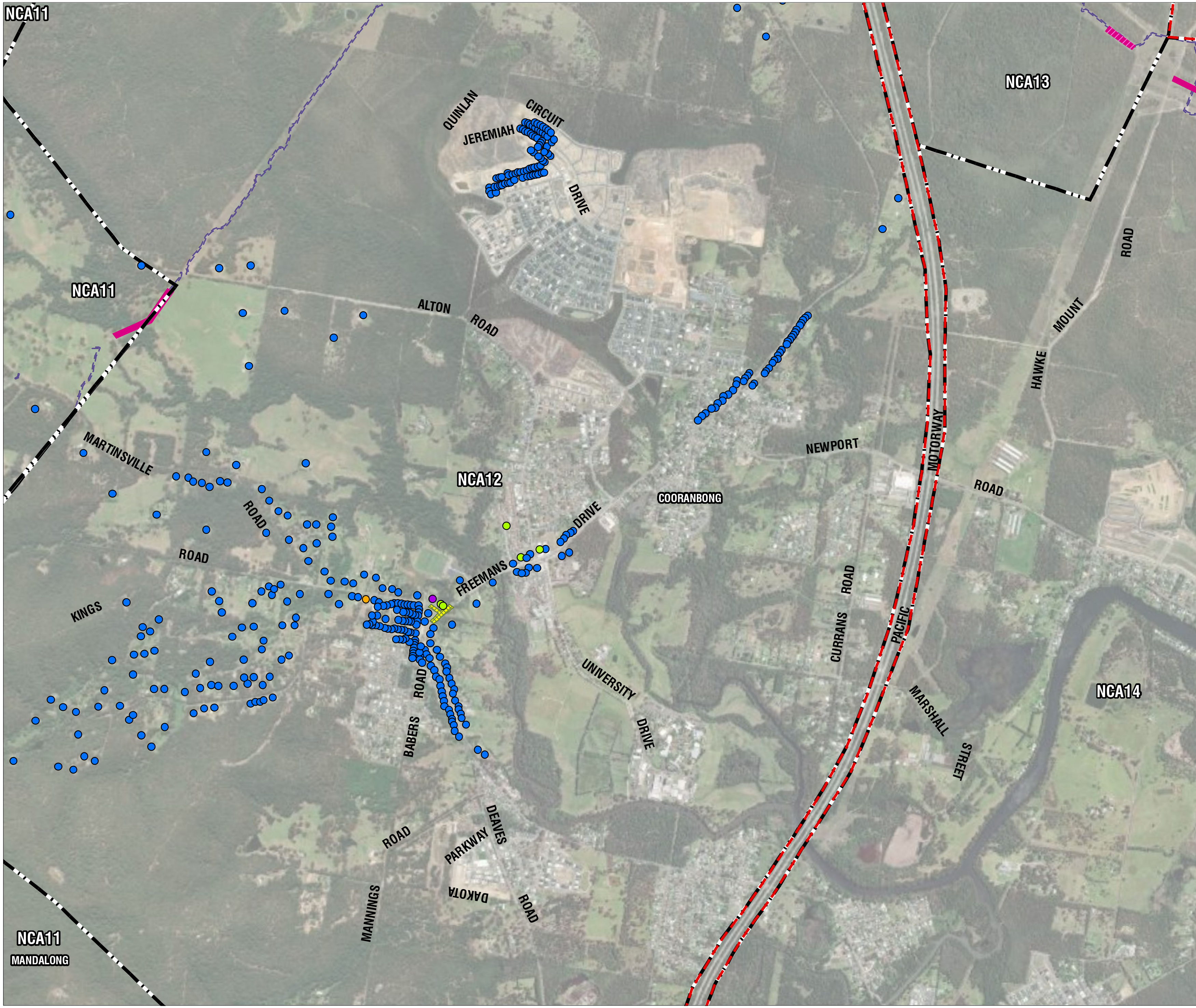


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

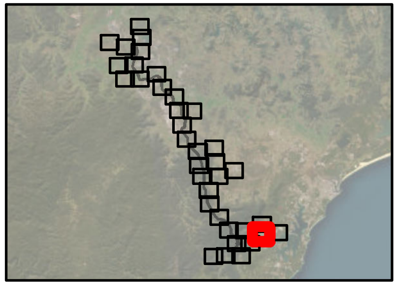
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Intersection
- Intersection (Intensive)
- Stringing station
- Stringing station OOH

Sensitive Receivers

- Other (Education)
- Other (Passive recreation)
- Other (Place of worship)
- Residential



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

Page 31 of 36

ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (minor)
- Substation
- Stringing station

Sensitive Receivers

- Commercial
- Industrial
- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

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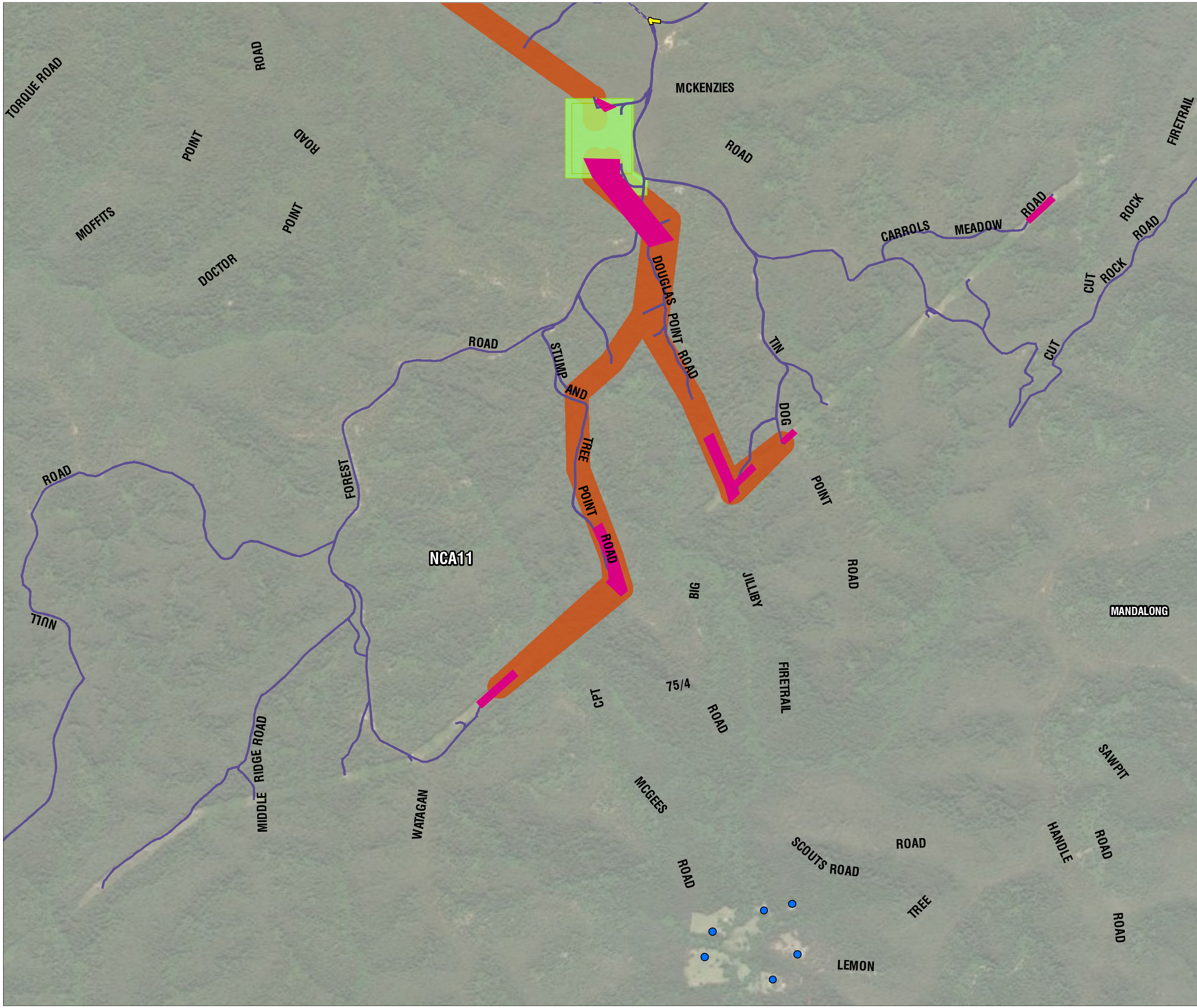
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

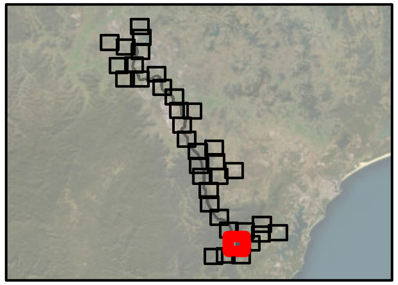


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection
- Stringing station
- Switching station

Sensitive Receivers

- Residential



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Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
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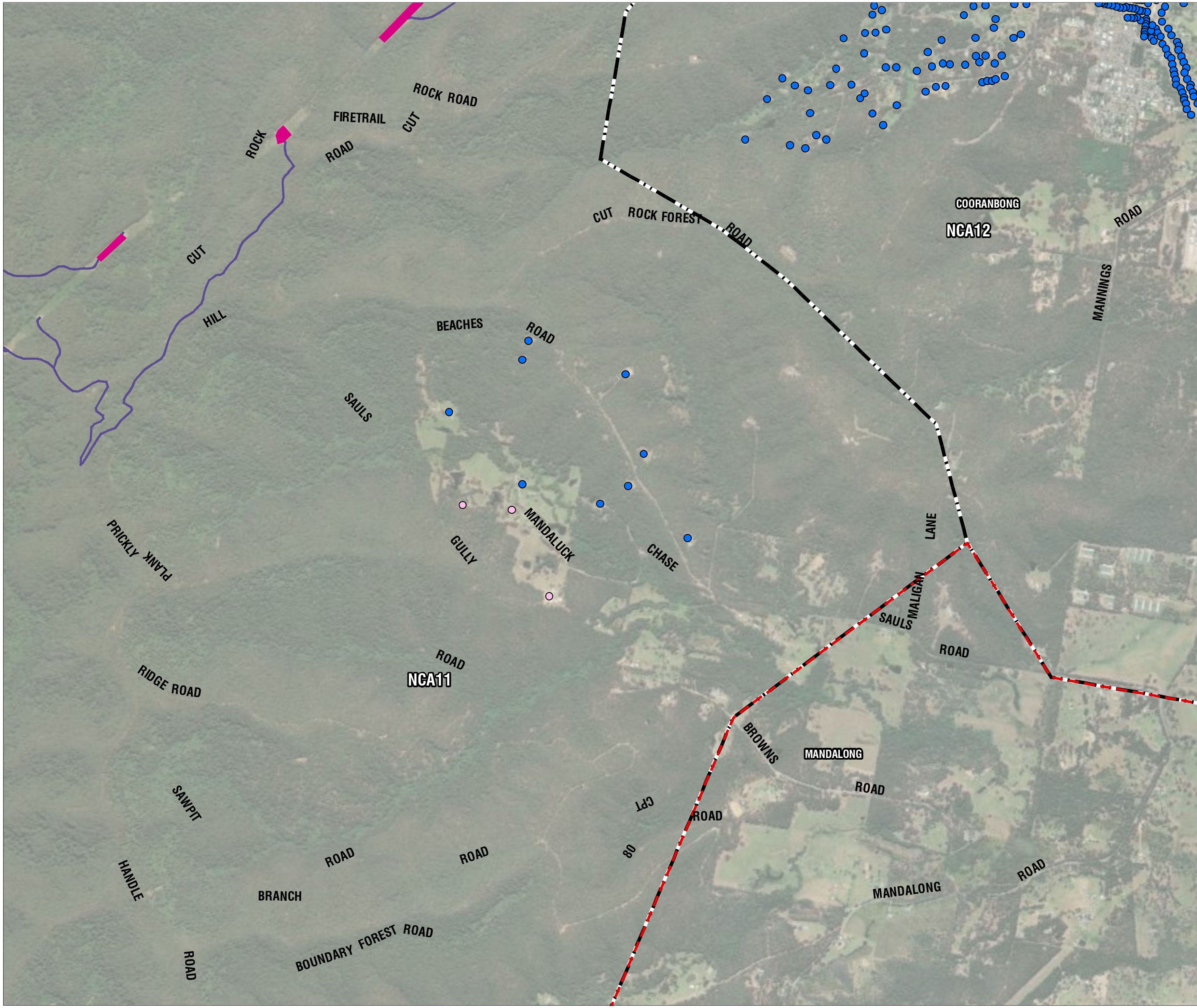
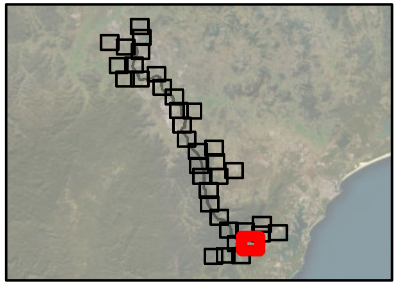
ATTACHMENT B



LEGEND
- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Sensitive Receivers
- Other (Hotel)
- Residential



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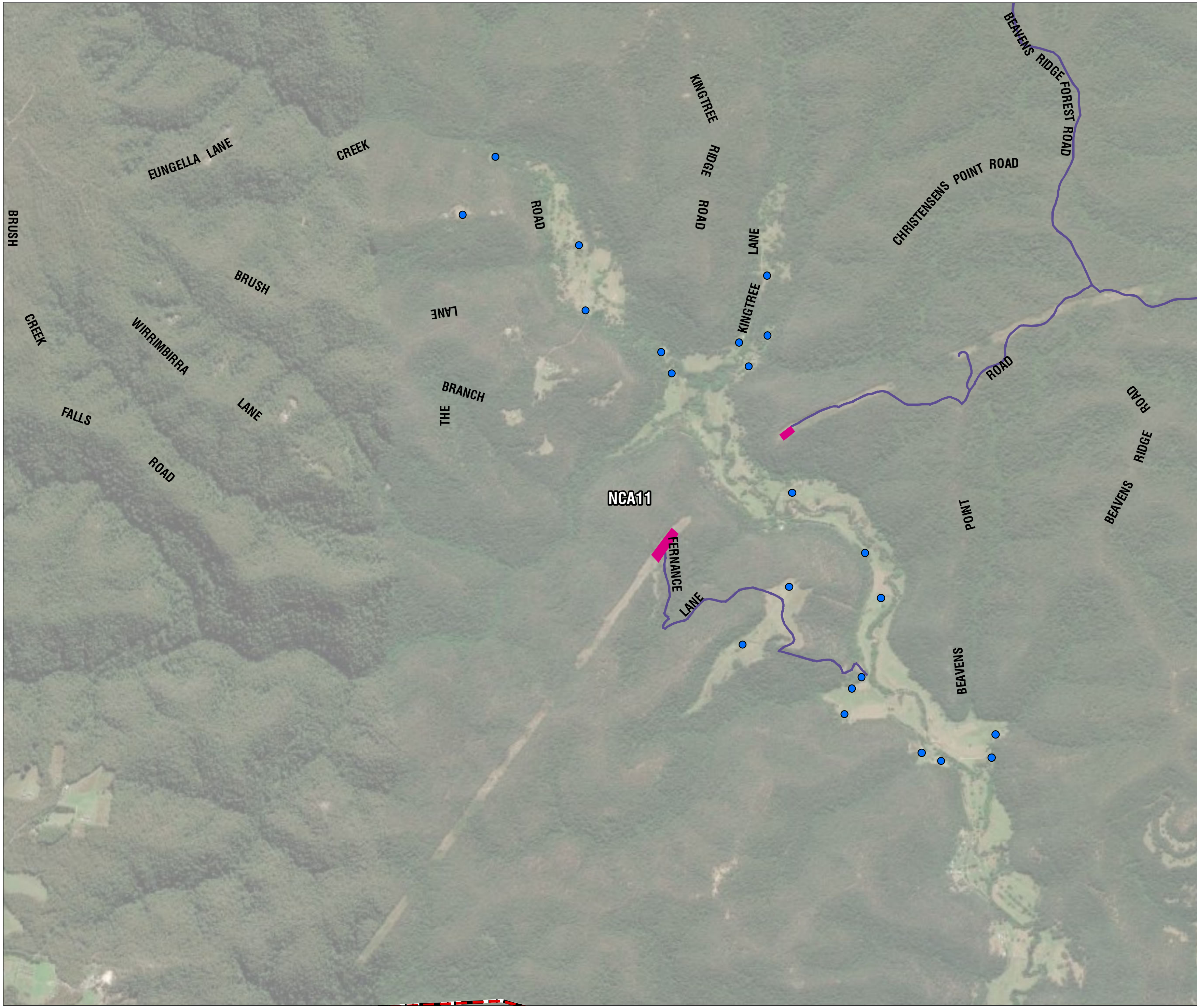
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B

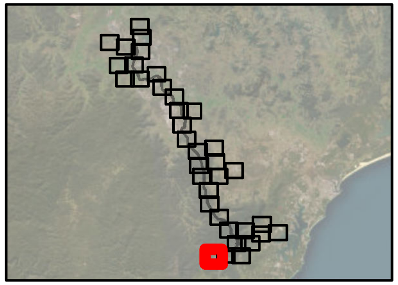


LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Sensitive Receivers

- Residential



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Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
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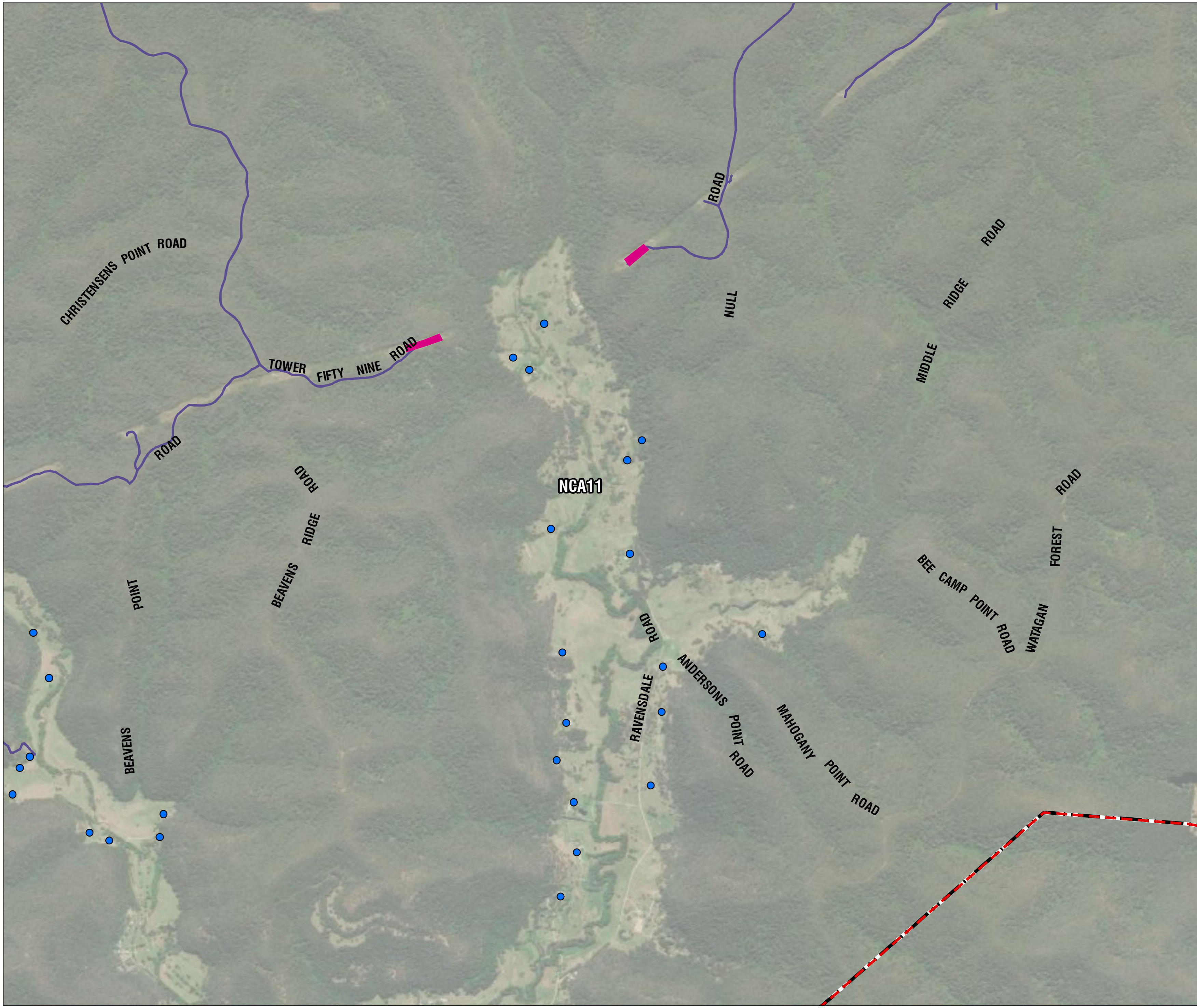


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

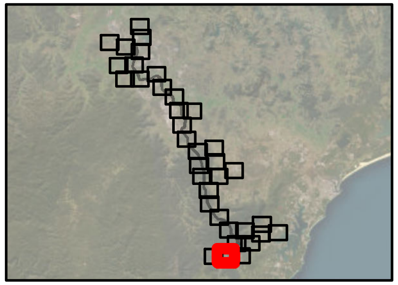
ATTACHMENT B

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Sensitive Receivers

- Residential



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
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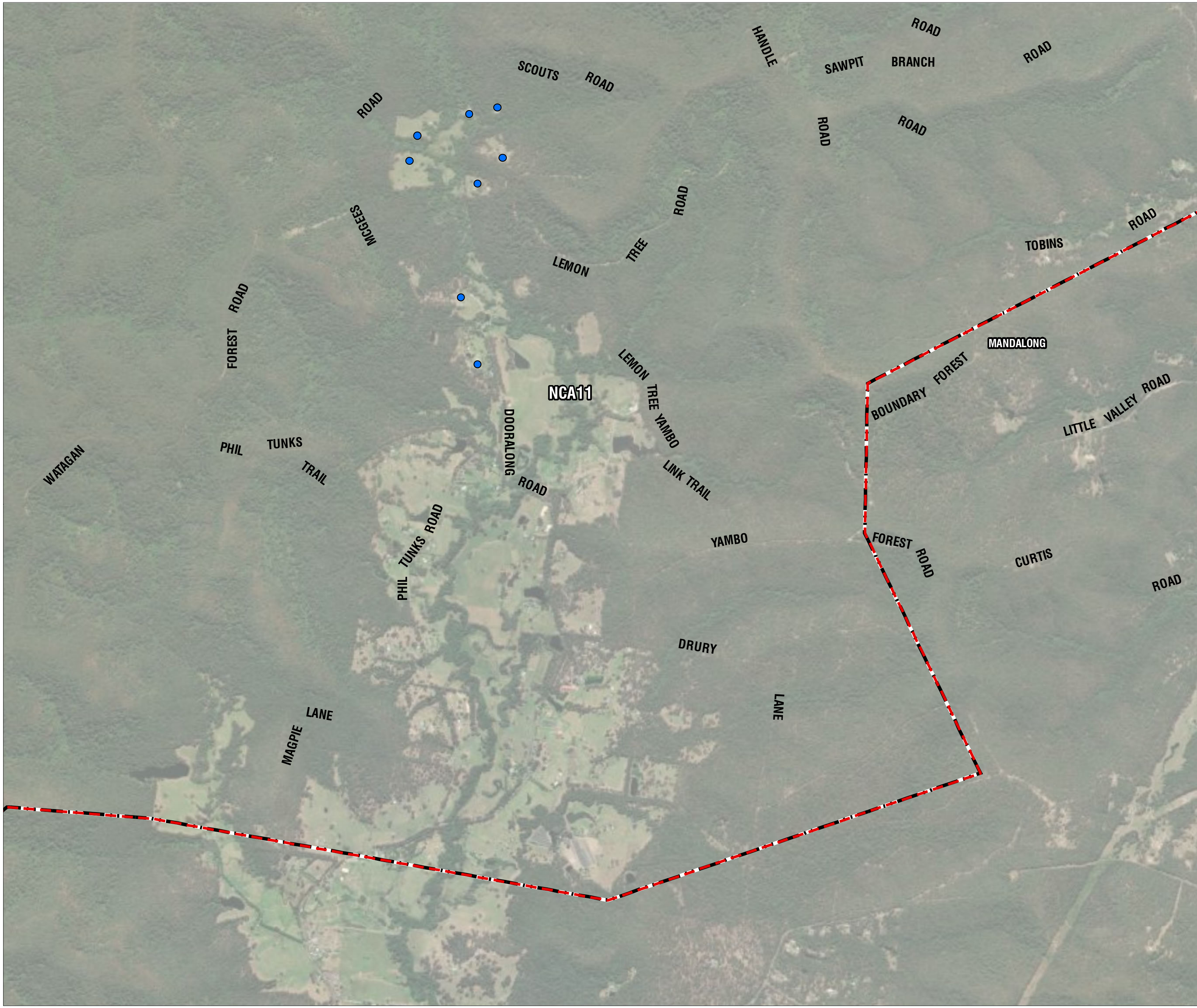
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT B



LEGEND
- Study area
- NCA boundary

Sensitive Receivers
- Residential

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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Attachment C Construction scenarios and equipment

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

14 July 2025

Equipment / Construction scenario	Total sound power level LAeq (LAmax) (dBA)	Chainsaw - 4-5 hp	Compactor	Concrete batching plant	Crane	Crane - franna	Dozer	Elevated work platform	Excavator (10 tonne)	Excavator (tracked) - 35t	Excavator (tracked) - 45t	Generator	Generator - attenuated	Grader	Hydraulic Hammer	Light vehicle	Line marking plant	Pavement laying machine	Power tools	Roller - large pad foot	Roller - smooth drum	Tensioners	Truck	Truck - asphalt	Truck - concrete	Truck - dump	Tub grinder / mulcher	Water cart	Whacker packer	Winching
Sound power level[2] (dBA)		**114**	**106**	**110**	**109**	**102**	**116**	**100**	**100**	**110**	**110**	**109**	**92**	**113**	**122**	**103**	**108**	**114**	**110**	**109**	**107**	**103**	**108**	**103**	**109**	**110**	**116**	**107**	**108**	**108**
Estimated on-time in a 15-minute period		**15**	**15**	**15**	**7.5**	**7.5**	**7.5**	**3**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**5**	**15**	**15**	**15**	**15**	**15**	**15**	**7.5**	**15**	**15**	**5**	**15**	**15**	**15**	**15**
Construction support sites																														
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Concrete works	117																	X			X			X	X	X			X	
Support site operation	112			X									X			X										X				
Laydown sites																														
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Laydown site operation	106					X																	X							

Equipment / Construction scenario	Total sound power level LAeq (LAmax) (dBA)	Chainsaw - 4-5 hp	Compactor	Concrete batching plant	Crane	Crane - franna	Dozer	Elevated work platform	Excavator (10 tonne)	Excavator (tracked) - 35t	Excavator (tracked) - 45t	Generator	Generator - attenuated	Grader	Hydraulic Hammer	Light vehicle	Line marking plant	Pavement laying machine	Power tools	Roller - large pad foot	Roller - smooth drum	Tensioners	Truck	Truck - asphalt	Truck - concrete	Truck - dump	Tub grinder / mulcher	Water cart	Whacker packer	Winching
Substation sites																														
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Concrete works	117																	X			X			X	X	X			X	
Switching stations																														
Earthworks	124		X				X			X				X	X				X	X						X		X		
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Vegetation clearing	120	X					X				X															X	X			
Concrete works	117																	X			X			X	X	X			X	
Accommodation facility																														
Facility operation	106 (118)												X			X							X							

Equipment Construction scenario	Total sound power level LAeq (LAmax) (dBA)	Chainsaw - 4-5 hp	Compactor	Concrete batching plant	Crane	Crane - franna	Dozer	Elevated work platform	Excavator (10 tonne)	Excavator (tracked) - 35t	Excavator (tracked) - 45t	Generator	Generator - attenuated	Grader	Hydraulic Hammer	Light vehicle	Line marking plant	Pavement laying machine	Power tools	Roller - large pad foot	Roller - smooth drum	Tensioners	Truck	Truck - asphalt	Truck - concrete	Truck - dump	Tub grinder / mulcher	Water cart	Whacker packer	Winching
Intersection works																														
Intersection works (typical)	114																X		X				X		X					
Intersection works (intensive)	118									X				X				X	X	X					X					
Access tracks (minor works)																														
Earthworks (minor)	112								X										X							X				
Access tracks (major works)																														
Earthworks	124		X				X			X				X	X				X	X						X		X		
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Corridor																														

Equipment Construction scenario	Total sound power level LAeq (LAmax) (dBA)	Chainsaw - 4-5 hp	Compactor	Concrete batching plant	Crane	Crane - franna	Dozer	Elevated work platform	Excavator (10 tonne)	Excavator (tracked) - 35t	Excavator (tracked) - 45t	Generator	Generator - attenuated	Grader	Hydraulic Hammer	Light vehicle	Line marking plant	Pavement laying machine	Power tools	Roller - large pad foot	Roller - smooth drum	Tensioners	Truck	Truck - asphalt	Truck - concrete	Truck - dump	Tub grinder / mulcher	Water cart	Whacker packer	Winching
Earthworks	124		X				X			X				X	X				X	X						X		X		
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Vegetation clearing	120	X					X				X															X	X			
Concrete works	117																	X			X			X	X	X			X	
Tower assembly / stringing	115				X	X		X				X							X			X	X							X
Tower sites																														
Earthworks	124		X				X			X				X	X				X	X						X		X		
Earthworks (no hydraulic hammer)	119		X				X			X				X					X	X						X		X		
Concrete works	117																	X			X			X	X	X			X	
Tower assembly	115				X	X		X				X							X			X	X							X

Equipment **Construction scenario**	**Total sound power level LAeq (LAmax) (dBA)**	**Chainsaw - 4-5 hp**	**Compactor**	**Concrete batching plant**	**Crane**	**Crane - franna**	**Dozer**	**Elevated work platform**	**Excavator (10 tonne)**	**Excavator (tracked) - 35t**	**Excavator (tracked) - 45t**	**Generator**	**Generator - attenuated**	**Grader**	**Hydraulic Hammer**	**Light vehicle**	**Line marking plant**	**Pavement laying machine**	**Power tools**	**Roller - large pad foot**	**Roller - smooth drum**	**Tensioners**	**Truck**	**Truck - asphalt**	**Truck - concrete**	**Truck - dump**	**Tub grinder / mulcher**	**Water cart**	**Whacker packer**	**Winching**
Stringing sites																														
Stringing	115 (118)				X	X		X				X							X			X	X							X

Attachment D Construction traffic

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

14 July 2025

Road name	RNP road type classification	Pavement type	Existing traffic volume (pass-by)						Construction traffic volume (pass-by)						Highest road traffic noise increase dB (day or night)
			Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		
			LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Freemans Dr east of Mount Faulk Road, Cooranbong	Arterial Road	Sealed	251	25	3367	282	517	40	80	50	412	406	150	74	2.6
Wollombi Road west of Middle Road, Pelton	Arterial Road	Sealed	106	16	2583	183	268	23	50	35	290	280	88	55	3.3
Broke Road south of Bulga Surface Operations access road, Mount Thorley	Arterial Road	Sealed	104	13	922	142	226	28	30	20	164	188	30	20	2.7
Cessnock Road east of Oakley Lane, Singleton Military Area	Arterial Road	Sealed	78	6	941	75	191	10	30	20	164	188	30	20	3.3
Freemans Drive south of Martinsville Road, Martinsville	Arterial Road	Sealed	456	56	9952	703	954	98	80	50	412	406	150	74	1.6

Road name	RNP road type classification	Pavement type	Existing traffic volume (pass-by)						Construction traffic volume (pass-by)						Highest road traffic noise increase dB (day or night)
			Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		
			LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Martinsville Road east of Pringles Road, Martinsville	Arterial Road	Sealed	54	14	877	112	84	16	25	25	200	149	45	25	3.3
Watagan Road west of Martinsville Road, Martinsville	Local Road	Sealed	5	1	132	10	12	1	25	25	200	149	45	25	12.4
New England Highway west of Lemington Road, Ravensworth	Arterial Road	Sealed	929	124	10633	1651	2852	427	50	35	290	280	88	55	0.5
AGL Site Access - West of New England Hwy	Local Road	Sealed	16	104	97	392	41	226	30	30	215	180	50	30	1.2
Golden Highway east of Gouldsville Road, Gouldsville	Arterial Road	Sealed	462	80	4343	938	1214	232	30	20	164	188	30	20	0.6
Lemington Road west of HVO Entrance, Howick	Local Road	Sealed	86	7	518	72	210	10	30	20	164	188	30	20	3.5

Road name	RNP road type classification	Pavement type	Existing traffic volume (pass-by)						Construction traffic volume (pass-by)						Highest road traffic noise increase dB (day or night)
			Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		
			LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Hayes Road (Tower 20 to 50 access route)	Local Road	Sealed	1	0	-	-	-	-	30	20	164	188	30	20	22.1
Hayes Road (Tower 20 to 50 access route)	Local Road	Unsealed	1	0	-	-	-	-	30	20	164	188	30	20	22.1
Mt Baker Road (Tower 53 to 59 access route)	Local Road	Sealed	1	0	-	-	-	-	15	13	89	92	15	13	20.1
Mt Baker Road (Tower 53 to 59 access route)	Local Road	Unsealed	1	0	-	-	-	-	15	13	89	92	15	13	20.1
Pokolbin Mt Rd (Tower 60 to 72 access route)	Local Road	Sealed	1	0	-	-	-	-	30	20	164	188	30	20	22.1
Pokolbin Mt Rd (Tower 60 to 72 access route)	Local Road	Unsealed	1	0	-	-	-	-	30	20	164	188	30	20	22.1
Archerfield Rd - (Tower 142 to 162 access route)	Local Road	Sealed	1	0	-	-	-	-	30	20	164	188	30	20	22.1

Road name	RNP road type classification	Pavement type	Existing traffic volume (pass-by)						Construction traffic volume (pass-by)						Highest road traffic noise increase dB (day or night)
			Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		Peak 1 hour		Day 7am to 10pm		Night (10pm to 7am)		
			LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Archerfield Rd - (Tower 142 to 162 access route)	Local Road	Unsealed	1	0	-	-	-	-	30	20	164	188	30	20	22.1
Pikes Gully Rd - (Tower 183 to 204 and OHEW acess route)	Local Road	Sealed	1	0	-	-	-	-	15	13	89	92	15	13	20.1

Attachment E Audible noise report

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

14 July 2025

Hunter Transmission Project - HTP

Audible Noise and Radio Frequency Interference Study

Prepared for EnergyCo

Prepared by Beca Pty Ltd

ABN: 85 004 974 341

11 July 2025

2583080-RPT-100-UE-001

Contents

Appendices

Appendix A – Parallel Assessment Plots

Revision History

Revision Nº	Prepared By	Description	Date
0	Arpana Korshapati	Draft Issue	28/02/2025
1	Arpana Korshapati (Interim draft)	• Revised AN and RFI results for 200 metres altitude • Included Section 6.4 and parallel assessment results • Interference at typical broadcast frequencies • Point to point (P2P)	23/04/2025
2	Arpana Korshapati	Gold Review – Draft (not for public release)	04/05/2025
3	Arpana Korshapati	Draft Issue (not for public release)	08/07/2025
4	Arpana Korshapati	Transgrid & EnergyCo comments incorporated (not for public release)	11/07/2025

Document Acceptance

Action	Name	Signed	Date
Prepared by	Arpana Korshapati		11/07/2025
Reviewed by	Chris Taylor Genevieve Steel		11/07/2025
Approved by	Adriana Loreto		11/07/2025
on behalf of	Beca Pty Ltd		

Glossary of Terms

ACSR	Aluminium Conductor Steel Reinforced
AN	Audible Noise
ANSI	American National Standards Institute
AS	Australian Standard
AS/NZS	Australian Standard/New Zealand Standard
AVP	Australian Energy Market Operator Victorian Planning
BPA	Bonneville Power Administration
BoM	Bureau of Meteorology
CB	Citizen Band
CDEGS	Current Distribution Electromagnetic Interference Grounding and Soil Structure Analysis
CIGRE	International Council on Large Electric Systems
CISPR	International Special Committee on Radio Interference
EMI	Electro Magnetic Interference
EPA	Environment Protection Authority
EPRI	Electric Power Research Institute
FZ	Fresnel Zone
ITU	International Telecommunication Union
kV	Kilovolts
NCA	Noise Catchment Area
NPfI	Noise Policy for Industry
PNTL	Project Noise Trigger Level
p.u	per unit
QP	Quasi Peak
REZs	Renewable Energy Zones
RFI	Radio Frequency Interference
RMS	Root Mean Square
RW	Round Wire
STD	Standard Deviation
SVG	Surface Voltage Gradient
TV	Television
TVI	Television Interference
TW	Trapezoidal Wire
UHF	Ultra High Frequency
VHF	Very High Frequency

Executive Summary

EnergyCo has commissioned Beca Pty Ltd (Beca) to evaluate the electrical performance of the new Hunter Transmission Project (HTP) overhead 500 kV transmission line with respect to Audible Noise (AN) and Radio Frequency Interference (RFI). The AN and RFI performance of the HTP line have been assessed at heights of 1 metre and 2 metres above ground.

The high Surface Voltage Gradients (SVG) on the transmission line conductors will result in the ionisation of the air in a small region surrounding the conductor surfaces. These partial discharges, known as corona discharges, produce AN and RFI. The AN and RFI emissions from the transmission lines will increase significantly during rain conditions when small droplets form on the surface of the conductors and amplify the SVG.

Surface Voltage Gradients of Conductors

Transgrid and Australian standards recommend limiting the conductor SVG to less than 16 kV/cm. This limitation helps mitigate the AN and RFI impact on public amenity in residential areas, while preserving the performance of communication channels. The standards however permit higher SVG values if acceptable AN and RFI performance can be demonstrated. The design of the HTP 500 kV double circuit transmission line is expected to produce average maximum[1] SVG values on the conductor bundles of up to 16.2 kV/cm. Consequently, a risk assessment is required to evaluate whether the AN and RFI impact from these transmission lines on the local environment is acceptable.

Audible Noise

The AN produced by a transmission line comprises both a wideband crackling sound with significant high frequency content as well as very narrowband tones, the most significant of which is the 100 Hz tone.

The Electric Power Research Institute (EPRI) semi-empirical calculation method has been applied to determine the wideband AN level of the line considered in this study. The following has been observed:

- Fair weather AN levels will be within the project noise trigger levels or close to the edge of the line easement.
- The maximum observed AN levels under the wet weather conditions are within Transgrid's nominated 50 dB limit at the edge of its easement.
- Under wet conditions, the project noise trigger levels are achieved within 425 metres from the centreline of the transmission line.
- The noise limits set by the NSW Noise Policy for Industry are reduced by 5 dB if tones are significant, this may need to be accounted for when assessing sensitive receivers.

Radio Frequency Interference

The RFI limits specified in AS 2344 are intended to protect radio and television reception from perceived annoyance, particularly for music listeners who are highly sensitive to even low levels of interference. Higher RFI emission levels might be acceptable for less sensitive receivers or in situations where there is greater tolerance for reduced intelligibility or increased annoyance, such as voice-only communication channels.

[1] The average maximum surface voltage gradient is defined as the average of the maximum surface gradients on each individual sub-conductor forming the conductor bundle.

The international Council on Large Electric Systems (CIGRE) empirical calculation method has been employed to determine the RFI levels for the HTP transmission line. The following has been observed:

- Calculated RFI emission levels will exceed the AS 2344 limits at the edge of the transmission line easement during L_{50} wet conditions for AM radio reception only.
- Under wet conditions, RFI is likely to negatively impact commercial AM radio reception within 131 metres from the centre of the transmission line.

Other forms of communication are not noticeably affected by RFI at the edge of the transmission line easement.

Recommendations and Next Steps

The following next steps and recommendations are proposed:

- Investigations are carried out to identify sensitive receivers[2] (e.g. residential dwellings and places of work, education, or worship) within the AN risk zone either side of the HTP 500 kV double circuit transmission line easement. In addition to identifying existing sensitive receivers, publicly available council Local Environmental Plans (LEP) should be reviewed to identify any authorised, but not yet constructed developments. Modifying factors for tonality may need to be considered at sensitive receivers identified within the AN risk zone.
- RFI investigations to be undertaken to identify any sensitive receivers within 131 metres from the centre HTP 500 kV double circuit transmission line. The impact to each receiver should be assessed for compliance with the 80/80[3] rule in accordance with AS 2344.

[2] The sensitive receiver investigation area should extend beyond the identified risk zones, such that all sensitive receivers are covered and to allow for potential design changes. The investigation area considered by SLR Consulting covers at least 1.5 km either side of the preferred transmission line alignment.

[3] The measured levels must comply with the limits for at least 80% of the time with a confidence level of at least 80% (80/80 rule).

1. Introduction

The Hunter Transmission Project (HTP, the project) involves the construction of a new overhead 500 kV transmission line of around 110 kilometres connecting the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring in the Hunter region of New South Wales (NSW).

Due to its strategic importance, the NSW Minister for Planning and Public Spaces has declared the HTP to be critical State significant infrastructure (CSSI) under the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

Under this process, the Energy Corporation of NSW (EnergyCo, the proponent) is required to prepare an environmental impact statement (EIS) in accordance with the NSW Environmental Planning and Assessment Regulation 2021.

This Audible Noise and Radio Frequency Interference Assessment informs the Noise and Vibration assessment for the EIS for the HTP and addresses the Secretary's environmental assessment requirements (SEARs) issued on 13th August 2024 (see Table 1).

Table 1: HTP SEARs – Audible Noise

Reference	Assessment Requirements
Amenity	• an assessment of the construction, operational and road noise and vibration impacts of the project
Hazards and risk	• identify possible effects on telecommunications systems, assess impacts and mitigation measures to avoid potential disruptions to radio communication services, which may include the installation and maintenance of alternative sites

The HTP scope includes:

- a new overhead 500 kV double circuit transmission line of around 110 kilometres (the HTP corridor),
- two new switching stations (Bayswater South and Olney),
- upgrade of existing Bayswater and Eraring substations,
- adjustments and upgrades to existing transmission lines,
- property adjustment works to facilitate access to the transmission lines and switching stations,
- utility adjustments required for the construction of the transmission network infrastructure, and
- ancillary works to support construction, including establishment of new access tracks and upgrade of existing access tracks, and construction support sites (some with temporary worker accommodation), and other construction facilities such as laydown areas.

The new transmission line would transport electricity generated in the Central-West Orana and New England Renewable Energy Zones (REZs). It would connect the existing 500 kV transmission line at Bayswater to the existing 500 kV transmission line in the Olney State Forest near Eraring. This would strengthen the State's core electricity grid and supply clean and reliable energy to NSW consumers for generations to come.

The HTP involves development across 5 local government areas (Muswellbrook, Singleton, Cessnock, Central Coast and Lake Macquarie). Most of this development would be concentrated in and around the HTP corridor.

An overview of the HTP is provided in Table 2 and shown in Figure 1. Further details are provided in Chapter 4 (Project description) of the HTP Environmental Impact Statement (EIS).

Table 2 Project overview

The project	• The critical State significant infrastructure application for the HTP covers 5 local government areas • Most development would be concentrated in and around the HTP corridor. Some ancillary development such as construction support sites and temporary worker accommodation, road upgrades and laydown areas would be outside the HTP corridor
Project impact area	• The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
Construction and operation	• Construction impact area around 2351 ha • Operation impact area around 1261 ha
Disturbance area	• Disturbance area around 1266 ha • Disturbance area A around 683 ha • Disturbance area A (centreline) around 214 ha • Disturbance area B around 367 ha • Disturbance area HZ around 1.84 ha
New transmission line and transmission towers	• Overhead 500 kV double circuit transmission line of around 110 km between Bayswater South 500 kV switching station and Olney 500 kV switching station • Steel lattice towers up to 85 m high and that are spaced anywhere between 75 m to around 1.3 km apart (typically between 300 m and 600 m) • 500 kV transmission lines with a minimum vegetation clearance of 13.5 m • Ancillary infrastructure such as earth wire and communications systems • Construction easement of around 140 m wide • Operational easement around 70 m wide
Switching stations/ substation works	• New Bayswater South 500 kV switching station – construction impact area around 26.6 ha • Modifications at the existing Bayswater 500 kV/330 kV substation within the existing footprint • New Olney 500 kV switching station – construction impact area around 20 ha • Augmentation and modifications at the existing Eraring 500 kV/330 kV substation, including installation of 2 new transformers
Adjustments and crossings -existing transmission lines	• Adjustments to existing double circuit 500 kV transmission lines: — Line 5A1 and 5A2: Eraring – Kemps Creek 500 kV at Ravensdale to connect to the new Olney 500 kV switching station — Line 5A3: Bayswater – Mt Piper 500 kV at Bayswater to connect to the new Bayswater South 500 kV switching station — Line 5A4: Bayswater – Wollar 500 kV at Bayswater to connect to the new Bayswater South 500 kV switching station • Adjustments to existing double circuit 330 kV transmission lines: — Line 31: Bayswater – Regentville 330 kV — Line 32: Bayswater – Sydney West 330 kV — Line 81: Newcastle – Liddell 330 kV • Crossing of existing double circuit 330 kV transmission lines: — Line 31: Bayswater – Regentville 330 kV at Bayswater — Line 32: Bayswater – Sydney West 330 kV at Bayswater — Line 81: 330 kV: Newcastle – Liddell 330 kV at Lemington and again at the Singleton Military Area

	— Line 82: 330 kV: Tomago – Liddell 300 kV at Warkworth and again at the Singleton Military Area
Upgrades – existing transmission lines and towers	• Upgraded earth wire on Line 5A3 and Line 5A4 • Upgraded earth wire and communications systems on Line 5A1 and Line 5A2 • Tower strengthening on various existing towers on Line 5A1, Line 5A2, Line 5A3 and Line 5A4
Road works	• Modifications to the existing public road network • New and upgraded access tracks for construction and operation
Construction support sites	• Five construction support sites: Hebden Road, Pikes Gully Road, Gouldsville Road, Wollombi Road and Freemans Drive • Helicopter pads (helipads) indicatively at: Hebden Road, Pikes Gully Road, Gouldsville Road and Freemans Drive
Ancillary sites	• Laydown areas, which would be established to allow for flexibility in construction and to minimise the need for vehicle movements to and from the construction support sites
Utility adjustments	• Third party utility works including gas, telecommunications, water, sewer and stormwater
Timing	• Construction to start in 2027 • Operation by end of 2029

2. Scope of Study

Beca Pty Ltd (Beca) has been commissioned by EnergyCo to assess the electrical performance of the new HTP transmission line with respect to Audible Noise (AN) and Radio Frequency Interference (RFI). The preferred alignment for the new 500 kV transmission line is identified as an **orange** line in Figure 1. This line is representative of the location of the HTP transmission line for the purposes of the EMF assessment, and it is referred to by this study as HTP 500 kV double circuit transmission line.

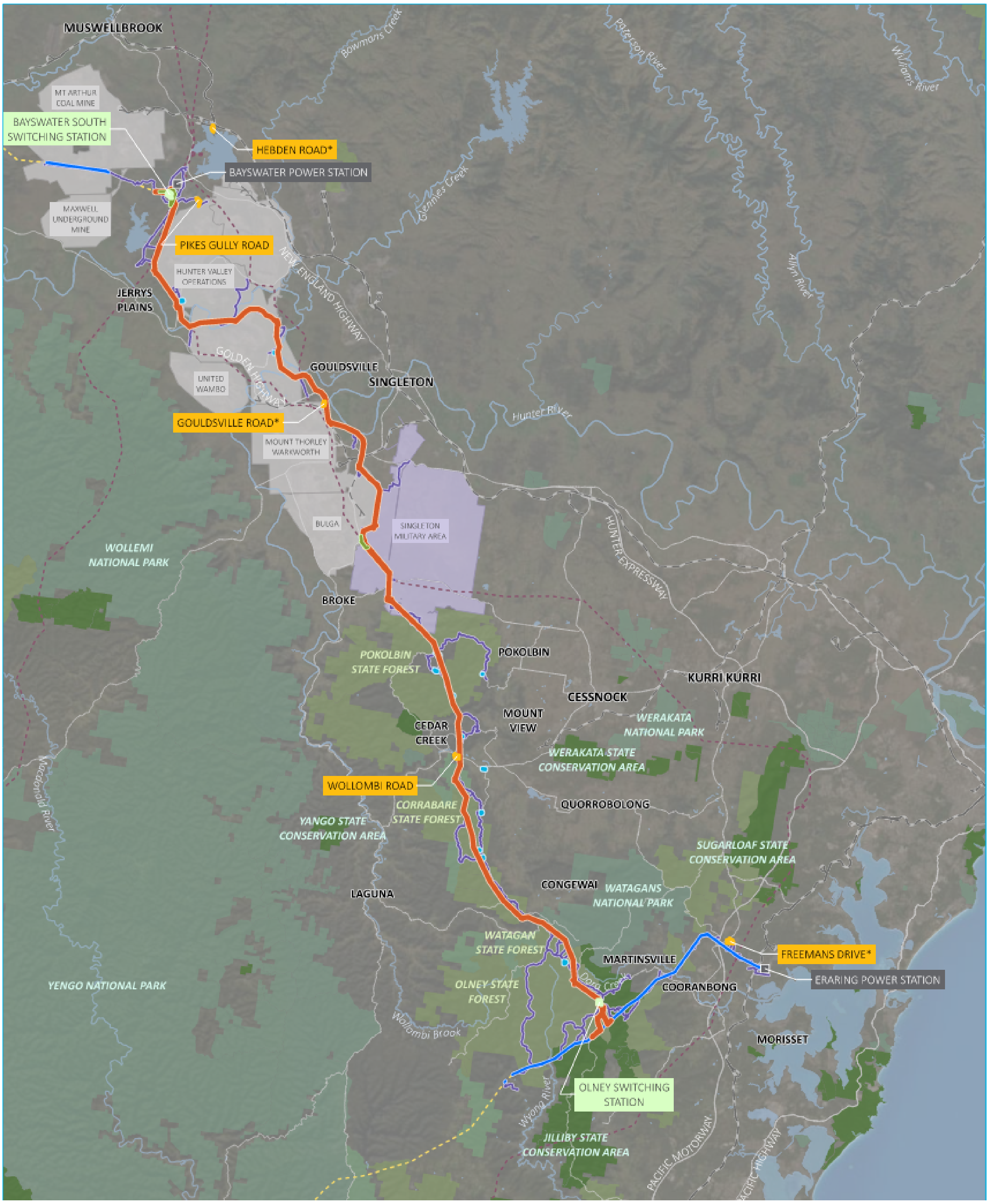

Figure 1: Hunter Transmission Project Overview

The scope of this study is to:

- Calculate the surface voltage gradients (SVG).
- Calculate the AN performance of the transmission line (at edge of easement) and determine the specific conditions where AN Levels exceed the allowable limits.
- Calculate the RFI performance of the transmission line (at edge of easement) and determine the specific conditions where RFI levels exceed the allowable limits for identified broadcasts (and typical broadcasts) in accordance with AS 2344, including: AM radio, FM radio, Aeronautical VHF, CB UHF and Digital TV.
- Identify the distance from centre of the line easement whereby sensitive receivers may be impacted (AN – Intrusiveness criteria, and RFI – Class 3 reception).

This study has been carried out in accordance with the requirements of the relevant Transgrid, Australian and international standards, industry guidelines and publications as specified in Table 3.

Table 3: Standards, policies and industry guidelines/publications referenced in the study.

Document / Org	Specification, Standards and Manuals	Revision
Transgrid Standards, Specifications and Manuals		
-	Transgrid transmission lines standards and guidelines	-
International Standards & Publications		
AS/NZS 7000	Overhead line design	2016
AS 1055	Acoustics: Description and measurement of environmental noise	2018
AS 2344	Limits of electromagnetic interference from overhead alternating current. powerlines and high voltage equipment installation in the frequency range 0.15 MHz to 3000 MHz	2016
Policies and Guidelines, Technical Notes and Publications		
NSW EPA NPfI	New South Wales Environment Protection Authority – Noise Policy for Industry	2017
CISPR TR 18-1	Radio interference characteristics of overhead power lines and high-voltage equipment – Part 1: Description of phenomena	2017
CISPR TR 18-2	Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits	2017
EPRI	EPRI AC Transmission Line Reference Book – 200 kV and Above	3rd Edition
CIGRE TB 20	CIGRE Technical Brochure No. 20: Interferences produced by corona effect of electric systems – Description of phenomena, Practical guide for calculation	1974
IEEE TPAS, Vol. PAS-101, Issue:10	A Comparison of Methods for Calculating Audible Noise of High Voltage Transmission Lines	1982
IEEE TPAS, Vol. PAS-100, Issue:1	Formulas for Predicting Audible Noise from Overhead High Voltage AC and DC Lines	1981
IEEE TPAS, Vol. PAS-92, Issue: 3	Comparison of Radio Noise Prediction Methods with CIGRE/IEEE Survey Results	1973
IEEE TPAS, Vol. PAS-91, Issue: 3	“An Analysis of Transmission Line Audible Noise Levels Based upon Field and Three-Phase Test Line Measurements”	1972
IEEE TPAS, Vol. PAS-99, Issue: 1	Review of Technical Considerations on Limits of Interference from Power Lines and Stations”,	1980
M. Ryan, M. Lanchester, S. Pugh (Paper No. 37)	“Noise Reduction through Facades with Open Windows”, Proceedings of ACOUSTICS 2011, Paper Number 37, 2 - 4 November 2011.	2011

Document / Org	Specification, Standards and Manuals	Revision
Southwire Energy Division	"Corona Effects on Bare Overhead Conductors", Oncor Presentation, 2015	2015
Research Studies Press	P. S. Maruvada, Corona Performance of High-Voltage Transmission Lines	2000
-	State of New York Public Service Commission, Opinion and Order Determining Health and Safety Issues, Imposing Operating Conditions, and Authorizing, in Case 26529, Operation Pursuant to those Conditions, Opinion No. 78-13	1978 and 1980

Qualifications and Assumptions:

- The findings of this study consider general requirements only. Some locations may have additional, more stringent requirements, including but are not limited to defence sites, precision agriculture, and medical facilities.
- It is assumed that transmission-line hardware is designed and tested such that the corona discharge is insignificant when compared to the conductors. Transmission line hardware is not considered by this study.
- Substation infrastructure is not considered by this study.
- Adjustments and upgrades to existing transmission lines are not considered by this study.
- This report is a supporting document for the "Noise and vibration impact assessment" required to accompany the EIS for the HTP and addresses the Secretary's Environmental Assessment Requirements (SEARs) issued on 13 August 2024.
- Site investigations e.g. noise measurements are to be undertaken by the noise specialist consultant (SLR) and are excluded from the scope of this document.
- Identification and evaluation of sensitive receivers is to be undertaken by the project noise consultant and excluded from the scope of this document.

3. Study Inputs

The content and outcomes of this report are based on the documents referenced in this section. This information has been supplied and confirmed by EnergyCo (or developed) under this project for use in this assessment. Any significant changes to this information will require a revision of this document.

3.1 Reference Documents

The listed documents in Table 4: and Table 5: includes drawings and information which have been referred to in this assessment.

Table 4: Reference documents used in this study

Reference	Title	Rev
2583080-RPT-100-JB-001	Hunter Transmission Project – Basis of Design	4.0
-	HTP1 - V2.8 - Transpositions @ 61, 127[4] (.kmz)	-
-	Line 81 (.Kmz)	-
-	Line 82 (.Kmz)	-
-	66 kV Ausgrid Line (.Kmz)	-
-	132 kV Ausgrid Line (.Kmz)	-
-	66 kV HVO Lines (Ausgrid)(.Kmz)	-
-	33 kV AGL Line (Ausgrid)(.Kmz)	-
-	Line 31 and Line 32 (.Kmz)	-
-	SLR Consulting, Hunter Transmission Project Noise and Vibration Impact Assessment	-
2583080-RPT-100-UE-002	Hunter Transmission Project- HTP- Transmission Lines Electric and Magnetic Fields (EMF) Assessment	1

Table 5: Reference tower drawings used in the study

Reference	Title	Rev
SKE-2583080-TL-001	Hunter TP 500 kV TL- Suspension tower type VSE/VSEH	-
SKE-2583080-TL-002	Hunter TP 500 kV TL- Light strain tower type VTU	-
SKE-2583080-TL-003	Hunter TP 500 kV TL- Medium strain tower type VTV	-
SKE-2583080-TL-004	Hunter TP 500 kV TL- Heavy strain tower type VTW	-
2583080-DRG-400-TL-0011_1	Transgrid line crossings HTP1 Span 92-93, 330 kV Line 81 (Deviation)	1
2583080-DRG-400-TL-0011_4	Transgrid line crossings HTP1 Span 176-177, 330 kV Line 81 (Deviation)	1

[4] Project brochure available online: https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-70610456%2120240509T042827.867%20GMT

4. AN and RFI Assessment Criteria

The following section identifies the assessment criteria and limits of the AN and RFI study considered in this report.

4.1 Surface Voltage Gradient

The source of the corona discharges on transmission line conductors is the high electric field strength near the surface of each conductor, which is referred to as the conductor Surface Voltage Gradient (SVG). Other factors, such as the accumulation of pollution and water droplets on the conductor surface influence the level of corona discharge. It is, however, the unperturbed electric field strength that is used as the reference field for the corona calculations. The effect of pollution and rain on the corona performance is then determined by adding empirical correction factors (environmental factors) to the reference performance.

Transgrid transmission lines standards and guidelines identify a maximum conductor SVG of 16 kV/cm[5] being generally accepted as a design criteria for sizing conductors and determining bundle sizes. This is in line with recommendations of AS/NZS 7000 for limiting the generation of corona discharges. The intention of this design criteria is to minimise the impact of AN and RFI on the local environment.

The corona performance of a transmission line is primarily dependent[6] on the average maximum SVG on the phase conductor bundles.

The study of these phenomena depends on factors relating to the system definition, i.e. phase conductor and bundle arrangements, system operating conditions and tower/line configurations for conductor heights relative to an observation point and weather conditions.

4.2 Audible Noise

Audible noise performance of a transmission line is primarily determined by the noise generation function, and the propagation of noise away from the source (i.e. line)[7]. Conductor corona generates two forms of audible noise - a wideband, random crackling sound and very narrowband tones - the most significant of which is the 100 Hz tone[8]. The wideband noise is the dominant component of the emitted sound energy; however, the narrowband tonal component may become particularly significant on new conductors with a hydrophobic surface under wet conditions.

Transgrid's transmission lines standards and guidelines recommend that audible noise is assessed for using the EPRI semi-empirical calculation method and advise a 50 dB(A) noise limit at the edge of the 70 metres easement in wet ($L_{50\ wet}$) conditions.

The NSW Noise Policy for Industry (NPfI) addresses the impact of noise from industrial sources scheduled under the Protection of the Environment Operations Act 1997. While transmission line easements are not 'scheduled premises' under the Act (i.e. NPfI does not necessarily apply), the NPfI does provide a framework for assessing the transmission line noise emissions.

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[5] Per Transgrid's transmission lines standards and guidelines, higher values of SVG may be accepted by Transgrid where acceptable AN and RFI performance is demonstrated.

[6] The line's corona performance is less influenced by secondary factors such as altitude and pollution. Severe pollution may however have a more significant effect on the corona performance of a transmission line and is generally specific to a particular area.

[7] EPRI AC Transmission Line Reference Book – 200 kV and Above- third edition

The intrusiveness noise level[9] and project amenity noise level[10] as defined in the NPfI have been provided for each Noise Catchment Area (NCA) by SLR Consulting[11] as an input to this document. The limits apply at the location of the sensitive receivers (i.e. the residential dwellings or places of work). Refer to Table 6 for a summary of project noise trigger levels and Figure 2 for NCA locations.

Table 6: Project noise trigger levels adopted for transmission lines considered in this study

Receiver Location	Assessment / Receiver Type	Project Noise Trigger Levels ($dBA_{Leq,15min}$)
NCA01	Day	42
	Evening	41
	Night	38
NCA03	Day	41
	Evening	38
	Night	37
NCA04	Day	40
	Evening	36
	Night	36
NCA05	Day	43
	Evening	40
	Night	38
NCA09	Day	40
	Evening	39
	Night	38
NCA11	Day	40
	Evening	37
	Night	35
NCA12	Day	42
	Evening	40
	Night	36
NCA13	Day	48
	Evening	48
	Night	43
NCA14	Day	40
	Evening	40
	Night	38
All other NCAs (NCA02, NCA06, NC08)	Day	40
	Evening	35
	Night	35
Edge of easement	Transgrid transmission lines standards & guidelines	50

In some locations a 35 dB(A) noise limit is adopted. Several international studies and legal proceedings have confirmed that 35 dB(A) is an appropriate maximum limit in a bedroom to address the impact of sleep disturbance. These studies have however also considered a reasonable attenuation factor for the high

[9] The intrusiveness noise level protects the community from intrusive noise by limiting the extent to which a noise source can exceed the background level. EPA states in Section 2.3 of the NPfI that the L_{EQ} level of noise intrusion from wideband noise sources may be up to 5 dB above the L_{90} background noise level at the receptor without being considered intrusive.

[10] The project amenity noise level preserves community amenity by providing an overall noise-level cap for different land uses

[11] SLR Consulting, Hunter Transmission Project Noise and Vibration Impact Assessment

frequency AN source through a partially open window, which increased the AN limit outside the house is 52 dB(A). No attenuation due to walls or windows is considered by this assessment.

A modifying factor to account for the additional annoyance of a tonal noise source may need to be applied. The Modifying factor for tonal noise is specified by Table C1 in Fact Sheet C of the NPfI as 5 dB. The criteria used to assess the 100 Hz tonality associated with corona AN is a one-third octave band level that exceeds the level of the adjacent bands on both sides by 15 dB or more.

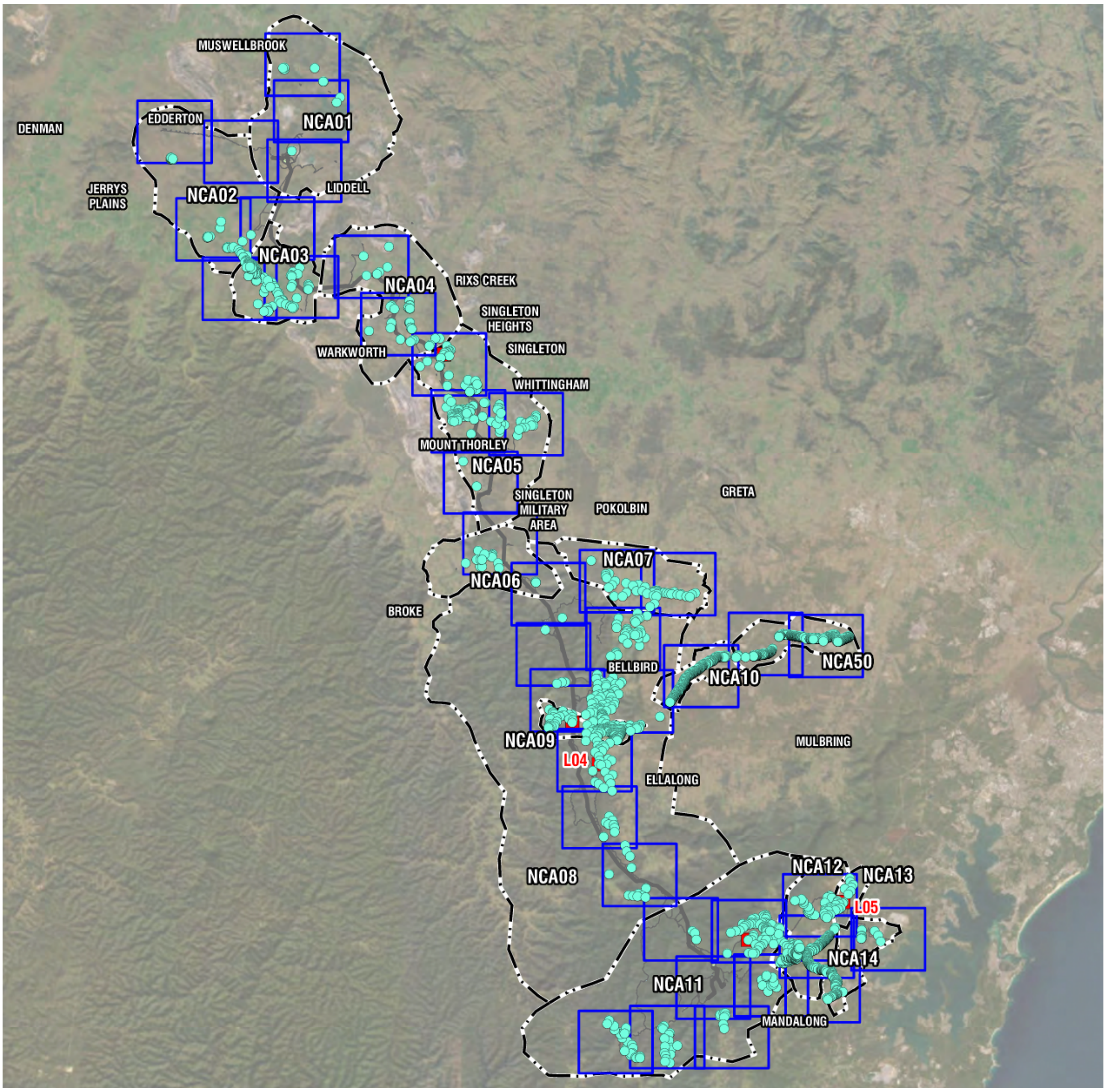

Figure 2: Hunter Transmission Project Noise Catchment Areas

4.3 Radio Frequency Interference

Limits for electromagnetic interference (radio disturbance) from the transmission lines considered in this study are established in AS 2344 in the frequency band 0.15 MHz to 3000 MHz. A satisfactory level of radio reception, as defined by the International Telecommunication Union (ITU), can be expected for broadcast, navigation, safety-of-life and other radio communication services in areas where the emissions from the transmission line are below these limits. These limits are generally applied at the boundary of the respective line easement.

New South Wales falls into ITU Region 3, Zone C. The applicable RFI emission limits for this zone and the (mostly) rural environments along the HTP line route are summarised in Table 7.

Compliance with the limits is verified by testing in accordance with CISPR TR 18-2. The measured levels at an appropriate location must comply with the limits for at least 80% of the time with a confidence level of at least 80% (80/80 rule). The only variability considered in the calculations was that between fair and wet weather conditions (and rainfall rate), the effects of wind, temperature, relative humidity and pollution will be negligible in comparison.

Table 7: RFI limits applied at the edge pf the transmission line easements

Frequency (MHz)	Field Strength (dBµA/m)		Field Strength (dBµV/m)
	Urban Areas[12]	**All Other Areas**	
0.15 – 0.3	-1.5	-1.5	n/a
0.3 – 0.5	-15.5	-15.5	n/a
0.5 – 1.7	-1.5	-15.5	n/a
1.7 – 3	-15.5	-15.5	n/a
3 – 30[13]	-15.5 to -28.5	-15.5 to -28.5	n/a
30 – 230	n/a	n/a	30
230 – 1 000	n/a	n/a	37
1 000 – 3 000	n/a	n/a	60

The RFI limits defined in AS 2344 are derived for a signal to noise protection ratio of 30 dB considering Region 3 as applicable to NSW Australia.

It is noted that these limits are defined for the protection of broadcast and communication reception against the subjective annoyance caused by the interference from transmission line RFI, specifically for perceived annoyance to music listeners. Higher RFI emission levels may be tolerable for less sensitive receivers (e.g. receivers located close to the relevant transmitter or receivers that use more sophisticated modulation techniques) or where there is greater tolerance for reduced intelligibility or increased annoyance.

Transgrid's transmission lines standards and guidelines specify that the "Class" defining the quality of reception using the CIGRE scale should not be worse than Class 3 for wet conductors.

[12] Applicable to areas having a population of greater than 2000 people that are serviced by local broadcast stations

[13] The limit decreases linearly with the logarithm of the frequency from 3 MHz to 30 MHz

5. System Definition

The corona performance of a transmission line is primarily dependent on the average maximum Surface Voltage Gradient (SVG) on the phase conductor bundles and weather conditions that result in water droplet formation on the surface of the conductors, which includes mist, fog and rain.

The line's corona performance is less influenced by secondary factors such as altitude and pollution. Severe pollution may however have a more significant effect on the corona performance of a transmission line and is generally specific to a particular area (e.g. seasonal insect swarms or severe dust storms).

The study of these phenomena depends on factors relating to the system definition, i.e. phase conductor and bundle arrangements, system operating conditions and tower/line configurations for conductor heights relative to an observation point and weather conditions.

5.1 HTP 500 kV Double Circuit Transmission Line

5.1.1 Phase and Bundle Arrangement

The baseline parameters used for the assessment in this report as taken from the basis of design report for the Hunter transmission project are summarised in Table 8.

Table 8: HTP transmission line – study parameters

Parameters	Description
Phase Conductors	Orange ACSR/GZ
Phase Sub-Conductors / Bundle Spacing	4 / 460 mm
Earth wires[14]	SC/AC 7/4.24
Minimum Ground Clearance	13.5 metres
Phase to Phase (V)	550 kV,1.1 p.u
Phase to Neutral (V)	317.54 kV,1.1 p.u
Observation Zone	1 metre (Maximum height of child, or seated adult) 2 metres (Maximum standing height of adult)
Transmission Line Easement	70 metres wide easement (35 metres from centreline)
System Frequency	50 Hz
Phasing Arrangement	Circuit 1 (Right) - RWB and Circuit 2 (Left) - BWR
Preferred Line Route	As per GIS information provided by EnergyCo

5.1.2 Tower Geometry

There are four tower types proposed along the length of HTP 500 kV double circuit transmission line:

- VTU – Light Tension Tower.
- VTV – Medium Tension Tower.
- VTW – Heavy Tension Tower.
- VSE – Suspension Tower / VSEH – Heavy Suspension Tower.

The tower outline drawings referenced in Section 3 define the relative position of each phase. The positions, as derived from these drawings, are summarised in Table 9 and have been adopted for the assessment. Actual

[14] SC/AC 7/4.24 earth wires (2 off) have been considered for all models in this assessment.

design dimensions may vary from the concept dimensions used. Differences are likely to be small, but reconfirmation of the calculated values may be required if designs vary significantly.

Table 9: HTP 500 kV double circuit transmission line tower geometry

Tower Type	Phase/Earthwire	Horizontal distance from tower centre (metres)	Average Height (at midspan) (metres)
VTU Light Strain Tower	A (Left)	-6.98	43.7
	B (Left)	-7.40	32.9
	C (Left)	-7.83	22.1
	A (Right)	7.83	22.1
	B (Right)	7.40	32.9
	C (Right)	6.98	43.7
	Earthwire (Left)	-8.10	53.06
	OPGW (Right)	8.10	53.06
VTV Medium Strain Tower	A (Left)	-7.15	43.7
	B (Left)	-7.61	32.9
	C (Left)	-8.06	22.1
	A (Right)	8.06	22.1
	B (Right)	7.61	32.9
	C (Right)	7.15	43.7
	Earthwire (Left)	-8.35	53.06
	OPGW (Right)	8.35	53.06
VTW Heavy strain Tower	A (Left)	-8.19	43.7
	B (Left)	-8.63	32.9
	C (Left)	-9.07	22.1
	A (Right)	9.07	22.1
	B (Right)	8.63	32.9
	C (Right)	8.19	43.7
	Earthwire (Left)	-9.35	53.06
	OPGW (Right)	9.35	53.06
VSE/VSEH Light Suspension Tower/Heavy Suspension Tower	A (Left)	-6.26	43.2
	B (Left)	-6.60	32.6
	C (Left)	-6.93	22.1
	A (Right)	6.93	22.1
	B (Right)	6.60	32.6
	C (Right)	6.26	43.2
	Earthwire (Left)	-7.2	53.7
	OPGW (Right)	7.2	53.7

5.2 Existing Nearby Services (Parallel Lines)

The proposed HTP 500 kV double circuit transmission line will parallel existing transmission lines in some locations. The wideband AN emissions from both transmission lines will contribute to the total wideband AN. Identified parallel sections are summarised in Table 10.

The identified parallel transmission lines have voltage levels ranging from 66 kV to 330 kV. Transmission lines with a rated voltage of below 230 kV would produce noise levels low enough not to be of concern[15] and have been excluded from this assessment. Parallel 330 kV transmission lines represented by Case 1 and Case 8 have been assessed using SESEnviro version 19.0[16].

Table 10: Parallel Line Scenarios

Parallel	Start Structure	End Structure	Transmission Line
Case 1	86	96	Transgrid, 2 x 330 kV circuits (lines 81 & 82)
Case 2	94	114	Ausgrid 1x 66 kV circuit (ID: 18513)
Case 3	124	130	Transgrid, 2 x 330 kV circuits (lines 81 & 82) Ausgrid 2 x 66 kV circuit (ID: 19297 & ID: 44795) Ausgrid 1 x 132 kV circuit (ID: 24413)
Case 4	128	130	Ausgrid 2 x 66 kV circuit (ID: 19297 & ID: 44795)
Case 5	132	136	Transgrid, 1 x 330 kV circuits (lines 82) Ausgrid 2 x 66 kV circuit ((ID: 19297 & ID: 44795) Ausgrid 1 x 132 kV circuit (ID: 24413)
Case 6	146	157	Ausgrid 1 x 66 kV circuit (ID: 19297)
Case 7	158	162	Ausgrid 1 x 66 kV circuit (ID: 19297) Ausgrid 1x 132 kV circuit proposed
Case 8	172	176	Transgrid 1 x 330 kV circuit (Line 81)
Case 9	177	186	Transgrid, 1 x 330 kV circuits (lines 82) Ausgrid 1x 132 kV circuit proposed Ausgrid 1 x 66 kV HVO
Case 10	187	200	Ausgrid 1 x 66 kV HVO Transgrid 3 x 330 kV circuit (Line 81, Line 31 and Line 32)

[15] EPRI AC transmission line reference book 3rd edition

[16] The SESEnviroPlus software package (part of the CDEGS suite) is an electromagnetic environmental impact assessment analysis (EEIA) tool. For a technical description of the software and its functionality, see: https://www.sestech.com/en/Product/Package/SESEnviroPlus

5.2.1 Phase and Bundle Arrangement

The baseline parameters used for the modelling of 330 kV Transgrid transmission lines, Line 81 and Line 82, as provided by EnergyCo (unless otherwise noted) are summarised below in Table 11.

Table 11: Identified nearby service (transmission lines) – Study parameters

Parameters	Description
330 kV Single Circuit Transmission Line[17]	
Phase Conductors	Olive ACSR/GZ
Phase Sub-Conductors / Bundle Spacing	2 / 380 mm
Earth wires[18]	SC/AC 7/1.44
Minimum Ground Clearance	Line 81 - 9 metres Line 82 - 10 metres
Phase to Phase (V)	363 kV,1.1 p.u
Phase to Neutral (V)	209.58 kV,1.1 p.u110
Observation Zone	1 metre (Maximum height of child, or seated adult), 2 metres (Maximum standing height of adult)
Transmission Line Easement	60 metres wide easement (30 metres from centreline)
System Frequency	50 Hz
Phasing Arrangement	Horizontal - RWB
Preferred Line Route	As per GIS information provided by EnergyCo

5.2.1 Tower Geometry

The tower outline drawings referenced in Section 3 and in Table 12 define the phase/bundle conductor arrangements considered in the assessment. Actual tower design dimensions may vary from the concept dimensions used as this parallel is of a proposed deviation and parameter considered is of preliminary design only. Differences are likely to be small, but reconfirmation of the calculated values may be required if any change in dimensions.

Table 12: Parallel lines geometry

Transmission Line	Phase/Earthwire	Horizontal distance from tower centre (metres)	Average Height (at midspan) (metres)
Line 81	A	10.67	12.9
	B	0	12.9
	C	-10.67	12.9
	1 x Earthwire	7.62	20.1
	1 x OPGW	-7.62	20.1
Line 82	A	10.67	14.4
	B	0	14.4
	C	-10.67	14.4
	1 x Earthwire	7.62	21.6
	1 x OPGW	-7.62	21.6

[17] The parameters considered for this transmission line are obtained from files provided or assumed based on standards, any changes to the parameter requires re-assessment.

[18] SC/AC 7/1.44 earth wires (2 off) have been considered for all models in this assessment.

5.3 Weather Data (Precipitation)

5.3.1 Precipitation

The AN and RFI emissions from a transmission line increase significantly under wet conductor conditions due to the formation of water droplets on the outer surface of the conductors. The Southwire[19] SVG plots in Figure 3 illustrate how droplets of different nominal diameters on the outer surface of the conductor create a higher, localised SVG adjacent to the droplet and therefore increase corona activity.

It is reasonable to suggest that more droplets will form on the surface of a conductor with larger diameter (i.e. larger surface area) and on bundles with more sub-conductors so will therefore be subject to more corona sources under wet-weather conditions.

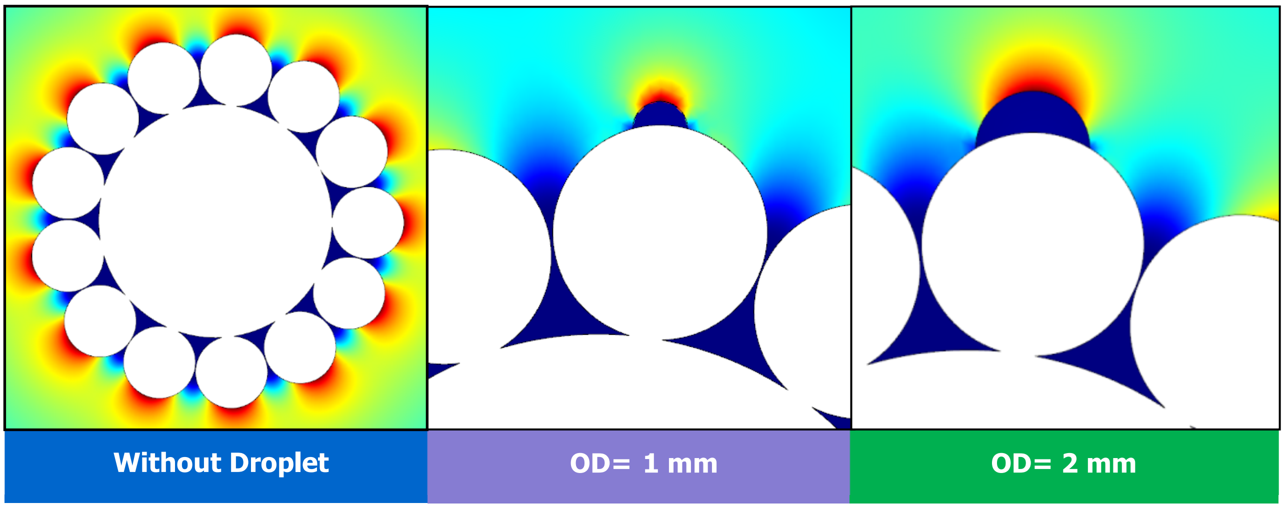

Figure 3: Surface voltage gradient plots for different water droplet sizes – Southwire

The increase in AN and RFI levels from a transmission line with increasing rain rates subsides at a maximum value for heavy rain rates that are exceeded only 5% of the time (i.e. the L_5 exceedance level). This level is used to represent the maximum AN and RFI performance of a transmission line. However, the AN and RFI performance of a line is generally described by the average wet weather levels. The average wet weather level is the level derived for rain rates exceeded 50% of the time for a particular region (i.e. the L_{50} exceedance level).

The general approach to predicting the L_{50} AN and RFI performance of a line (which is adopted by the semi-empirical calculation methods) is to calculate the heavy rain L_5 level and then apply a correction factor to determine the L_{50} average wet conductor level. This correction factor is a function of the equivalent smooth conductor surface voltage gradient, sub-conductor diameter and sub-conductor number.

One weather condition that can cause particularly noticeable AN is mist or fog[20]. This is because the mist or fog forms at night and early morning under light wind conditions which have relatively low background AN level (ambient) and therefore less attenuation. The measurement of AN performance in these conditions is identified with the L_{50} level (wet weather) but should be assessed for residential areas with low levels of ambient noise.

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[19] Southwire Energy Division, "Corona Effects on Bare Overhead Conductors", Oncor Presentation, 2015

[20] Typical conditions for mist or fog are low, non-zero wind conditions, an ambient temperature below the dew point temperature and a relative humidity of at least greater than 95% without any recorded rainfall over the 24-hour period.

5.3.2 Historical Weather Data

Long-term historical weather data from the Bureau of Meteorology (BoM) was gathered and processed to determine nominal and peak rain rates over 24-hour periods at nominated sites along the HTP 500 kV double circuit transmission line. The results of this analysis are summarized Table 13.

From the table below, the highest recorded rain-fall rate (highlighted yellow) for respective preferred line alignment considered in this study, shall be used as a weather correction factor in SES-Enviro Version 19.0[21] for calculation methods.

Table 13: Calculated nominal rainfall parameters along HTP 500 kV double circuit transmission line

Location	BoM Station	Rain Rate (mm/hr)	
		Mean	**STD**
Lake Macquarie - Cooranbong	61412	0.41	0.52
Cessnock Airport	61260	0.37	0.41
Singleton defence	61430	0.36	0.41
Singleton	61397	N/A	N/A
Singleton military area	61430	N/A	N/A
Scoresby	8614	0.06	0.17
Ferny Creek	86266	0.33	0.37

5.4 Altitude

Air density affects the generation of corona sources and the resulting AN and RFI emissions. At higher altitudes above sea level air density reduces, and corona inception occurs at lower conductor surface gradients. The HTP 500 kV double circuit transmission line will be exposed to various altitudes, towers between Olney and the Singleton military area are predominantly in forested areas located between 100 metres and 600 metres above sea level, while towers between Singleton military area and Bayswater are located between 14 metres and 200 metres above sea level.

An altitude of 200 metres is adopted for AN and RFI evaluation due to most receptors being located in the lower river flat areas. Refer to the sensitive receiver assessment as completed by SLR Consulting[22].

[21] The SESEnviroPlus software package (part of the CDEGS suite) is an electromagnetic environmental impact assessment analysis (EEIA) tool. For a technical description of the software and its functionality, see: https://www.sestech.com/en/Product/Package/SESEnviroPlus

[22] SLR Consulting, Hunter Transmission Project Noise and Vibration Impact Assessment

6. Surface Voltage Gradient

The AN and RFI performance of the transmission lines are correlated to the average maximum surface voltage gradient (corona discharge) on the conductor bundles. The average maximum SVG was calculated for the baseline parameters, tower/line configuration and phasing arrangements for each structure outlined in Section 5. The results are summarised in Table 14.

Table 14: Calculated average maximum SVG on HTP 500 kV double circuit transmission line towers.

500 kV Tower Type	[23]Average Maximum Surface Voltage Gradient (kV/cm)		
	Phase A	**Phase B**	**Phase C**
VTU	15.8	15.7	15.9
VTV	15.7	15.8	15.9
VTW	15.6	15.9	15.7
VSE / VSEH	16.2	15.7	16.1

For the HTP 500 kV double circuit transmission line – it is observed that the highest SVG values are associated with the VSE/VSEH tower types along the line, while relativity uniform SVG values are observed for other towers. This is attributed mostly to the smaller circuit spacing for the VSE/VSEH geometry, as the phase spacings for all towers considered are consistent.

The reported values reflect the unperturbed electric field strength that is used as the reference field for the corona calculations. The effect of pollution and rain on the corona performance is determined by adding empirical correction factors (environmental factors) to the reference performance.

[23]The average maximum surface voltage gradient is defined as the average of the maximum surface gradients of the individual sub-conductors forming the conductor bundle

7. Audible Noise Performance

7.1 Methodology

There are numerous evaluation methods available for predicting the AN performance of a transmission line. These methods generally only consider the wideband components' sound pressure level, although the pure tone component observed at 100 Hz may also be derived. Generally, the evaluation methods are divided into two distinct types, empirical and semi-empirical methods.

Empirical calculation formulas are derived from field test data recorded at test locations adjacent to operating transmission lines or full-scale test spans. Through regression analysis of the test data, strong correlation between the computed wideband AN level (sound pressure) for each phase of the transmission is identified to be a function of the main parameters, surface voltage gradient (*g*),sub-conductor number (*n*), sub-conductor diameter (*d*) and distance between the conductors and the measurement point (*R*).

This may be mathematically expressed as:

Equation 1:

$$AN = AN_0 + k_1 f_1(g) + k_2 f_2(n) + k_3 f_3(d) + k_4 f_4(R) + K$$

where AN_0 is a reference noise level, k_1 to k_4 are empirical constants, f_1 to f_4 are functions of the independent main parameters and *K* is an adjustment factor of the regression analysis.

While the empirical formulas only consider the primary dependencies on the four identified variables, there is also a strong correlation with weather and pollution conditions that is not accounted for, as well as less significant dependencies on other variables that are not considered. Given that the empirical calculation formulas are derived from a discrete, and often limited number of operational transmission lines, they are specific to the characteristics of the line design philosophy for the respective utility or group of utilities who have developed it, as well as the characteristic weather of the region. It is therefore not surprising that the methods developed by individual transmission utilities and national industry bodies have different empirical constants.

An example of a less significant dependency is that of the outer strand diameter. All empirical formulas are based on a derived correlation between the emission levels and the outer diameter of a smooth cylinder with radius equal to the outer diameter of a stranded conductor. The SVG plots published by Southwire[24] illustrate in Figure 4 how the actual SVG is much higher at discrete points around the circumference (or fringes) of a round wire conductor. In between those discrete points, in the troughs between adjacent outer strands, the SVG is much lower.

For trapezoidal wire (TW) conductors, the peak SVG is lower than that of the round wire (RW) conductor but has a larger distribution around the circumference of the TW conductor. RW conductors that have a high strand-to-conductor radius ratio will have a higher peak SVG over a smaller surface area, whereas conductors with a low strand-to-conductor radius ratio will have the opposite effects, similar to the TW conductors. The available empirical formulas do not consider this dependency and the sensitivity of the calculated AN level to the strand-to-conductor radius ratio is implicit to the empirical constants in Equation 1. This empirical constant will therefore vary for the various methods which are derived for different types of bundles with many small-diameter sub-conductors (e.g. Hydro Quebec – IREQ method) to those derived by utilities that use bundles with fewer large-diameter sub-conductors (e.g. EPRI method).

[24] Southwire Energy Division, "Corona Effects on Bare Overhead Conductors", Oncor Presentation, 2015

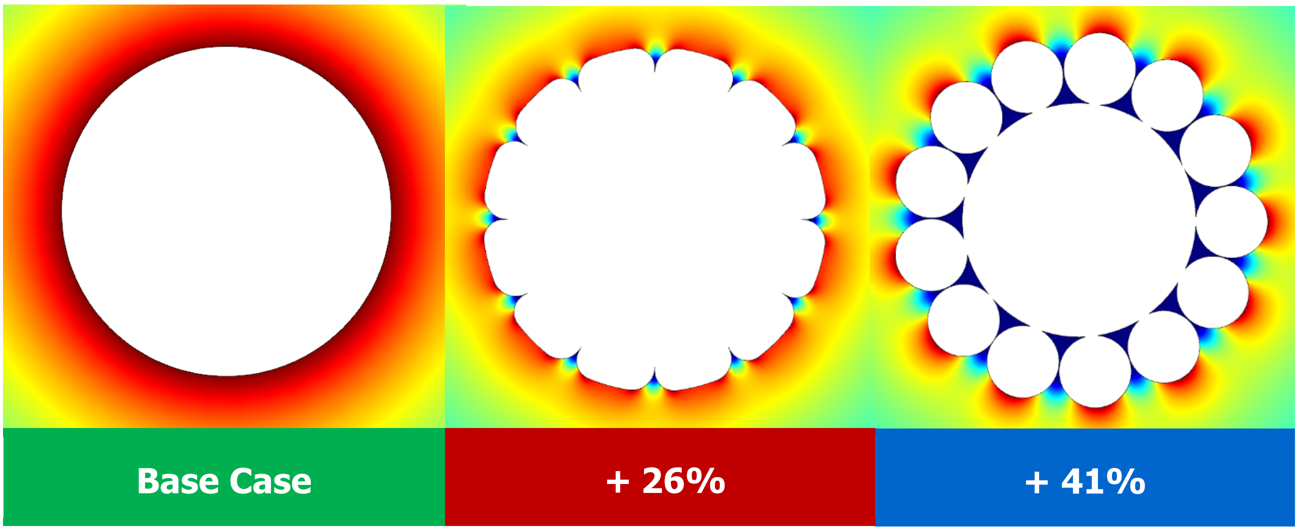

Figure 4: Surface voltage gradient plots for different conductor types [Southwire]

The empirical formulas are also generally derived for average rain conditions (i.e. L_{50} exceedance levels). Given that the maximum AN level is dependent on the rain rate, the formulas are therefore specific to the range of average rain rates for locations specific to the lines included in the regression analysis.

For example, the empirical EPRI formula was derived from measured data on the full-scale test span. The L_{50} natural rainfall intensity for the derived formula was 0.75 mm/hr at the Pittsfield, Massachusetts project test facility. The corresponding rainfall rates derived in Section 0 for the transmission lines considered in this study are observed to be higher than this value (according to BoM) and will therefore require correction factors for a defined rate to ensure parity for this analysis. Using the EPRI calculation formula without a rainfall rate correction factor, would produce misleading AN calculation results.

Several published empirical calculation methods for AC transmission lines were compared in an IEEE committee report[25], which concluded that results obtained from applying the different methods to as many of the test configurations/methods as possible (even when some methods were outside the domain of validity) would provide significant variation. The paper strongly suggests taking care to use a particular method within the specified range for which the method was researched or develop. Further, for the methods included in SES-Enviro Version 19.0 (six empirical methods), the results compare favorably with experimental results.

Beca have reviewed details for the transmission lines tested in developing the methods used in SES-Enviro Version 19.0, as the IEEE Committee suggests. Some methods may be applicable only when particular conditions apply i.e. based on the empirical data obtained under different test conditions. In this case, the domain of validity for all the available methods[26] is technically applicable to the transmission lines considered in this study, however, may not be appropriate to produce the most accurate results specific to the topography and configuration.

Semi-empirical calculation formulas and the experimental data are generally derived from tests on three phase and single-phase lines, or within outdoor test cages. The conductor bundle under test is surrounded by

[25] IEEE Committee Report, “A Comparison of Methods for Calculating Audible Noise of High Voltage Transmission Lines”, IEEE Trans., Vol. PAS-101, October 1982, pp. 4090-4099

[26] There are six available empirical methods introduced in SES-Enviro for AC voltages: IREQ method (Canada), General Electric method (USA), BPA method (USA), EdF method (France), ENEL method (Italy), and FGH method (Germany).

a cage of earthed wires that replicate the average maximum SVG on the bundle with much reduced ground clearances. The test conductor is tensioned over a shorter length to negate the impact of the catenary shape on the generated noise. This scaled down test facility allows numerous different conductors to be tested, including concept bundle designs, over a wide range of SVGs. Water sprinkler systems are attached to the cage that allows testing of the bundles under controlled rain rates. Semi-empirical formulas generally predict the heavy rain L_5 exceedance level, which represents the upper limit of the AN emissions, but provide correction factors for different rain rates. Experimental data is independent of the transmission line geometry, so correction factors also account for the SVG and bundle geometry dependencies to produce more accurate assessment of AN for different rainfall rates. Additionally, new conductors can be monitored over time to determine the impact of new conductor effects associated with grease and drawing oil on the outer surface of the conductor which causes hydrophobic effects.

At a first instance, the experimental data from the test cage / laboratory is used to derive a per unit length line generated noise source i.e. quantity A, defined as the A-weighted[27] generated acoustic power density. Acoustic transmission theory is then used to determine the sound pressure propagating AN level at an observation point from the line sources, called AN generation functions, applied to the phase conductor bundles.

The **EPRI (USA) semi-empirical method** is considered the most appropriate for assessing the AN performance of the transmission lines considered in this study and is also the preferred method per Transgrid's transmission lines standards and guidelines. The EPRI method also provides an SVG-dependent rainfall rate correction factor, a method of calculating the sound pressure level at the 100 Hz tone and a correction factor for new conductor effects.

EPRI (semi-empirical) calculation methods were used in SES-Enviro Version 19.0 to determine the wideband AN levels for the lines considered in this study. Results calculated using the BPA method are included for comparison purposes only. The EPRI calculations considered a rainfall rate of 0.52 mm/hr for the HTP 500 kV double circuit transmission line (refer to Section 5.1.2). The BPA calculations provide $L_{50\ wet}$ exceedance levels for an unspecified rainfall rate.

SES-Enviro Version 19.0 does not provide sound pressure level calculations for the 100 Hz pure tones. Modifying factors for tonality may need to be considered at sensitive receivers identified within the AN risk zone.

[27] The A-weighted level is a widely used noise measure that considers the entire frequency spectrum of the noise, but which gives more weight to the mid-frequencies (500-3000 Hz). Human hearing is most sensitive at this range.

7.2 Wideband AN Level

7.2.1 HTP 500 kV Double Circuit Transmission Line

The wideband AN performance of the transmission line considered in this study is calculated for all proposed tower types using SES-Enviro Version 19.0 for the baseline parameters, tower/line configuration and phasing arrangements outlined in Section 5.

The calculated wideband AN levels are assessed at observation height of 1 metre and 2 metres above ground for average rain ($L_{50\ wet}$) and average fair weather ($L_{50\ dry}$) condition and the results are summarised in Table 15.

Table 15: Calculated wideband AN levels at the edge of 70 metres easement.

Towers	Observation Height	EPRI, dB(A)		BPA, dB(A)		Limit
		$L_{50\ wet}$	$L_{50\ dry(adj)}$	$L_{50\ wet}$	$L_{50\ dry}$	
VTU	1 metre	47.2	19.9	46.5	21.5	50
	2 metres	47.3	20.0	46.5	21.5	50
VTV	1 metre	47.1	19.8	46.4	21.4	50
	2 metres	47.2	19.9	46.5	21.5	50
VTW	1 metre	46.8	19.5	46.2	21.2	50
	2 metres	46.9	19.6	46.2	21.2	50
VSE/	1 metre	47.9	20.7	47.1	22.1	50
	2 metres	47.9	20.8	47.1	22.1	50

The maximum sound pressure level ($L_{50\ wet}$) at the edge of the 70 metres easement is identified as 47.9 dB(A) which is less than the 50 dB(A) limit as required by Transgrid's transmission lines standards and guidelines. Fair weather AN levels[28] will be within the most stringent project noise trigger level of 35 dB(A) within the edge of the line easement.

7.2.2 Parallel Transmission lines - HTP 500 kV Double Circuit, 330 kV Line 81 and 330 kV Line 82

The new HTP 500 kV double circuit transmission line alignment is identified to parallel existing two 330 kV double circuit transmission lines (line 81 and Line 82). The parallel section is identified between spans, from Tower 86 to Tower 96. The assessment considers both parallel easements to share a boundary line, without encroaching – for a centre-to-centre distance of 65 metres[29] (HTP 500 kV and Line 81) and 60 metres (Line 81 and Line 82).

The total wideband AN emissions relative to the parallel line sections are assessed at observation heights of 1 metre and 2 metres above ground for average rain ($L_{50\ wet}$) and average fair weather ($L_{50\ dry}$) conditions. The results relevant to the HTP 500 kV double circuit transmission line are summarised in Table 16. Also refer Appendix A for associated plots.

The assessment has considered the system definition for both modelled systems as per Section 5 of this report.

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[28] EPRI method L_{50dry} sound pressure level with fair weather correction factor of 15 dB applied, based on long-term audible noise measurements conducted in clean environments, which show that during fair weather (dry) conditions the AN level is about 25 dBA less than that of the L50 AN levels during measurable rain.

[29] The measured minimum distance between the centre points of each respective easement.

Table 16: Calculated wideband AN levels at the edge of easement of 70 metre line easement for VSE/VSEH tower[30]

Towers	Observation Height	EPRI, dB(A)		BPA, dB(A)		Limit
		$L_{50\ wet}$	$L_{50\ dry(adj)}$	$L_{50\ wet}$	$L_{50\ dry}$	
VSE/VSEH	1 metre	48.5	21.8	48.1	23.1	50
	2 metres	48.6	21.9	48.2	23.2	50

The maximum sound pressure level ($L_{50\ wet}$) at the edge of the 70 metres easement is identified as 48.6 dB(A) which is less than the 50 dB(A) limit as required by Transgrid's transmission lines standards and guidelines. Fair weather AN levels[31] will be within the project noise trigger level of 35 dB(A) within or close to the edge of the line easement.

7.2.3 Parallel Transmission lines - HTP 500 kV Double Circuit and 330 kV Line 81

The new HTP 500 kV double circuit transmission line alignment is identified to parallel existing 330 kV double circuit transmission lines (line 81). The parallel section is identified between spans, from Tower 172 to Tower 176. The assessment considers both parallel easements to share a boundary line, without encroaching – for a centre-to-centre distance of 65 metres[32].

The total wideband AN emissions relative to the parallel line sections are assessed at observation heights of 1 metre and 2 metres above ground for average rain ($L_{50\ wet}$) and average fair weather ($L_{50\ dry}$) conditions. The results relevant to the HTP 500 kV double circuit transmission line are summarised in Table 17. Also refer Appendix A for associated plots.

The assessment has considered the system definition for both modelled systems as per Section 5 of this report.

Table 17: Calculated wideband AN levels at the edge of easement of 70 metre line easement for VSE/VSEH tower[33]

Towers	Observation Height	EPRI, dB(A)		BPA, dB(A)		Limit
		$L_{50\ wet}$	$L_{50\ dry(adj)}$	$L_{50\ wet}$	$L_{50\ dry}$	
VSE/VSEH	1 metre	48.3	21.5	47.8	22.8	50
	2 metres	48.4	21.6	47.9	22.9	50

The maximum sound pressure level ($L_{50\ wet}$) at the edge of the 70 metres easement is identified as 48.4 dB(A) which is less than the 50 dB(A) limit as required by Transgrid's transmission lines standards and guidelines. Fair weather AN levels[34] will be within the project noise trigger level of 35 dB(A) within or close to the edge of the line easement.

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[30] Only a single tower/line configuration has been modelled in parallel assessment, as VSE/VSEH tower produces worst RFI limits

[31] EPRI method L_{50dry} sound pressure level with fair weather correction factor of 15 dB applied, based on long-term audible noise measurements conducted in clean environments, which show that during fair weather (dry) conditions the AN level is about 25 dB(A) less than that of the L50 AN levels during measurable rain.

[32] The measured minimum distance between the centre points of each respective easement

[33] Only a single tower/line configuration has been modelled in parallel assessment, as VSE/VSEH tower produces worst RFI limits.

[34] EPRI method L_{50dry} sound pressure level with fair weather correction factor of 15 dB applied, based on long-term audible noise measurements conducted in clean environments, which show that during fair weather (dry) conditions the AN level is about 25 dB(A) less than that of the L_{50} AN levels during measurable rain.

7.3 100 Hz Tonality

The sound pressure level produced by transmission line corona include pure tones, the most significant of which occurs at twice the power frequency i.e. at the 100 Hz tone. The AN sound pressure level is correlated to the voltage phase angle of the phase conductor bundle that generates it. The total pressure is determined by six direct and six reflected wave fronts with these phase correlations that are correlated at the observation point. The vector total of these wave fronts results in the observed sound pressure level of the 100 Hz tone at the observation point. Variations in observation height and distance from the line's easement will result in a standing wave pattern of constructive and destructive interference.

The hum is particularly noticeable in similar conditions to that which produces a large amount of corona loss i.e. heavy rain. The hum noise is only slightly attenuated by the natural landscape, i.e. trees, air, so at larger distance from the line and/or at residential zones it may become more noticeable. In addition, the resulting hum is dependent on the location of the measuring point, including its height above ground.

Modifying factors for tonality may need to be considered at sensitive receivers.

7.4 New Conductor Effects

The BPA method of calculating AN levels is defined for aged (i.e. weathered) conductors and not newly strung conductors. Grease applied to the steel core strands for corrosion protection, or residual drawing oil from the cable manufacturing process will create a hydrophobic surface on the outer strands of the conductor and in the valleys between adjacent outer strands. During rain or mist/fog conditions, the hydrophobic nature of the conductor surface causes moisture on the conductor surface to form small droplets that do not move downwards to the under surface of the conductor under the normal forces of gravity and capillary action. Small droplets collecting around the conductor surface act as sources of concentrated corona activity that vibrate at harmonic frequencies of 50 Hz (most notably 100 Hz and 200 Hz).

The sun's UV and chemical pollution break down these residual oil and grease layers over time, resulting in a hydrophilic outer conductor surface. The hydrophilic surface opposes the formation of droplets on the conductor surface and results in conductors with minimal corona sources. The observed period of conductor ageing may be as long as 3 years in low-pollution regions, as reported in the EPRI reference book.

Grease near the conductor core will migrate to the surface and fill the valleys between adjacent surface strands due to mechanical torsion forces on the conductor. This further prevents the conductor from shedding surface water and results in increased AN generation. This process can continue for many years.

The residual drawing oil on the newly strung conductors will increase AN levels under the line above the calculated levels reported in Section 7.2 to Section 7.3, for the first few years of operation. Research conducted by EPRI correlates a higher increase in initial AN level for conductors operating at lower surface voltage gradient. For the surface voltage gradients at which the transmission lines considered by this study will operate, the increased AN levels attributed to surface hydrophobicity on the new conductors are likely to be less than 2 dB (for the first few months).

7.5 AN Risk Assessment

The distance from the centre of the transmission line easement at which the AN is likely to negatively impact residential dwellings when evaluated using the EPRI method, at nighttime during average rain conditions is summarised in Table 18 (for HTP 500 kV double circuit transmission line and parallel lines). The AN emissions from the transmission lines do not exceed the night-time noise limits under fair weather conditions.

Figures 5, 6 and 7 show the noise levels with respect to distance. Figure 5 shows the noise levels considering only the HTP 500 kV double circuit transmission line, Figure 6 considers the HTP line, Line 81, and Line 82, while Figure 7 considers the HTP line and Line 81.

Table 18: Distance from the centre of the of 70 metres easement at which AN may impact residential dwellings.

Receiver Location	PNTL ($dBA_{Leq,15min}$)	Tower Types/Geometry	Distance (metres)
NCA01, NCA05, NCA09, NCA14	38	VTU	212
		VTV	209
		VTW	199
		VSE / VSEH	236
NCA03	37	VTU	249
		VTV	246
		VTW	235
		VSE / VSEH	276
NCA04, NCA12	36	VTU	291
		VTV	288
		VTW	275
		VSE / VSEH	321
NCA13	43	VTU	83
		VTV	81
		VTW	76
		VSE / VSEH	95
All other NCAs (NCA02, NCA06, NCA08, NCA11) (Rural residential)	35	VTU	388
		VTV	384
		VTW	369
		VSE / VSEH	425
NCA05 parallel with Line 81 & Line 82	38	VSE	253
NCA03 parallel with Line 81	37	VSE	286

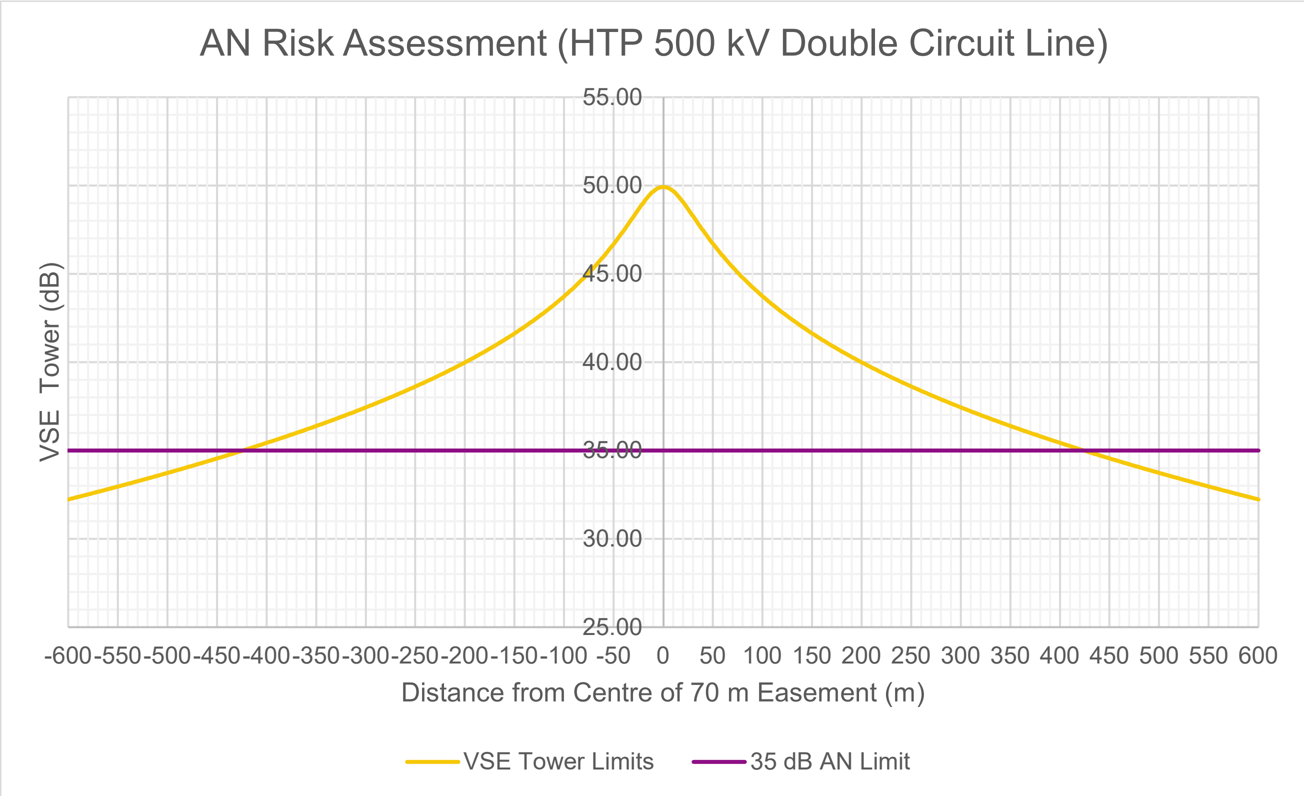

Figure 5: Distance at which AN may impact residential dwellings – VSE Tower (HTP 500 kV double circuit transmission line)

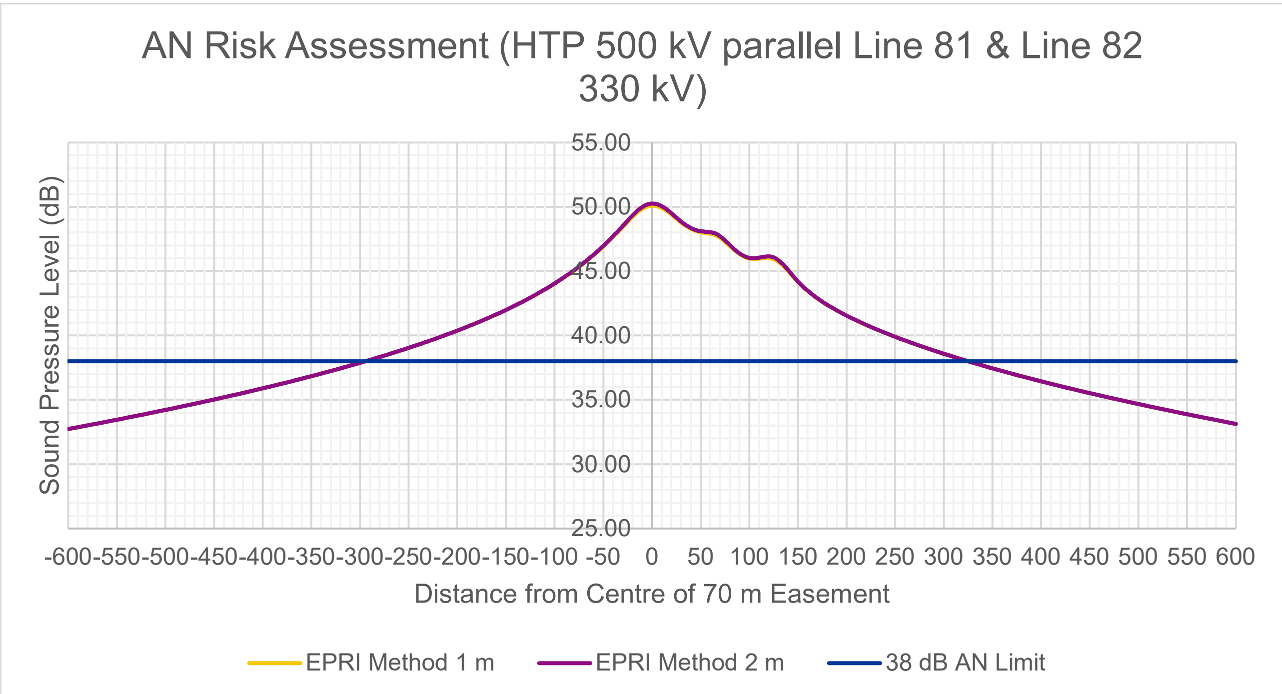

Figure 6: Distance at which AN may impact residential dwellings – HTP 500 kV double circuit transmission line parallel Line 81 & Line 82 330 kV

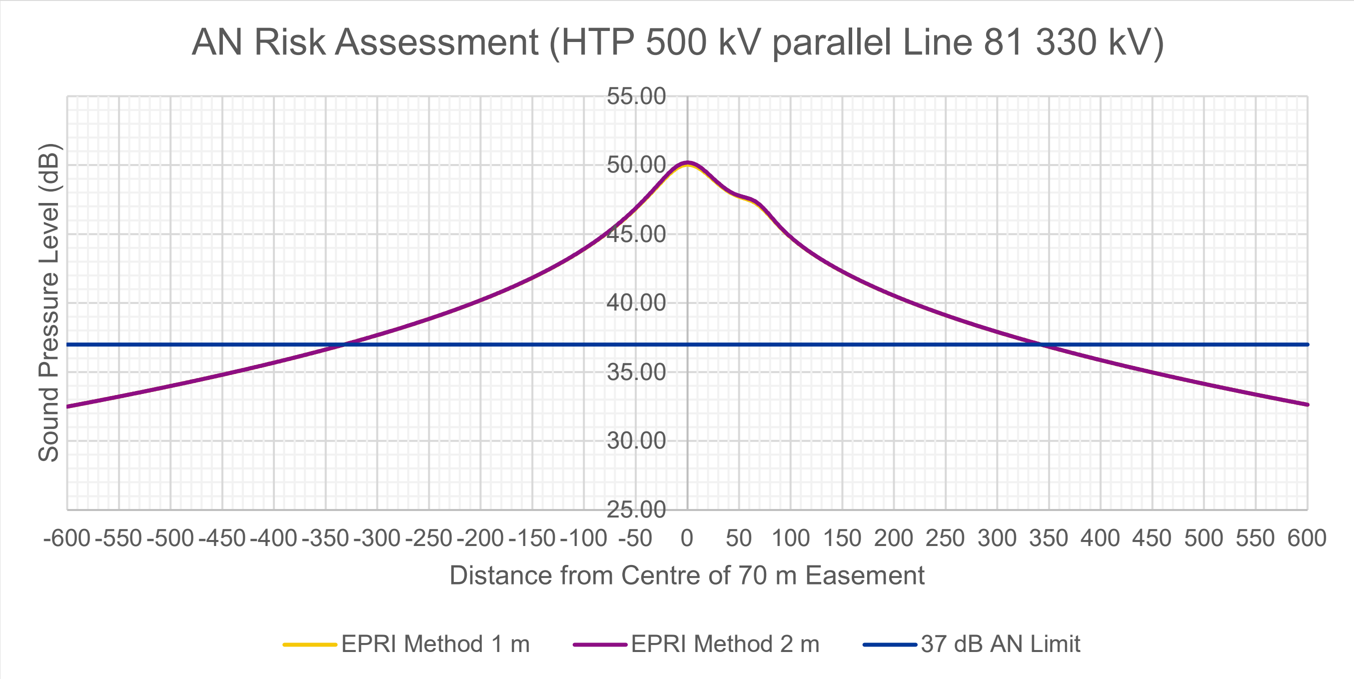

Figure 7: Distance at which AN may impact residential dwellings – HTP 500 kV double circuit transmission line parallel Line 81 330 kV

Further investigations should be carried out to identify sensitive receivers in the identified (potential) AN risk zones.

A statistical based audible noise study [35] concluded that the risk of public noise complaints for a transmission line was low for a wideband AN level less than 52 dB(A) at the sensitive receiver. This study has been the basis of subsequent studies which have verified the validity of the guideline level. The New York State Public Service Commission adopted the recommended 52 dB(A) $L_{50\ wet}$ limit at the edge of transmission line easement as a reasonable standard[36],[37]. The Commission concluded that 35 dB(A) is an appropriate maximum limit in a bedroom to address the impact of sleep disturbance. Given that the noise occurs only during rain conditions, the limit is increased to 36.5 dB(A) to account for background noise. For a reasonable attenuation factor of 15.5 dB for the high frequency noise source through a partially open window, the audible noise limit outside the house is 52 dB(A).

The AN emissions from the transmission lines considered by this study are below 52 dB(A) at the edge of the 70 metres wide easement for the HTP 500 kV double circuit. Beca are not aware of any comparable guidelines in Australia[38], but the referenced publications are considered a valid basis for assessing the risk of public noise complaints.

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[35] D.E. Perry, “An Analysis of Transmission Line Audible Noise Levels Based upon Field and Three-Phase Test Line Measurements”, IEEE Trans., Vol. PAS-91, May/June 1972, pp. 857-865

[36] State of New York Public Service Commission, Opinion and Order Determining Health and Safety Issues, Imposing Operating Conditions, and Authorizing, in Case 26529, Operation Pursuant to those Conditions, Opinion No. 78-13, June 19, 1978.

[37] State of New York Public Service Commission, Agreement between New York State Public Service Commission and Power Authority of State of New York Concerning Operation of Massena-Marcy 765kV Transmission Line February 7, 1980

[38] There is a noise study that was carried out in Australia that looked at noise reduction through facades with open windows which concluded that the tested residencies, despite variations in construction, all achieved reductions ranging from 5 dBA and up to 15 dBA in some cases. Refer to M. Ryan, M. Lanchester, S. Pugh (Paper No. 37), “Noise Reduction through Facades with Open Windows”, Proceedings of ACOUSTICS 2011, 2 - 4 November 2011.

8. Radio Frequency Interference Performance

8.1 Evaluation Methods

Similar to AN evaluation methods, empirical and semi-empirical methods have been developed to calculate the RFI performance of a transmission line. The same advantages and disadvantages discussed in Section 7.1 for these methods apply to the RFI calculations.

In line with this, a worldwide joint CIGRE/IEEE comparison of RFI calculation methods was documented in an IEEE committee report[39]. The comparison concluded that RFI predictions made with calculation methods developed in one country could be out by more than 10 dB from the measured performance of a constructed line in another country. The selection of an appropriate method is therefore critical for the RFI risk assessment.

RFI levels are traditionally measured using a quasi-peak (QP) detector that provides a weighting function which better accounts for the degradation in radio reception quality. The international CISPR measurement standard for QP RFI levels specifies a 500 kHz centre frequency and 9 kHz bandwidth. The American ANSI measurement standard specifies a 1 MHz centre frequency and 10 kHz bandwidth for QP RFI levels. The frequency spectrum for positive corona streamer pulses, which are the main source of RFI from a transmission line is flat from 0 Hz to approximately 1.59 MHz [40][8], after which it decreases with increasing frequency.

The narrowband measurements at 500 kHz and 1 MHz represent the maximum receiver interference level at all frequencies.

The joint CIGRE/IEEE comparison study included a comparison of measured and calculated RFI for several test transmission lines operating at varying voltage levels up to 750 kV. For lines with comparable conductor bundles and surface voltage gradients, it is observed that the semi-empirical EPRI method produces calculations significantly lower than the measured RFI levels under both fair weather (approximately 8 dB) and wet weather (approximately 5 dB) conditions. The empirical CIGRE calculations more accurately predicted the measured levels.

Based on the joint CIGRE/IEEE comparison and as recommended by Transgrid’s transmission lines standards & guidelines, the CIGRE method is the considered by this assessment. The CIGRE (empirical) calculation method was used in SES-Enviro Version 19.0 to determine the RFI levels at 500 kHz and 1 MHz. Results calculated using the EPRI (semi-empirical) calculation method are included for comparison purposes only.

Both methods predict heavy rain (i.e. L5 exceedance levels) and have fixed correction factors for calculating average rain and average fair-weather levels. Both the CIGRE and EPRI calculation methods provide formulas for calculating the RFI level at higher frequencies[41] for the assessment of interference to various forms of communications identified adjacent to the preferred line routes.

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[39] IEEE Committee Report, “Comparison of Radio Noise Prediction Methods with CIGRE/IEEE Survey Results”, IEEE Trans., Vol. PAS-92, May/June 1973, pp. 1029-1042.

[40] P. S. Maruvada, Corona Performance of High-Voltage Transmission Lines, Research Studies Press, 2000, pp. 116 - 117.

[41] Per the EPRI reference book, the most complete empirical method for predicting TVI above 30 MHz is the method developed by the BPA, a method which was first developed to predict TVI from overhead lines during rain but has since expanded.

8.2 RFI Levels

The RFI performance of the transmission lines considered in this study at 500 kHz is calculated for all proposed tower types using SES-Enviro Version 19.0 for the baseline parameters, tower/line configuration and phasing arrangements outlined in Section 5.

The calculated RFI levels are assessed at observation height of 1 metre and 2 metres above ground for average rain ($L_{50\ wet}$) and average fair weather ($L_{50\ dry}$) conditions. The results are summarised below for towers on the HTP 500 kV double circuit transmission line in Table 19. All the outputs related to RFI are normalized to CISPR values (bandwidth of 9 kHz and measuring frequency of 500 kHz).

Table 19 shows that RFI emission levels are expected to exceed the AS 2344 limits at the edge of the transmission line easement during L_{50} wet conditions using CIGRE calculation method. Figure 8 shows that the AS 2344 limits are achieved at a distance of 131 metres from the centreline of the transmission line.

Table 19: Calculated RFI levels at the edge of 70 m easement @ 500 kHz

Tower Type / Geometry	Observation Height	Radio Frequency Interference @ 0.5MHz (dBµA/m)				
		CIGRE		EPRI		Limits
		$L_{50\ wet}$	$L_{50\ dry}$	$L_{50\ wet}$	$L_{50\ dry}$	
VTU	1 metre	0.7	-17.4	4.5	-13.1	-15.5
	2 metres	0.9	-17.2	4.6	-12.9	-15.5
VTV	1 metre	0.7	-17.4	4.3	-13.2	-15.5
	2 metres	0.9	-17.2	4.4	-13.1	-15.5
VTW	1 metre	0.9	-17.2	3.8	-13.7	-15.5
	2 metres	1.1	-17.0	3.9	-13.6	-15.5
VSE / VSEH	1 metre	1.1	-16.8	5.5	-12.0	-15.5
	2 metres	1.5	-16.6	5.6	-11.9	-15.5

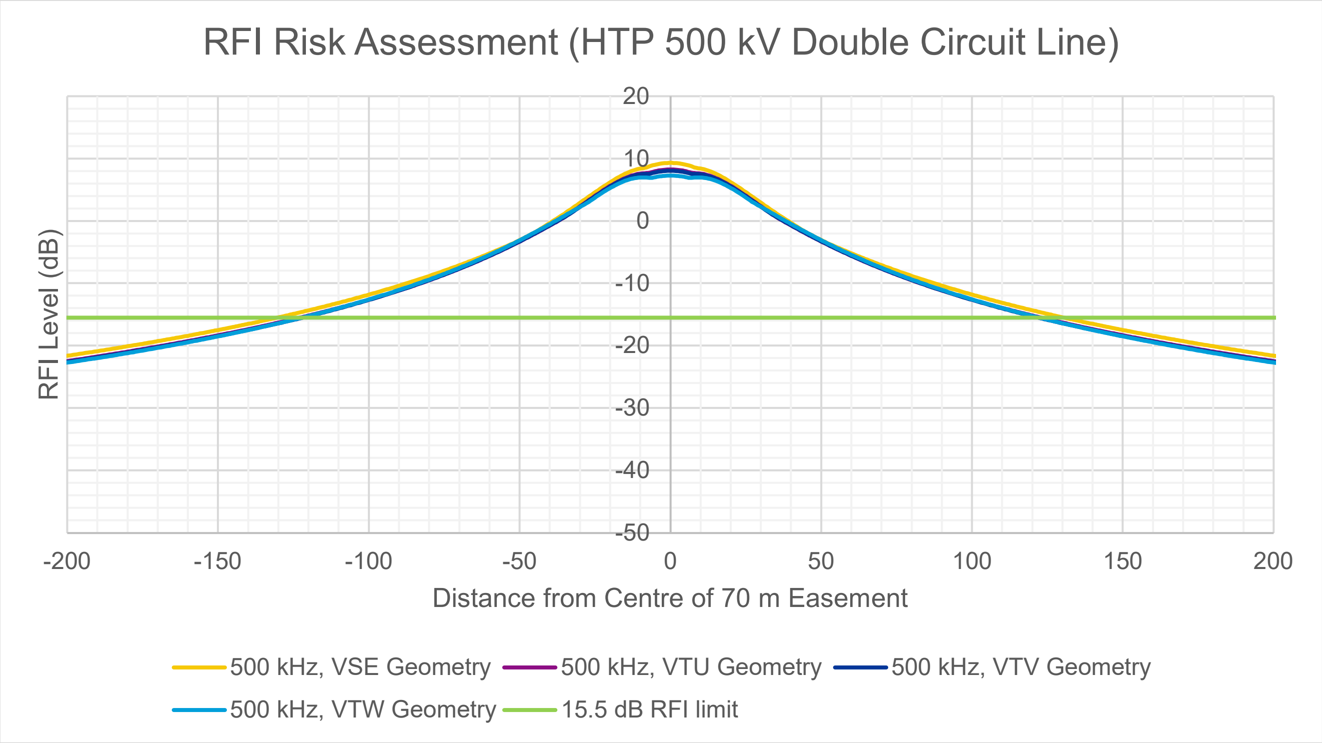

Figure 8: Calculated RFI levels (500 kHz)

8.3 Interference at Typical Broadcast Frequencies

8.3.1 National and Local AM radio Stations

A list of both national and local AM radio stations (and respective transmitters/receivers) that have coverage through the preferred line alignments for the lines considered in this study, is included[42] [43] in Table 20. These sites are identified using the public databases available through the Australian Communications and Media Authority (ACMA)[44]

The summary included in Table 20 is a comparison of the calculated maximum RFI levels[45] with the AS 2344 RFI limits, as well as the limits associated with a Class 3 rating for the quality of reception on the CIGRE scale.

Table 20 shows that RFI emission levels are expected to exceed the AS 2344 limits at the edge of the transmission line easement during L_{50} wet conditions using the CIGRE calculation method. Figure 9 shows the RFI emission level as a function of distance considering a 1000 kHz signal frequency. This figure shows that the AS 2344 limits are achieved 98 metres from the centreline of the transmission line.

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[42] Digital Audio Broadcasting (DAB+) stations are not included since the digital receiver's audio codec results in reception that is more immune to noise.

[43] Frequency modulated (FM) stations and Digital TV broadcast services are not included, since there is a lack of background material available on the determination of limits to protect their respective service reception i.e. the limits do not express the protection required for services operating in the typical bands from 30 MHz to 1 GHz, and is largely an overstatement of what is expected to be actually required when compared with CISPR general product limits. Instead (for completeness), RFI emissions at typical broadcast frequencies for these services have been calculated against the limits of Table 20, near the HTP transmission line alignment.

[44] *Website Source:* https://web.acma.gov.au/pls/radcom/site_proximity.main_page/

[45] Maximum RFI levels calculated at transmitter frequency is associated with VSE/VSEH HTP 500 kV double circuit transmission line tower geometry.

Table 20: National and local AM radio stations along HTP 500 kV double circuit transmission line

Coverage Area	AM Radio	Site location	Frequency (kHz)	Observation profile height (metres)	CIGRE method (dBµA/m)	EPRI method (dBµA/m)	Limit (dBµA/m)	
					$L_{50\ wet}$	L_{50wet}	AS 2344	CIGRE Class 3
Cooranbong	2EA Newcastle	Broadcast Site 97 Maitland Rd SANDGATE	1413	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		
Cooranbong	2HD Newcastle	Broadcaster Site Off Maitland Rd 1km NW of SANDGATE	1143	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		
Cooranbong	2NC Newcastle	Broadcast Australia Site 2 Lawson Ave WOODBERRY	1233	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		
Cooranbong	2PB Newcastle	Broadcast Australia Site 2 Lawson Ave WODBERRY	1458	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		
Cooranbong	2RN Newcastle	Broadcast Australia Site 2 Lawson Ave WOODBERRY	1512	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		
Singleton	2NM Muswellbrook	Wybong Rd 6km SW of MUSWELLBROOK	981	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		
Singleton	2UH Muswellbrook	Broadcast Australia Site 179 McCullys Gap Rd MUSWELLBROOK	1044	1	-2.8	-0.4	-15.5	-3.5
				2	-2.6	-0.4		

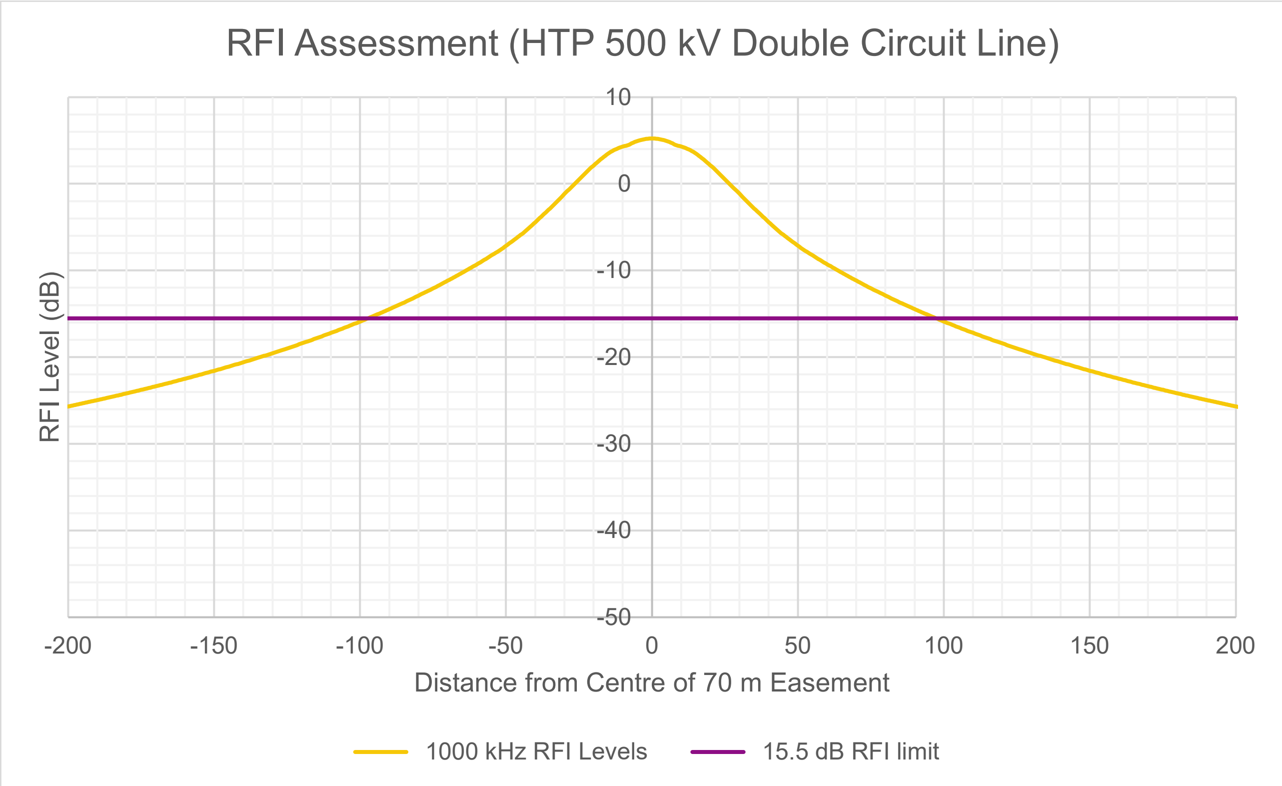


Figure 9: Comparison of the calculated maximum RFI levels with AS 2344 RFI limits (1000 kHz)

The quasi-peak (QP) detector was developed to provide a measure of the interference effect of pulsative noise on analogue AM and TV broadcast reception. It has also been applied to analogue TV reception. A Root Mean Square (RMS) measurement of the noise is preferred, as it is more appropriate to reception of all other communication services[46], including navigation, aeronautical, safety-of-life, amateur radio and citizen band (CB) radio. The worst case RFI levels measured in an RMS receiver, at 500 kHz and 1.0 MHz, are summarised in Table 21 and plotted in Figure 10. The Figure 10 shows that the AS 2344 limits are achieved 47 metres for 500 kHz and 30 metres for 1000 kHz, when measuring from the centreline of the transmission line.

Table 21: Calculated RFI levels at the edge of the 70 m line easement for VSE towers with RMS detector.

Radio Frequency Interference (dBμA/m)	Operating Case / Tower Option	CIGRE method	EPRI method	Limit			
		$L_{50\ wet}$		$L_{50\ wet}$	AS 2344	CIGRE Class 3	
500 kHz	1 metre			5.3	9.1	-15.5	-3.5
	2 metres			5.5	9.2		
1000 kHz	1 metre			1.3	3.1	-15.5	-3.5
	2 metres			1.5	3.1		

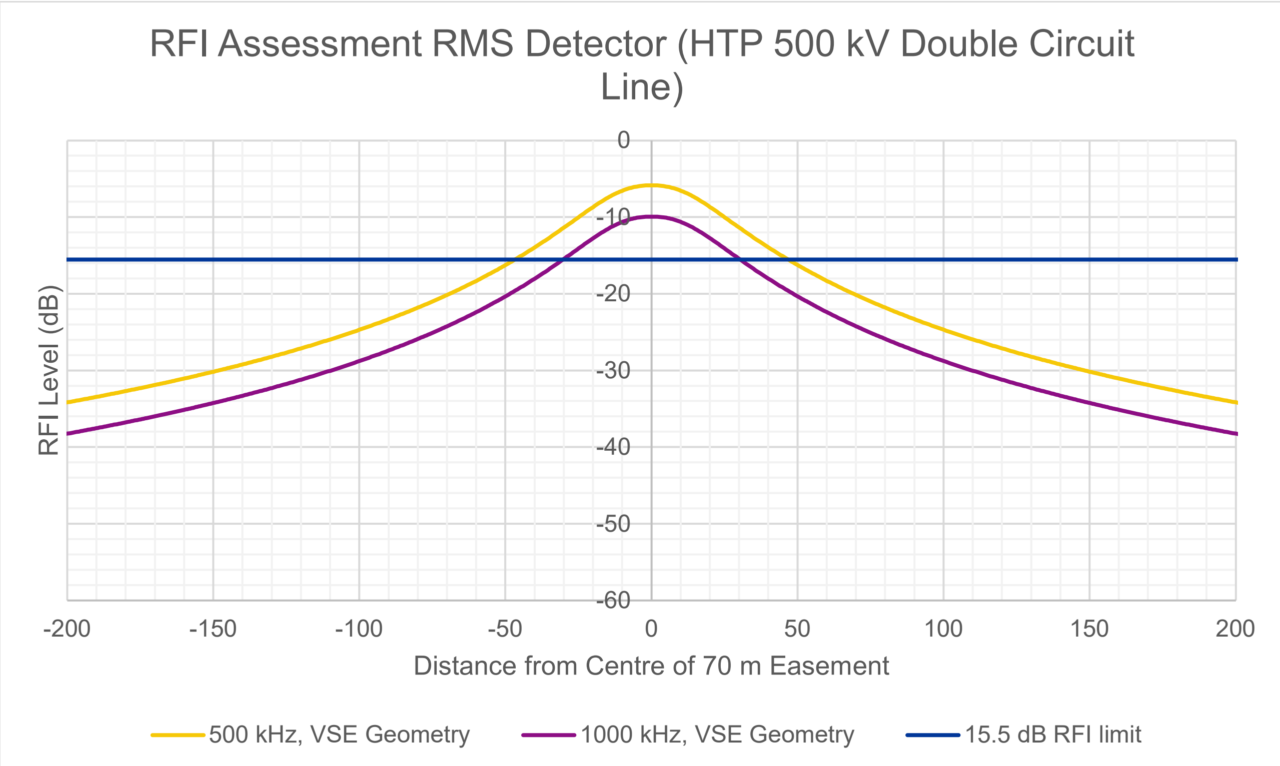


Figure 10: Calculated RFI levels at the edge of the 70 m line easement for VSE towers with RMS detector

[46] IEEE Committee Report, "Review of Technical Considerations on Limits of Interference from Power Lines and Stations", IEEE Trans., Vol. PAS-99, January/February 1980, pp. 365-388

8.3.2 TVI for Commercial Broadcasts above 30 MHz

The corona RFI emissions (for a CISPR quasi-peak detector) at typical broadcast frequencies for commercial FM radio (90 MHz), aeronautical VHF (128 MHz), UHF CB (477 MHz) and Digital TV (600 MHz) were assessed for the transmission line considered in this study. RFI levels are calculated at the edge of the transmission line easement considering wet conductor conditions. The results are compared to the limits summarised in Table 22. The fair weather RFI levels will be significantly[47] below the stated wet conductor levels.

The CIGRE RFI frequency correction factors are defined for frequencies only up to 30 MHz. For frequencies above 30 MHz, the correction factors specified in the EPRI reference book (third edition) have been used[48] to assess interference to sensitive receivers operating at commercial broadcast frequencies.

Table 22: Corona RFI emission (for a CISPR quasi-peak detector) at typical broadcast frequencies for HTP 500 kV double circuit transmission line.

Broadcast / Service	Observation Height	RFI @ 1.0MHz (dBµV/m) CISPR Addition Method		RFI @ 1.0MHz (dBµV/m) RMS Addition Method		Limits	
		CIGRE Method	**EPRI Method**	**CIGRE Method**	**EPRI Method**	**AS2344**	**CIGRE Class 3**
		$L_{50\ wet}$	**$L_{50\ wet}$**	**$L_{50\ wet}$**	**$L_{50\ wet}$**		
Commercial FM radio - 90 MHz	1 metre	11.09	11.93	14.06	14.53	30	N/A
	2 metres	11.69	12.18	14.05	14.31	30	N/A
Aeronautical VHF - 128 MHz	1 metre	8.03	8.87	11.0	11.48	30	N/A
	2 metres	8.63	9.12	10.99	11.25	30	N/A
UHF CB - 477 MHZ	1 metre	-3.40	-2.56	-0.43	0.05	37	N/A
	2 metres	-2.79	-2.31	-0.44	-0.18	37	N/A
Digital TV - 600 MHz	1 metre	-5.39	-4.55	-2.42	-1.94	37	N/A
	2 metres	-4.79	-4.30	-2.43	-2.17	37	N/A

[47] As per AS 2344-2016, measurements of radio disturbance due to corona may be confined to one prevalent weather condition (wet weather) by application of a +18 dB correction factor. Conversely, EMI calculations performed by EPRI (third edition) predict the average fair-weather noise levels by a subtraction of 21.6 dB (+/- 5 dB for calculation error which is consistent with fair-weather noise variability).

[48] Per the EPRI reference book, the most complete empirical method for predicting TVI above 30 MHz is the method developed by the BPA, a method which was first developed to predict TVI from overhead lines during rain but has since expanded.

8.4 Interference at Frequencies at 800 MHz and above

Interference caused by conductor corona from AC transmission lines decreases as frequency increases. Consequently, devices operating at high frequencies are not expected to experience radio interference issues. Mobile phones and GPS systems are examples of common devices which typically operate at high frequencies, these are further discussed in the following sections.

8.4.1 Mobile phones

In relation to mobile phone interference the EPRI AC Transmission Line Reference Book—200 kV and Above, Third Edition reports that:

“Many cell antennas are currently operating on top of transmission-line structures. The proper functioning of these cell antennas over the years gives a very good indication that perceptible interference from transmission lines with cell phones is a highly unlikely event. Because of the high operating frequency (above 800 MHz), the use of digital technology in the newer phones, and years of successful operation of cell antennas on transmission-line towers, it is highly unlikely that transmission-line radio noise will interfere with cell phone systems.”

8.4.2 Global Positioning Systems (GPS)

GPS devices such as those used in agricultural vehicles typically operate in UHF bands above 1000 MHz. The degradation in the performance of GPS receivers when used under or near power line conductors EPRI AC Transmission Line Reference Book—200 kV and Above, Third Edition reports that:

“At the surface of the earth, the satellite microwave signals are weak, and any reduction of signal intensity due to scattering by conductors or noise due to corona and/or gap discharges could degrade receiver performance or cause loss of signal lock.

The potential effects of EMI from transmission-line corona and/or signal scattering from overhead conductors have been evaluated analytically by Silva and Olsen (2002). More specifically, their analysis shows that scattering is unlikely to lead to significantly reduced signal strength, and that corona and gap noise are small enough at 1200–1500 MHz to be neglected. These conclusions have been supported by a small number of practical measurements made under transmission lines with GPS receivers. It is thus unlikely that power line conductors will interfere with use of the GPS satellite signals.”

8.5 Parallel Transmission Lines

The only potential RFI issues associated with parallel transmission lines was AM radio reception during rain conditions. For AM radio reception, QP detectors are used to assess the impact of the RFI on the quality of reception.

Where there are two sources of RFI at a receiver location (e.g. parallel transmission lines), the measured QP level will not be significantly affected by the second source if the RFI level from that source is more than 3 dB below the RFI level of the first source.

RFI calculations were carried out for the existing (or planned) transmission lines that parallel the transmission line considered in this study. The RFI from these secondary sources was more than 3 dB below the RFI from the primary sources i.e. lines considered in this study. The contributions from the existing transmission lines does not therefore affect the results in Section 8.2.

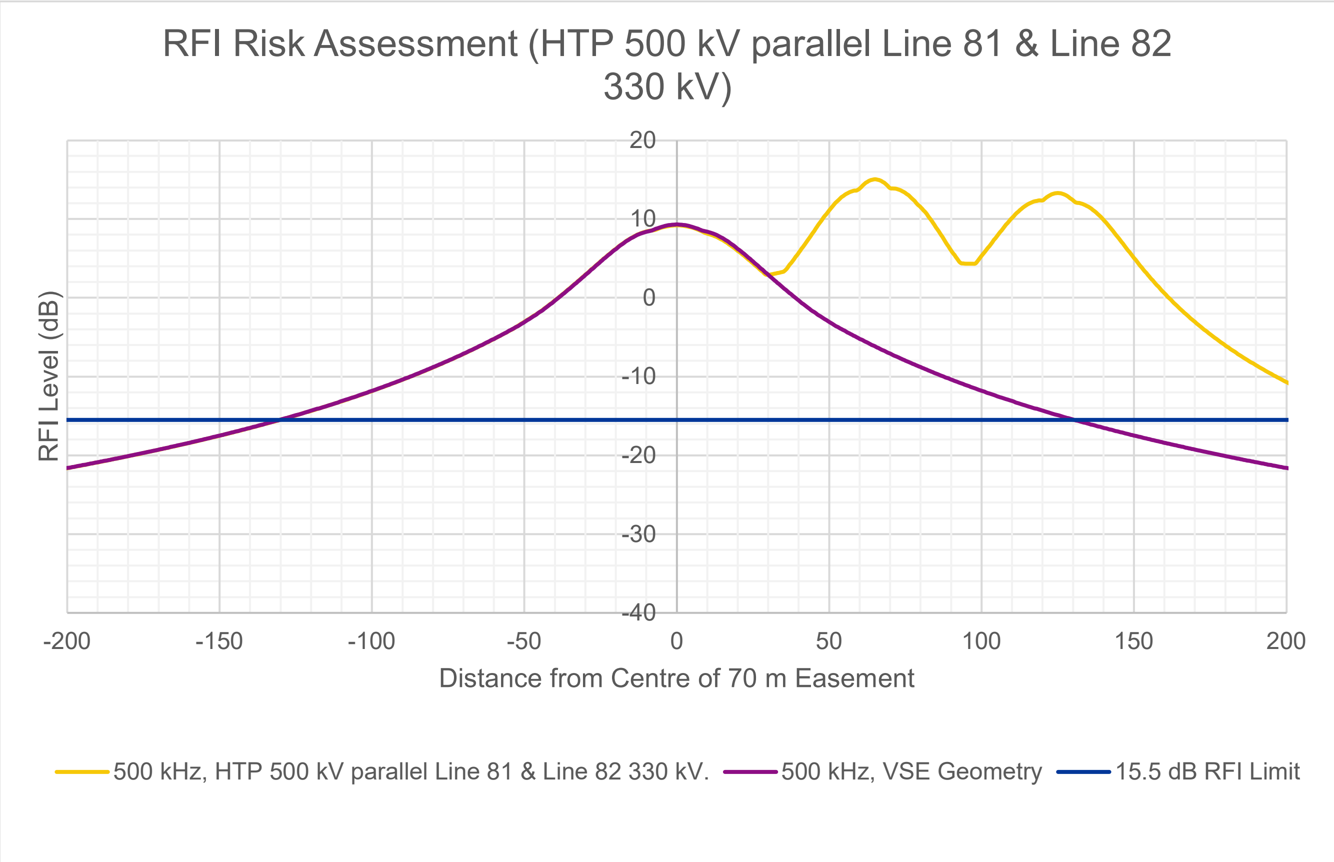


Figure 11: HTP 500 kV double circuit transmission line parallel Line 81 & Line 82 330 kV

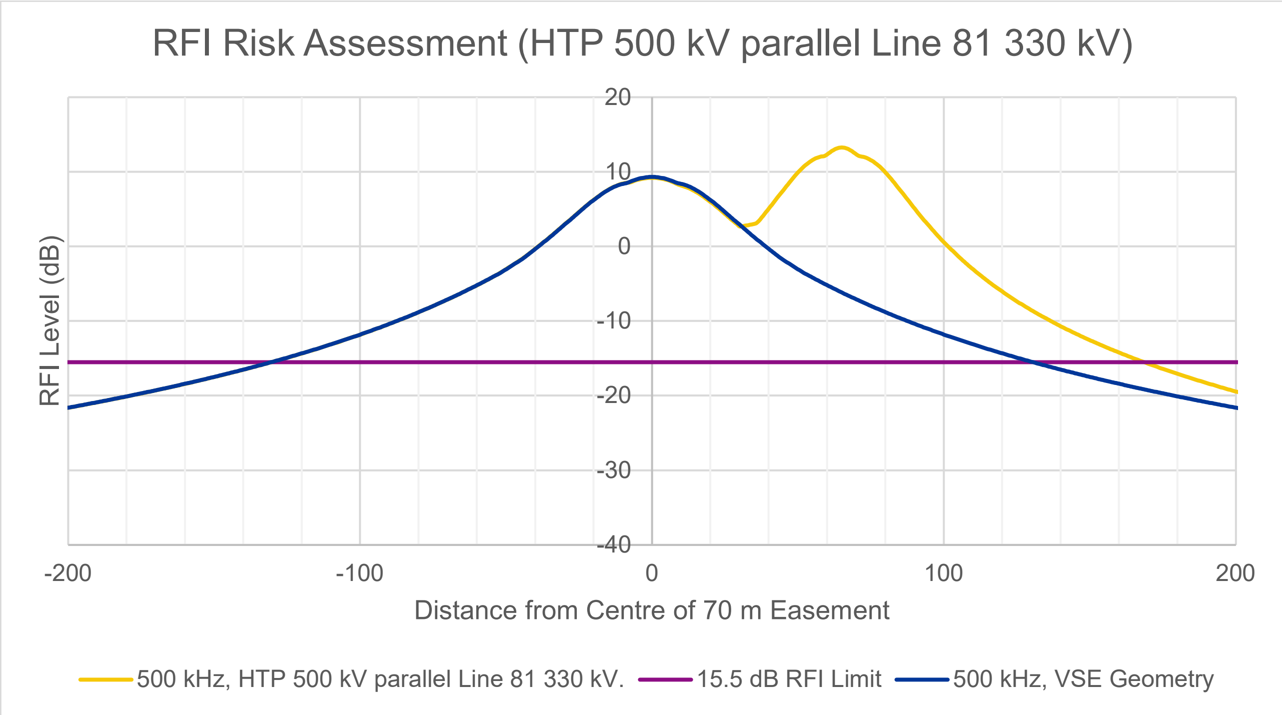


Figure 12: HTP 500 kV double circuit transmission line parallel Line 81 330 kV

8.6 New Conductor Effects

As discussed in Section 7, the new conductor effects will not significantly increase the RFI levels near the new HTP 500 kV transmission line as these effects will not impact results presented in Section 8.

8.7 RFI Risk Assessment

The distance from the centre of the HTP 500 kV double circuit transmission line at which the RFI is likely to negatively impact commercial AM radio reception during rain conditions is limited to 131 metres. For all other communication devices, the quality of reception will at least be better than Class 3 on the CIGRE scale under average rain conditions outside of the transmission line easement.

It is recommended that investigations are undertaken to identify any sensitive receivers impacted by the proposed transmission line. The impact to each receiver should be assessed for compliance with the 80/80 rule[49] in accordance with AS 2344.

[49] The measured levels must comply with the limits for at least 80% of the time with a confidence level of at least 80% (80/80 rule).

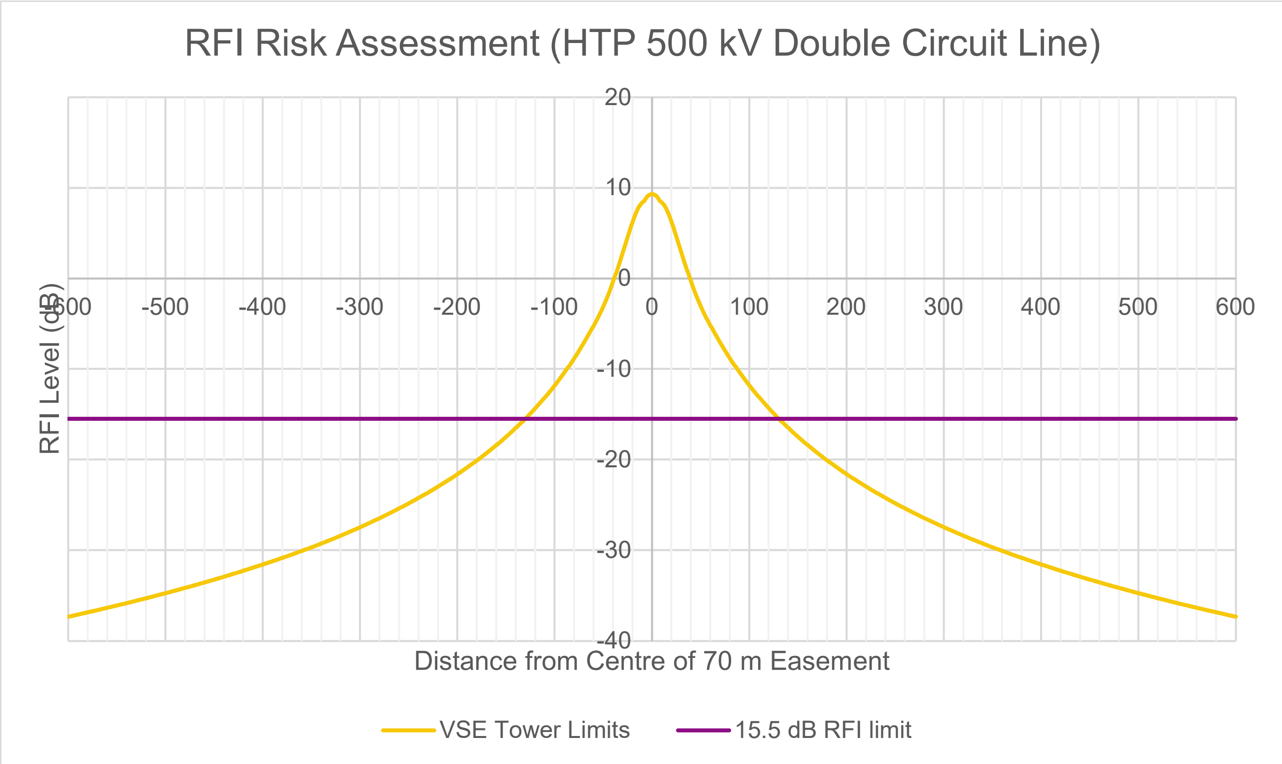


Figure 13 Distance at which RFI may impact residential dwellings – VSE Tower (HTP 500 kV double circuit transmission line)

8.8 Point-to-Point (P2P)

Microwave is a line-of-sight wireless communication technology which utilises high frequency beams of radio waves to provide high-speed wireless connections which allows for a multitude of telecommunication services. In radio communications, the Fresnel Zone refers to one of several concentric ellipsoids within the radiation pattern of a circular wave.

The concept of Fresnel Zone clearance can be used to analyse interference caused by obstacles, such as transmission structures, near the line-of-sight of a radio beam. To achieve optimal radio reception, the first Fresnel Zone must remain largely unobstructed. While obstructions beyond the first Fresnel Zone have minimal impact on UHF communications links (e.g., 400 MHz), it is recommended to consider the second Fresnel Zone for SHF communications links (e.g., 10 GHz), as these higher-frequency links are more susceptible to interference from obstacles.

8.8.1 Database Search

A summary of point-to-point communication links i.e. microwave beams, operating in the vicinity of the HTP 500 kV double circuit transmission line alignment is illustrated in Figure 14. These sites are identified using the public databases available through ACMA[50].

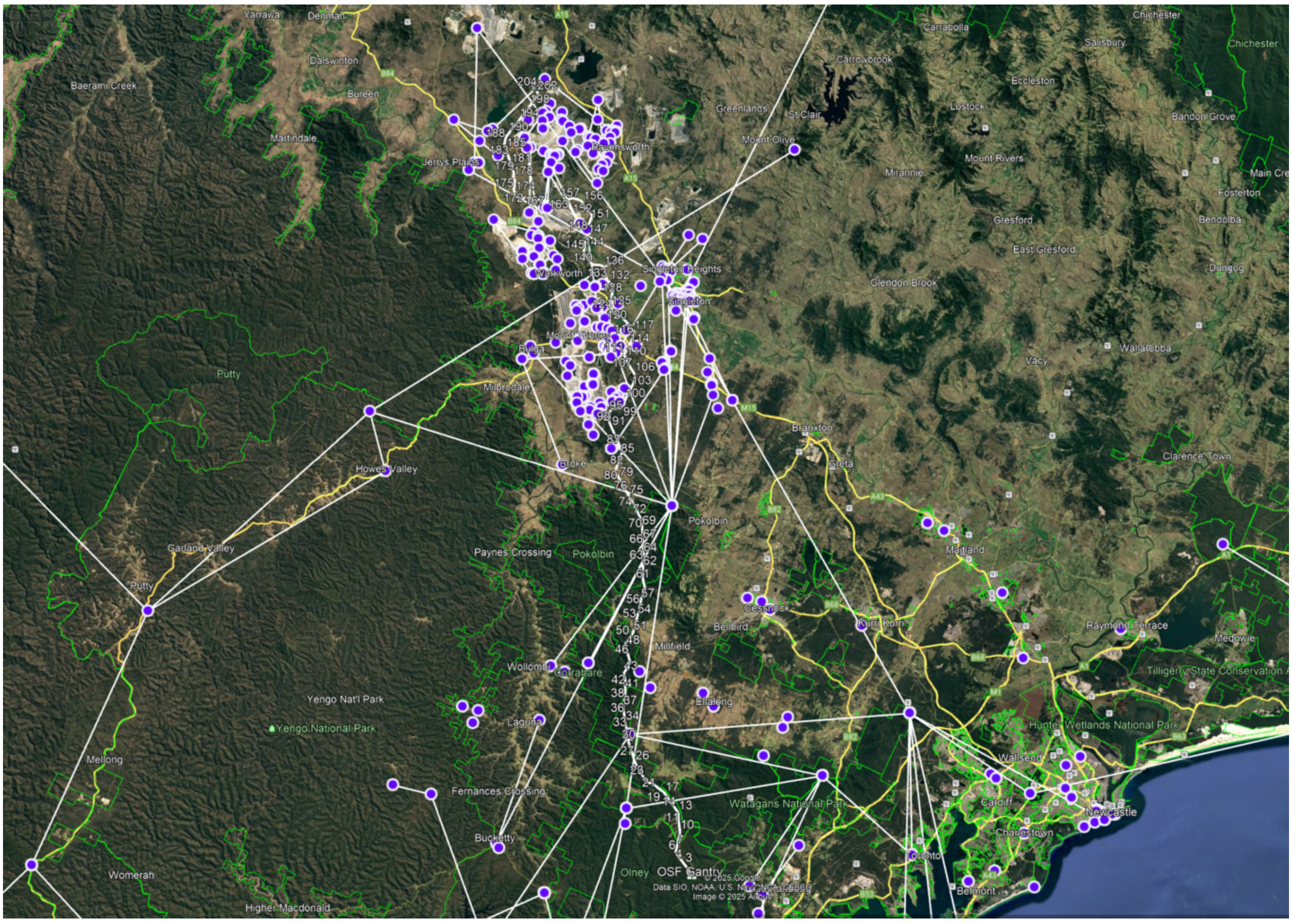


Figure 14 P2P communication links for the HTP 500 kV double circuit transmission line alignment

[50] *Website Source:* https://web.acma.gov.au/pls/radcom/site_proximity.main_page/

8.8.2 Point-to-Point Evaluation

The identified point-to-point communications links have been reviewed against the preferred line alignment and the concept design towers. Identified findings from this desktop review are presented in Table 22. Where the line alignment and height have the potential to obstruct the line of sight (LOS) communications link this is highlighted for consideration in future design development.

As noted on Table 23 the transmission line route alignment has been identified as potentially impacting several Point-to-Point communication systems. As required by Transgrid's standards and guidelines the integrity of communication links is maintained during the design of transmission lines, and no towers should be positioned within the applicable Fresnel zone.

The respective Fresnel Zone for point-to-point links and the perceived impacts on the communication services is to be calculated and assessed as part of the detailed design process. In cases where it is not feasible to avoid interference with existing communication links, appropriate modifications to the affected systems may be required to restore their original functionality to maintain uninterrupted performance.

Table 23 Point-to-point communications links

ACMA Site ID	Closest Structure	Frequency (GHz)	Distance between Antennas (km)	Transmitter Height (m)	Receiver Height (m)	Tower/Line Height (m)	Height to applicable FZ (m)	Potential interference (Y/N)
6084	27	0.404	31.4	632	589	567	540	Y
6084	63	10.6	18.4	352	587	455	496	N
6084	77	5.95	32.6	589	555	297	541	N
6084	86	0.4	21.7	89	609	201	0.4	N
6115	16	7.45	20	640	488	497	508	Y
6148	31	7.66	26.9	338	525	590	492	Y
6214	161	10.9	6.6	118	119	104	110	Y
6220	136	7.66	52.13	555	652	212	574	N
6337	199	10.8	33.2	120	454	297	341	N
6339	205	10.9	7.6	238	221	272	217	Y
53560	118	10.9	9.6	155	148	119	143	N
53560	147	10.9	23.7	130	179	141	132	Y
53560	173	10.9	26.5	155	201	214	169	Y
55600	63	7.9	39	639	300	487	570	N
55600	66	7.8	39	280	592	570	525	Y
55600	102	7.9	17.1	592	106	194	205	Y
250048	171	0.45	6.9	144	213	190	132	Y
250678	160	10.8	7.3	135	143	138	129	Y
402093	140	22.9	8.5	153	95	156	121	Y
9011286	147	21.9	8.5	153	95	139	96	Y
9011286	166	22.1	4.8	95	138	89	127	N
9015039	170	10.9	9.3	138	103	141	103	Y
9017023	167	22.1	4.8	74	126	105	114	N
10022711	88	10.9	10	142	234	219	217	Y

9. Results and Recommendations

Surface Voltage Gradients of Conductors

Transgrid and Australian standards recommend that the conductor SVG be limited to less than 16 kV/cm to minimise the impact of AN and RFI. Higher values of SVG may be used where acceptable AN and RFI performance is demonstrated. The design of the HTP 500 kV double circuit transmission line will result in average maximum values of SVG on the conductor bundles of up to 16.2 kV/cm. Validation of the noise assessment completed by SLR will need to be undertaken to verify the results of the operational noise impacts during detailed design.

Audible Noise

The EPRI (semi-empirical) calculation method was determined to be the most appropriate method that is available in the SES-Enviro Version 19.0 software tool for calculating the wideband AN level from HTP 500 kV double circuit transmission lines. The following has been observed:

- Fair weather AN levels will be within the project noise trigger level of 35 dB(A) within or close to the edge of the line easement.
- The maximum observed AN limits under the wet weather conditions are within 50 dB limit at the edge of its easement.
- Under wet conditions, the project noise trigger levels are achieved within 425 meters from the centreline of the transmission line.
- The noise limits set by the NSW Noise Policy for Industry are reduced by 5 dB if tones are significant, this may need to be accounted for when assessing sensitive receivers.

Radio Frequency Interference

The RFI limits in AS 2344 (*Limits of electromagnetic interference from overhead alternating current powerlines and high voltage equipment installations in the frequency range 0.15 MHz to 3000 MHz*) are defined for the protection of radio and television reception for perceived annoyance to music listeners. The International Council on Large Electric Systems (CIGRE) empirical calculation was determined to be the most appropriate method available in the SES-Enviro Version 19.0 software tool for calculating the RFI levels. This method was used to determine the RFI levels for the HTP transmission lines. It is found that:

- The calculated emission levels applicable to AM reception (500 kHz – 1.6 MHz) exceed the AS 2344 limits at the edge of the transmission line easement during L_{50} wet conditions for all lines considered and assessed in this report.
- Under wet conditions, RFI is likely to negatively impact commercial AM radio reception within 131 meters from the centre of the transmission line.

Other forms of communication are not noticeably affected by RFI at the edge of the transmission line easement.

Recommendations and Next Steps

The following next steps and recommendations are proposed:

- Investigations are carried out to identify sensitive receivers (e.g. residential dwellings and places of work, education, or worship) within 425 metres of the centre of the HTP 500 kV double circuit transmission line easement. In addition to identifying existing sensitive receivers, publicly available council Local Environmental Plans (LEP) should be reviewed to identify any authorised, but not yet constructed developments. Modifying factors for tonality may need to be considered at sensitive receivers identified withing the AN risk zone.

- RFI investigations to be undertaken to identify any sensitive receivers within 131 metres from the centre HTP 500 kV double circuit transmission line easement. The impact to each receiver should be assessed for compliance with the 80/80 rule[51] in accordance with AS 2344, and the risk of public RFI complaint assessed.
- Potentially impacted Point-to-Point communication systems are to be assessed, quantified, and minimized during the detailed design process. In cases where it is not feasible to avoid interference with existing communication links, appropriate modifications to the affected systems may be required to restore their original functionality to maintain uninterrupted performance.

[51] The measured levels must comply with the limits for at least 80% of the time with a confidence level of at least 80% (80/80 rule).

A

Appendix A – Parallel Assessment Plots

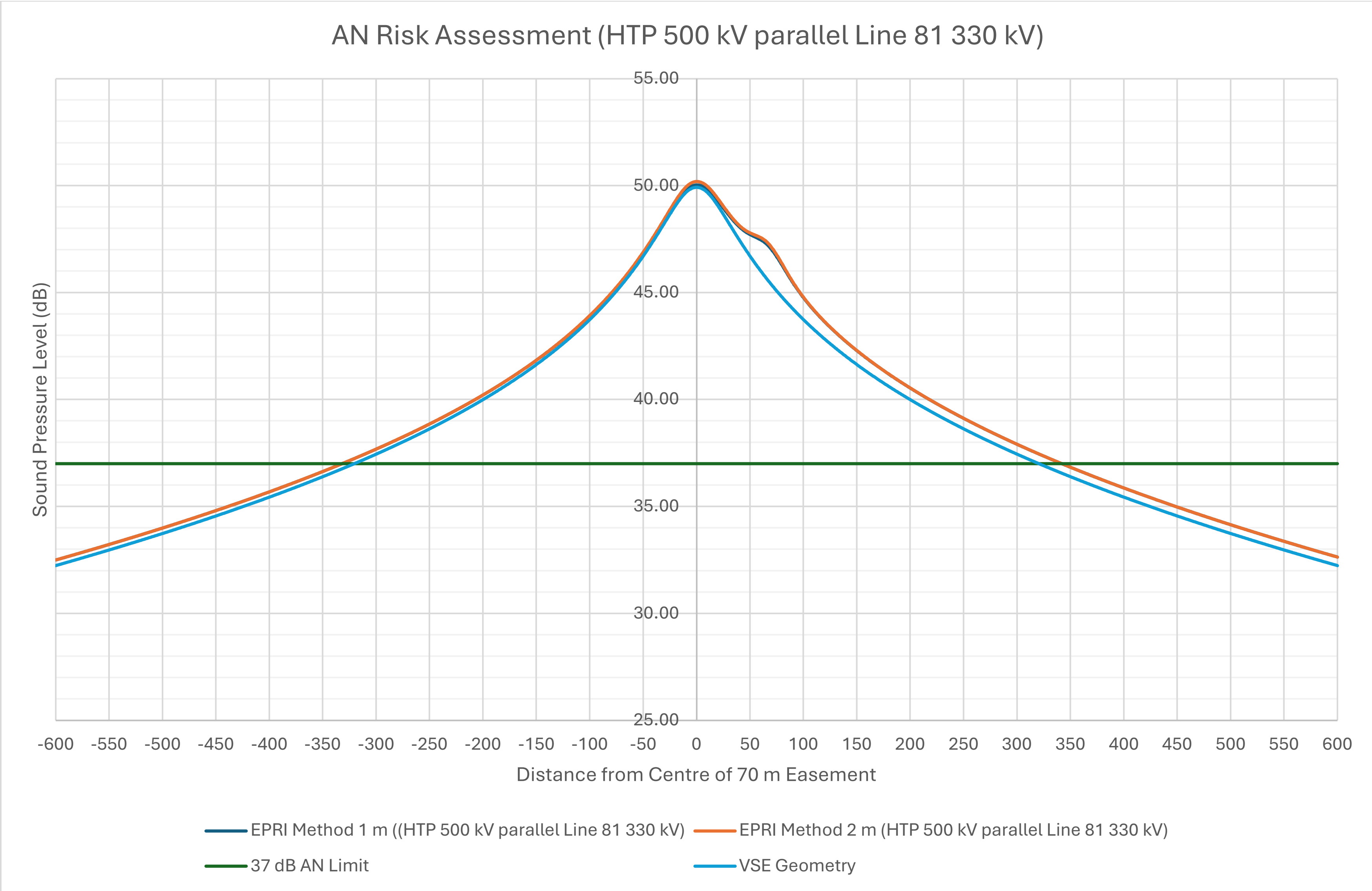


Figure A 2 HTP 500 kV parallel Line 81 330 kV

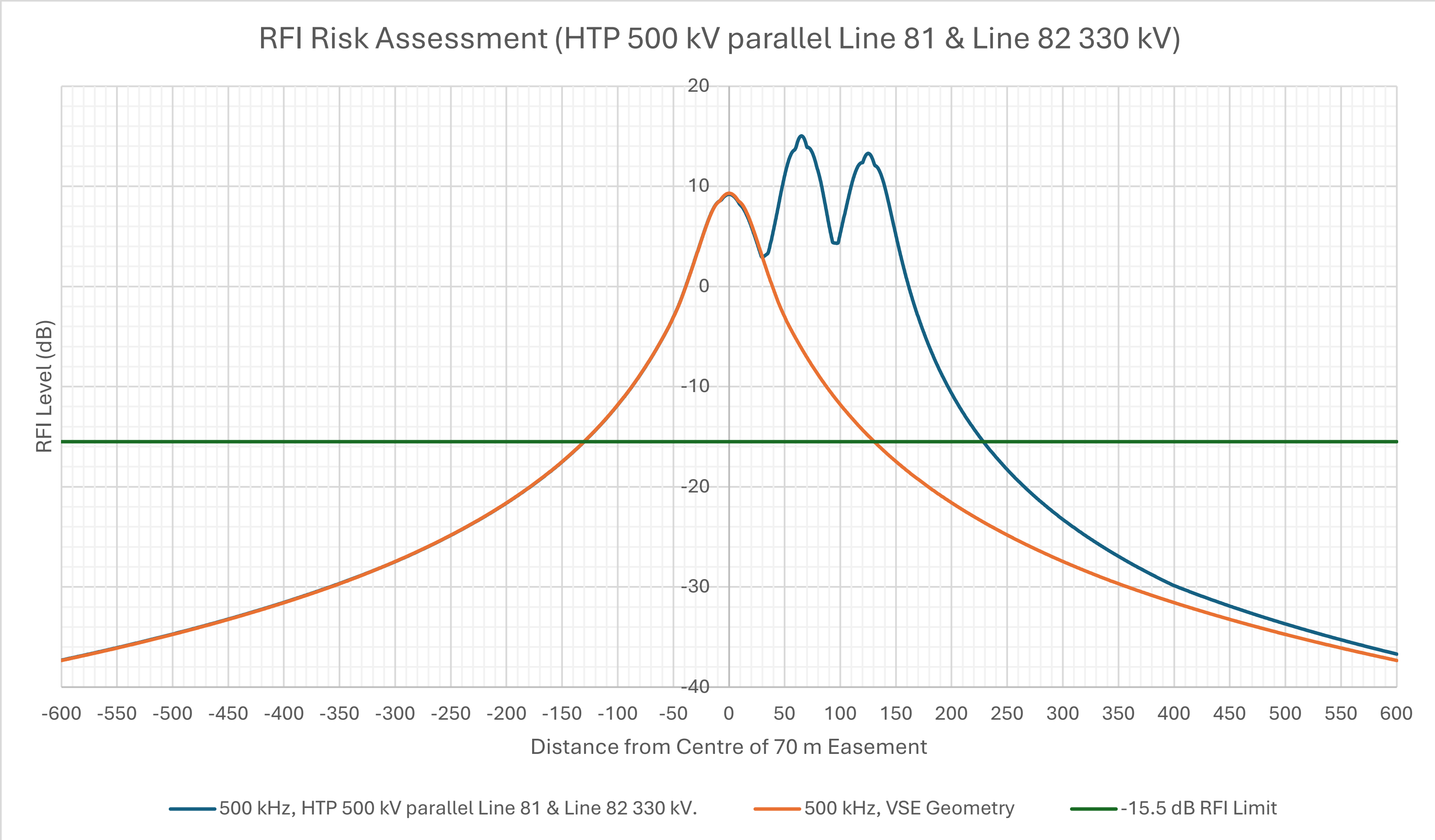


Figure A 3 RFI Risk assessment (HTP 500 kV parallel Line 81 & Line 82 330 kV)

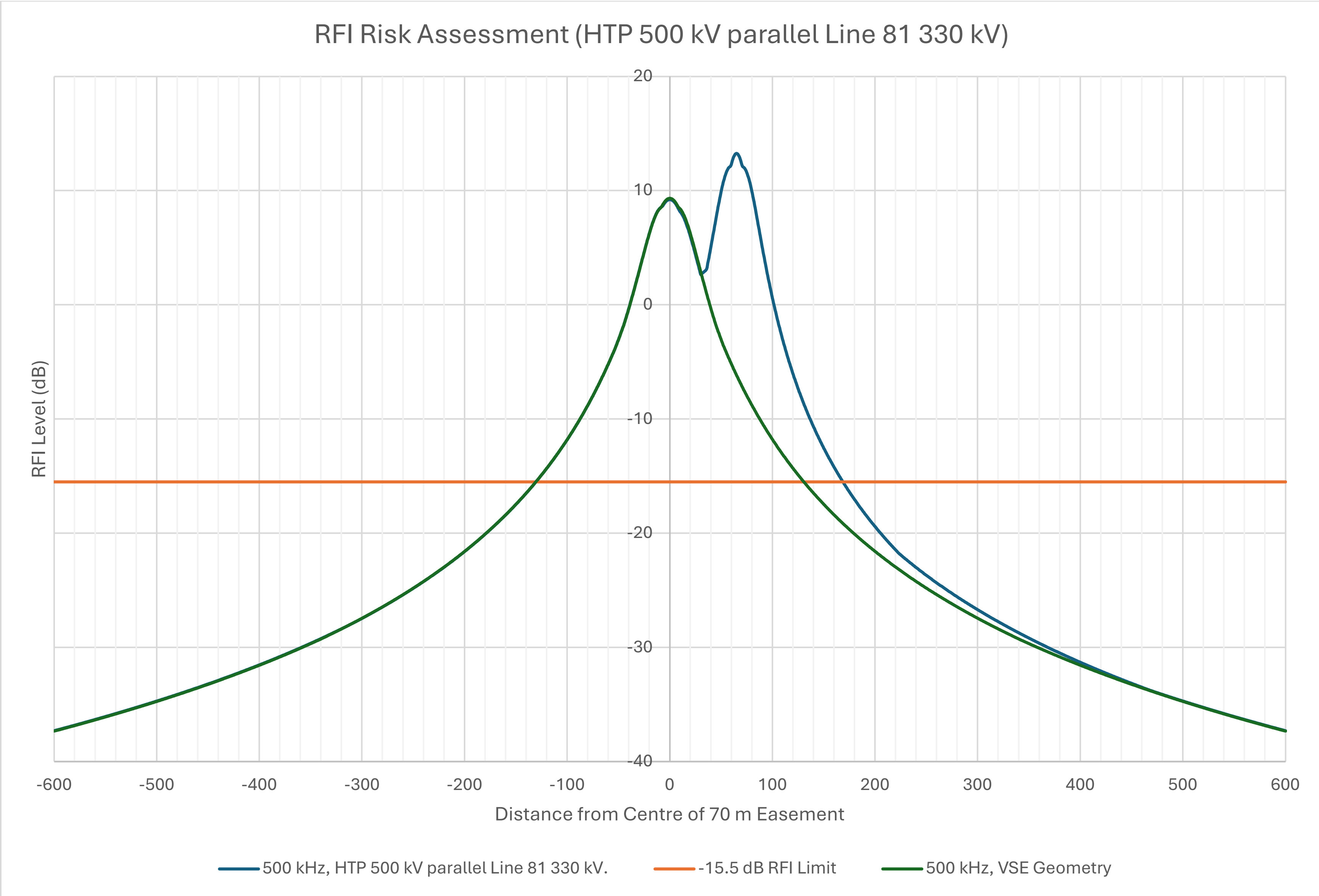


Figure A 4 RFI Risk Assessment (HTP 500 kV parallel Line 81 330 kV)

Attachment F Ambient noise monitoring results

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

14 July 2025

L01 Noise monitoring details

Device and monitoring location	
Address and coordinates	66 Long Point Road East, Gouldsville NSW 2330 (321156, 6394870)
Logger device and serial number	ARL EL-316 (SN: 203526)
Sound level meter device and serial number	Brüel & Kjær Type 2250L (SN: 3003389)
Description of location	Logger located on west side of the driveway fence in line with the northern façade of the property, approximately 75 m south of Long Point Road, and 630 m west of any currently proposed works associated with the HTP.
Description of ambient noise	Attended noise measurements indicate the ambient noise environment at this location is dominated by insect and other animal noise, and to a lesser extent, road traffic noise.

Map of noise monitoring location

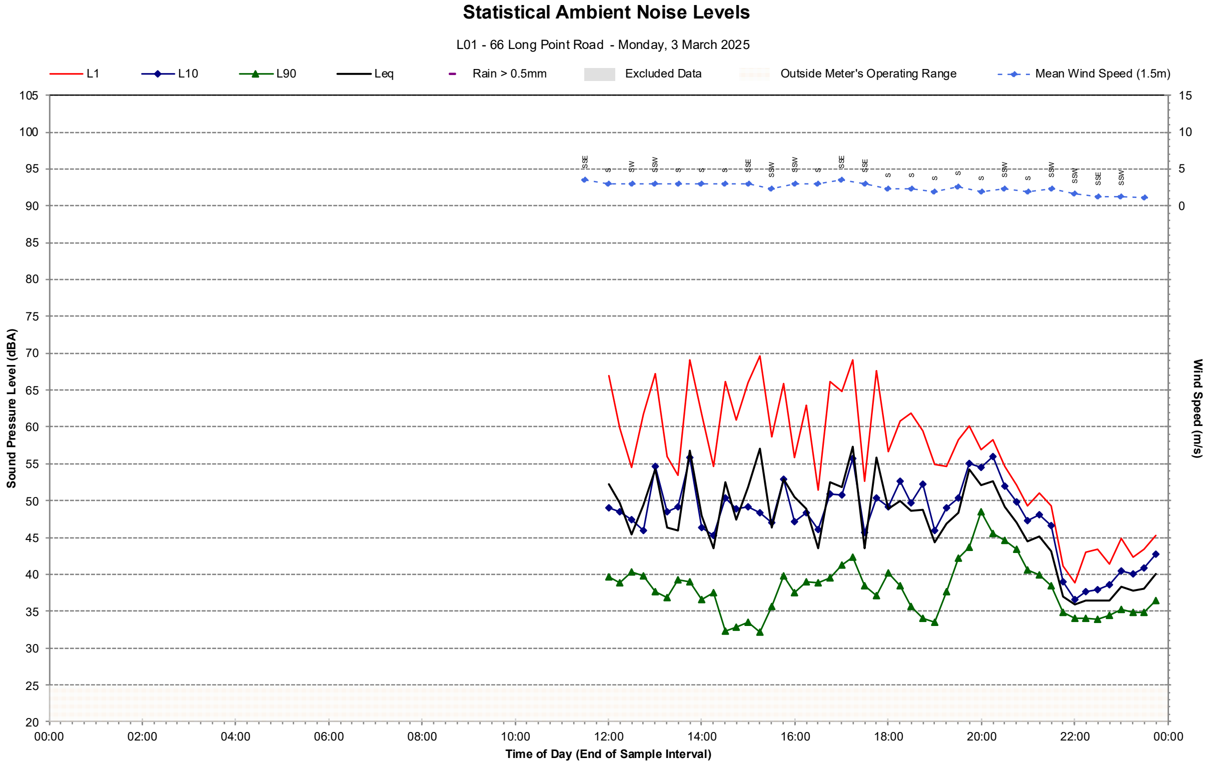
Ambient noise logging results – NPfI defined time periods

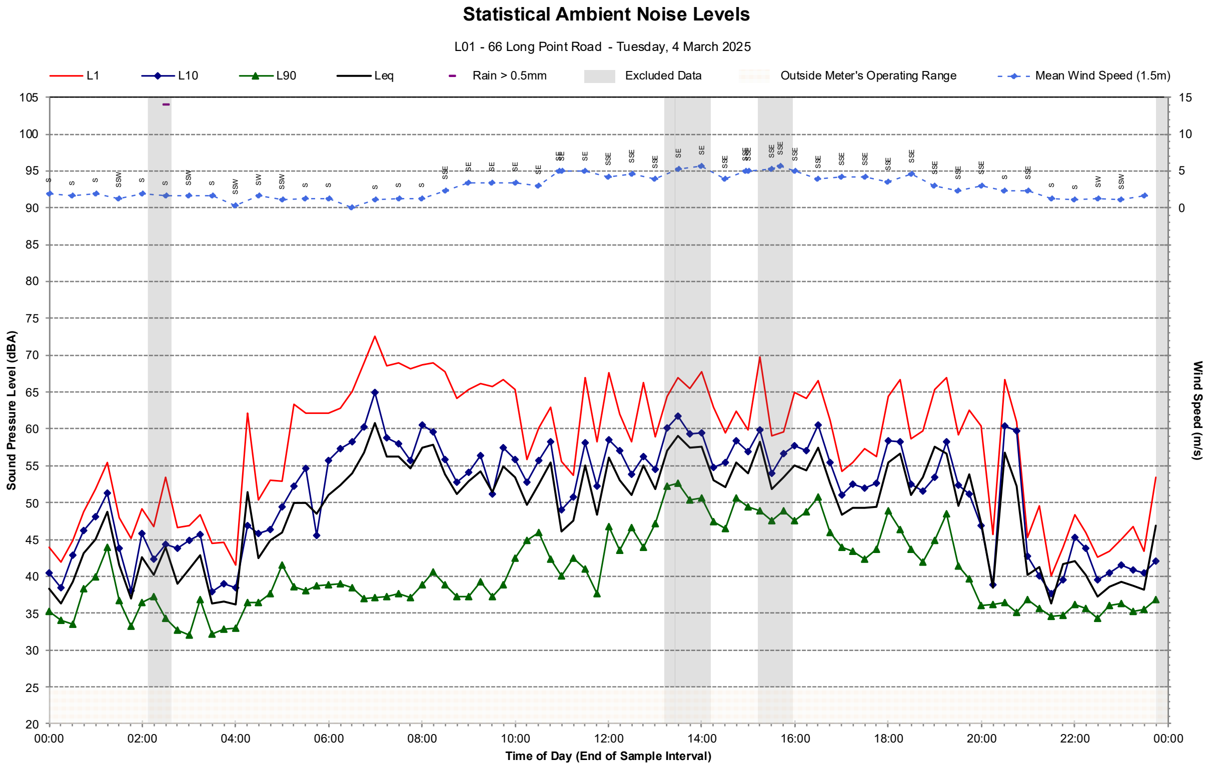
Monitoring Period	Ambient measured noise level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	38	65	54	62
Evening	35	51	45	55
Night-time	33	48	41	46

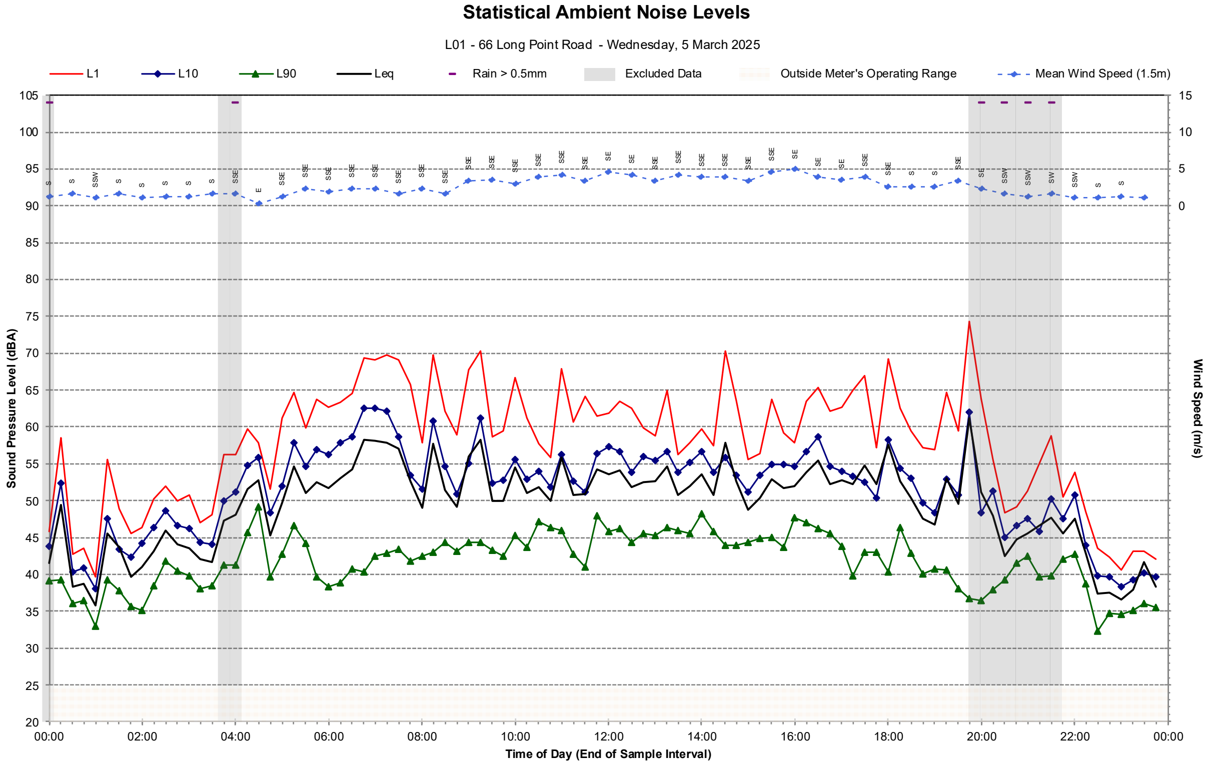
Attended noise measurement results

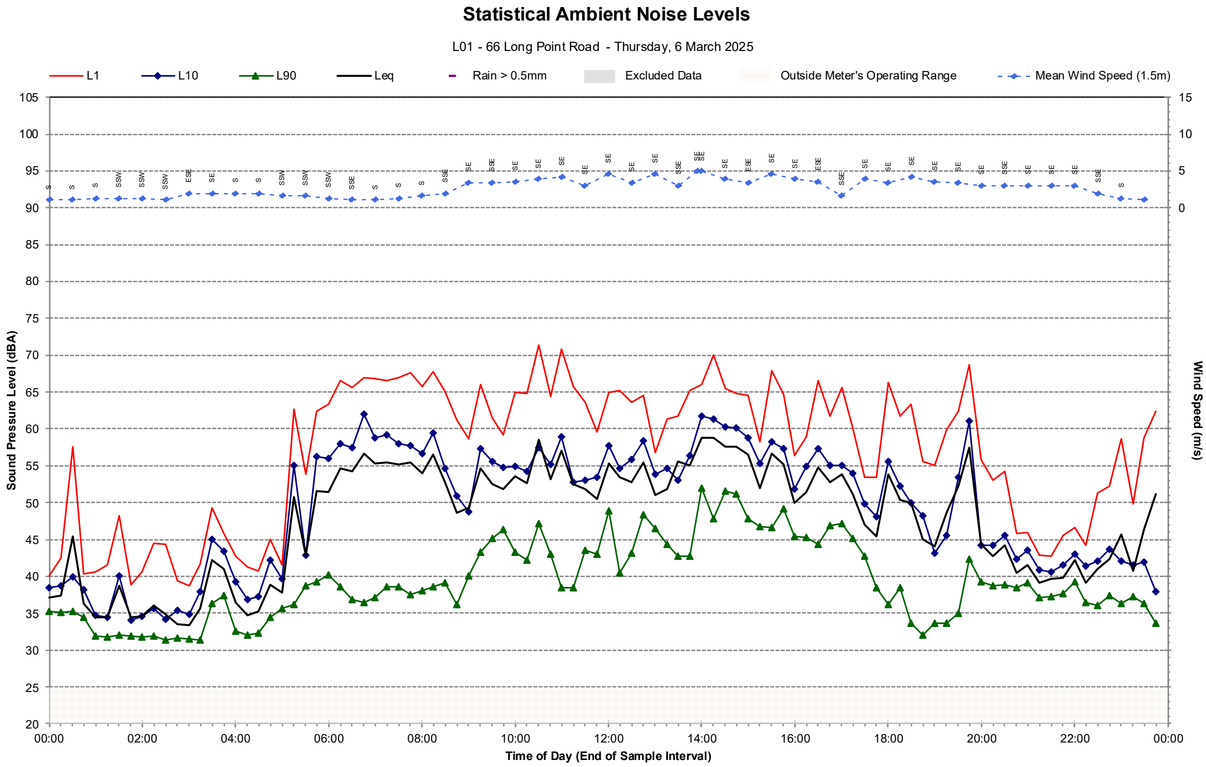
Date and start time	Attended measured noise level (dBA)		
	L_{A90}	L_{Aeq}	L_{Amax}
14/02/2025 09:59	35	52	77

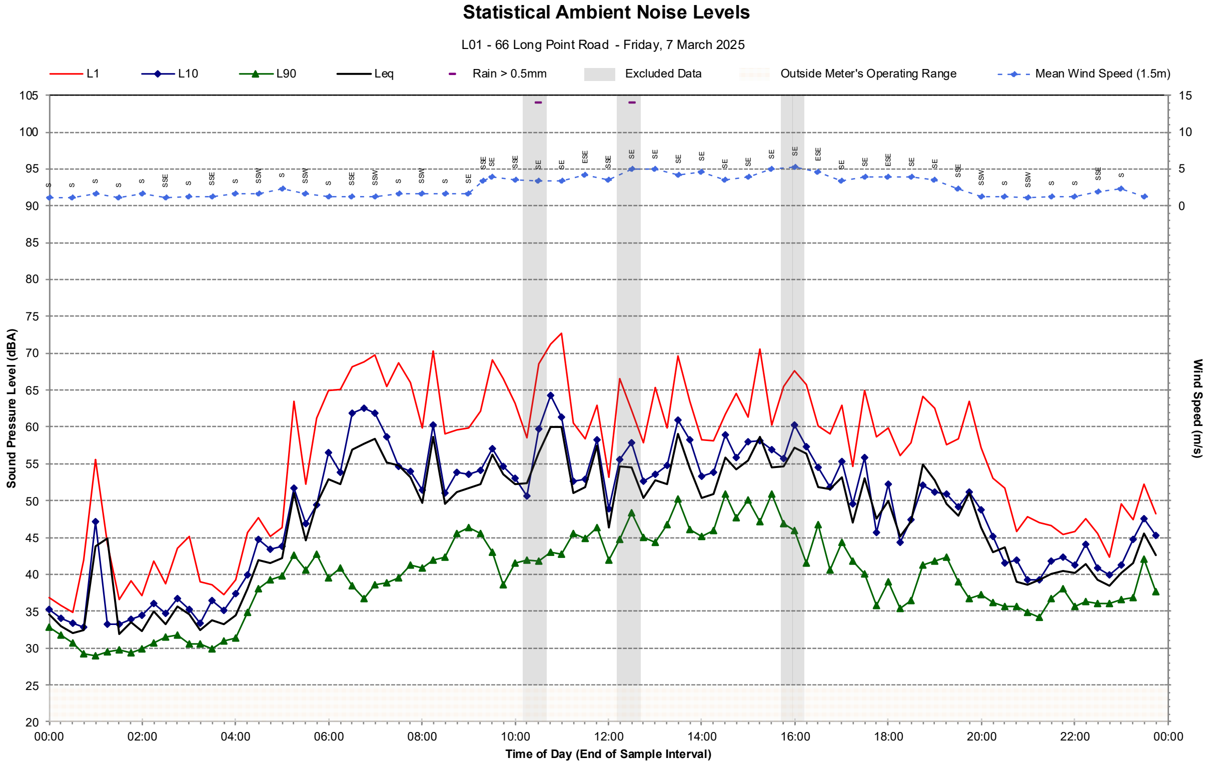
Photo of noise monitoring location

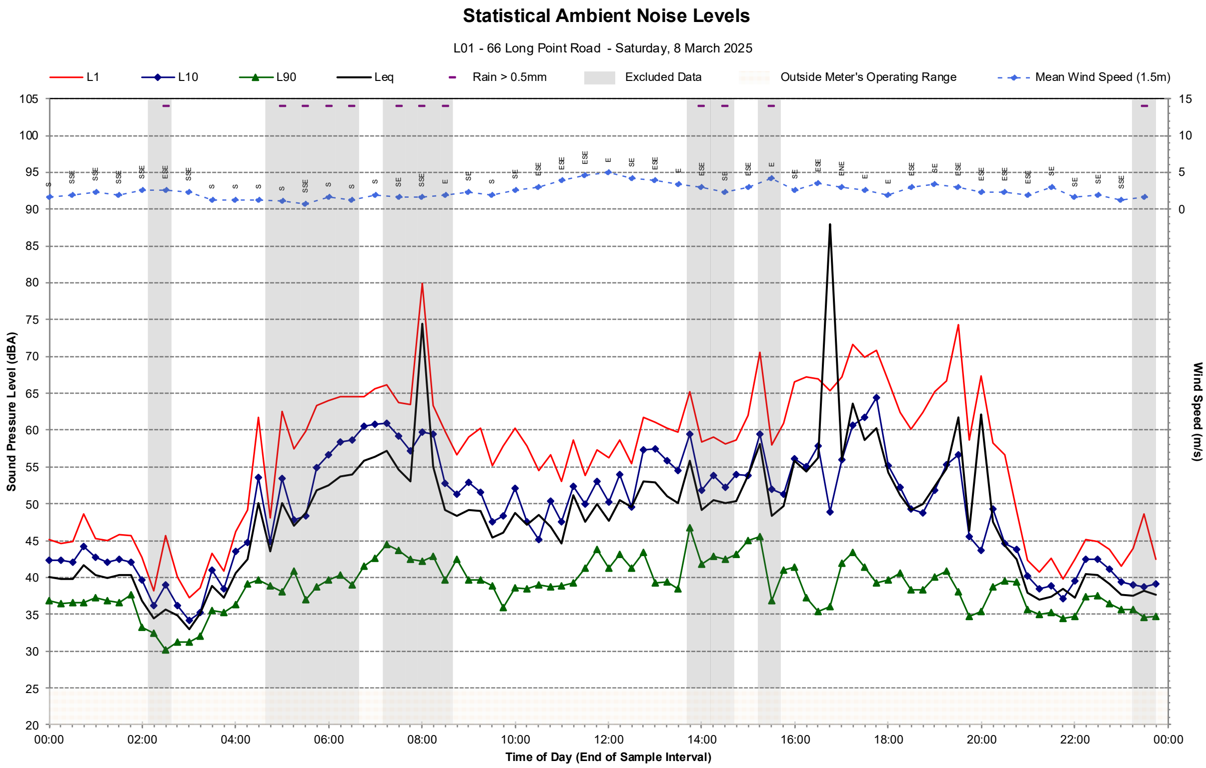

Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Monday, 3 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

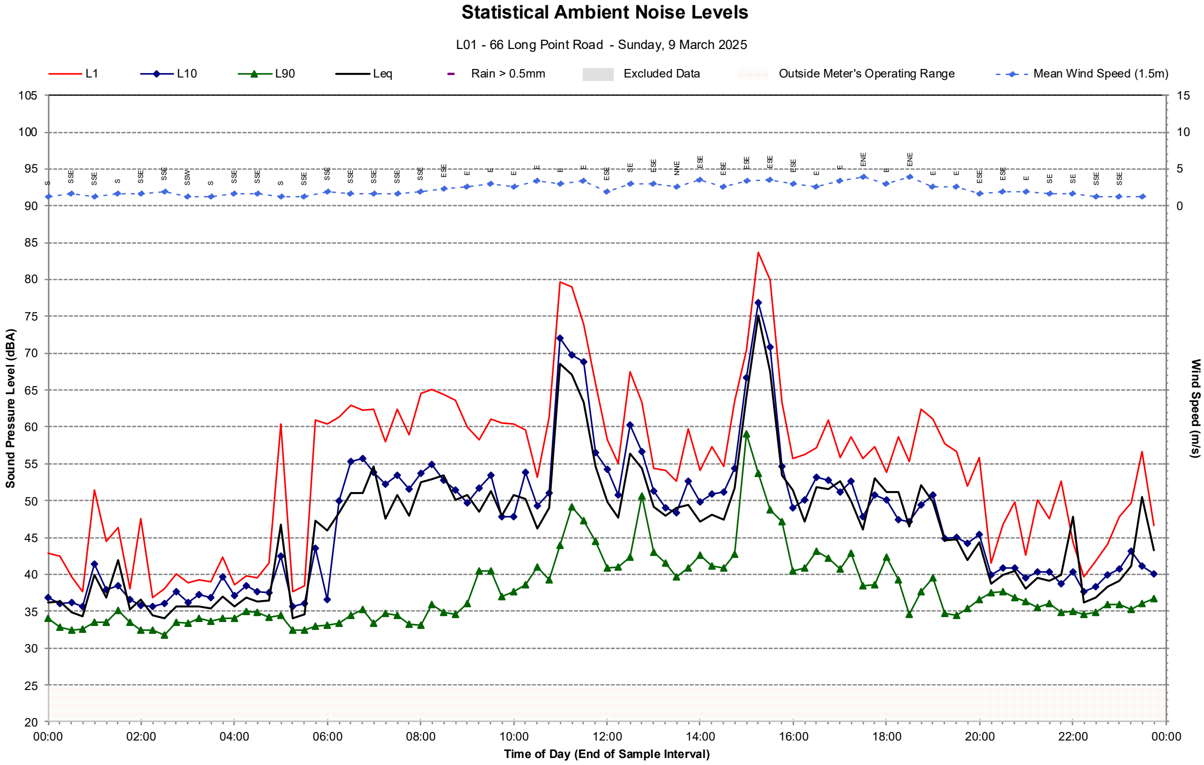

Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Tuesday, 4 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

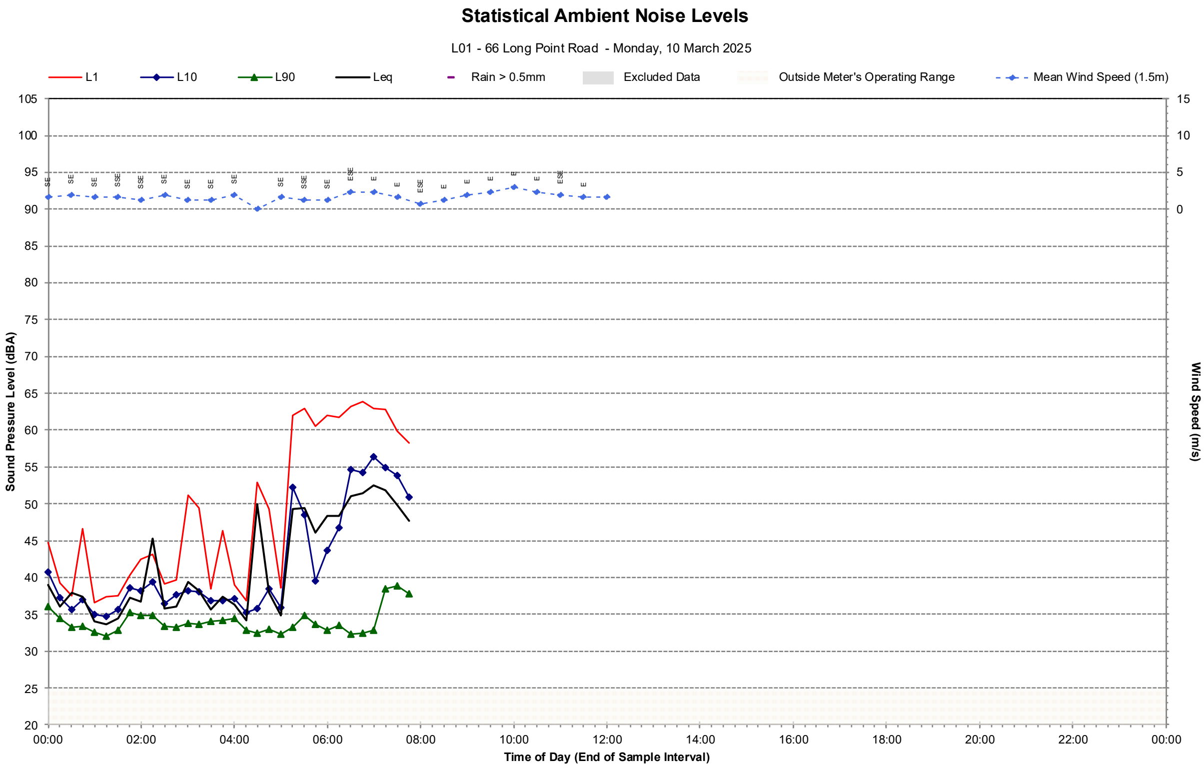

Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Wednesday, 5 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Thursday, 6 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Friday, 7 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Saturday, 8 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Sunday, 9 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L01 - 66 Long Point Road - Monday, 10 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

L02 Noise monitoring details

Device and monitoring location

Address and coordinates	33 Mount Baker Road Mount View NSW 2325 (336466, 6362977)
Logger device and serial number	ARL EL-316 (SN: 103494)
Sound level meter device and serial number	RION-NA28 (SN: 470370)
Description of location	Logger located in clearing north of the property, approximately 80 m south of Mount Baker Road, and 1.2 km west of any currently proposed works associated with the HTP.
Description of ambient noise	Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise, and birdsong with some road traffic noise contributing to the L_{Aeq}.

Map of noise monitoring location

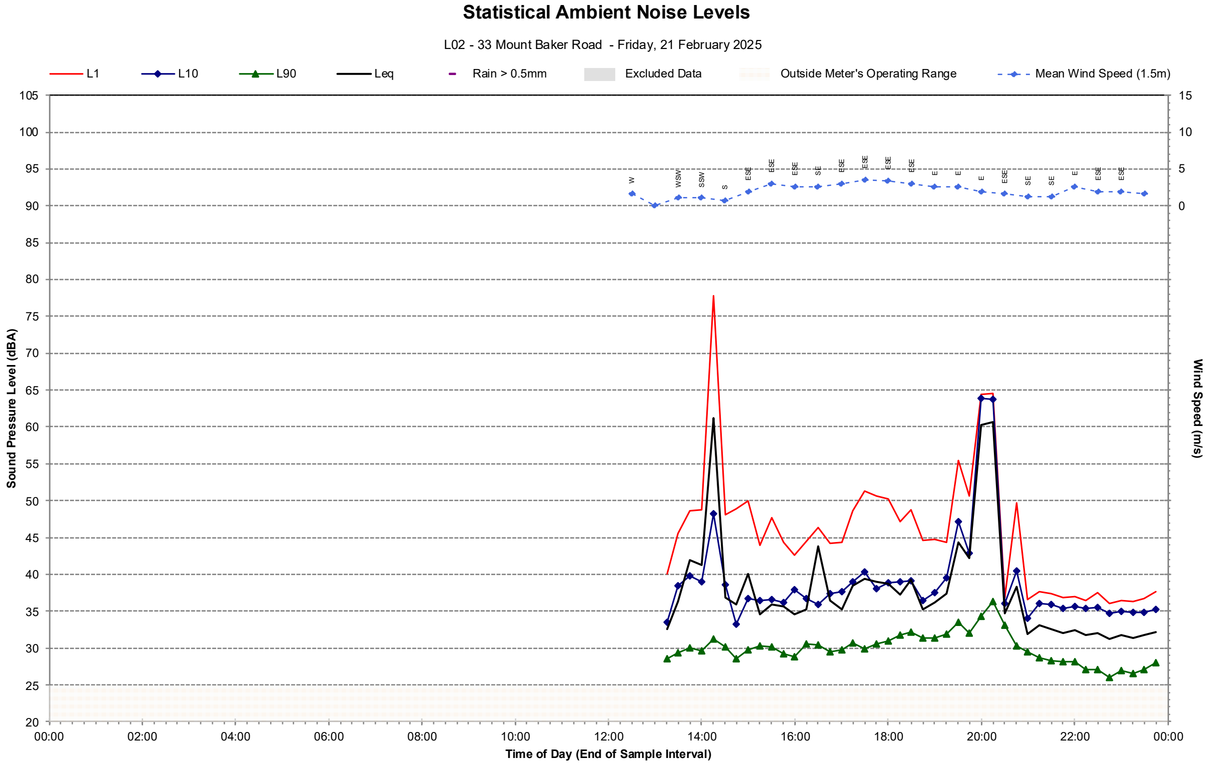
Ambient noise logging results – NPfI defined time periods

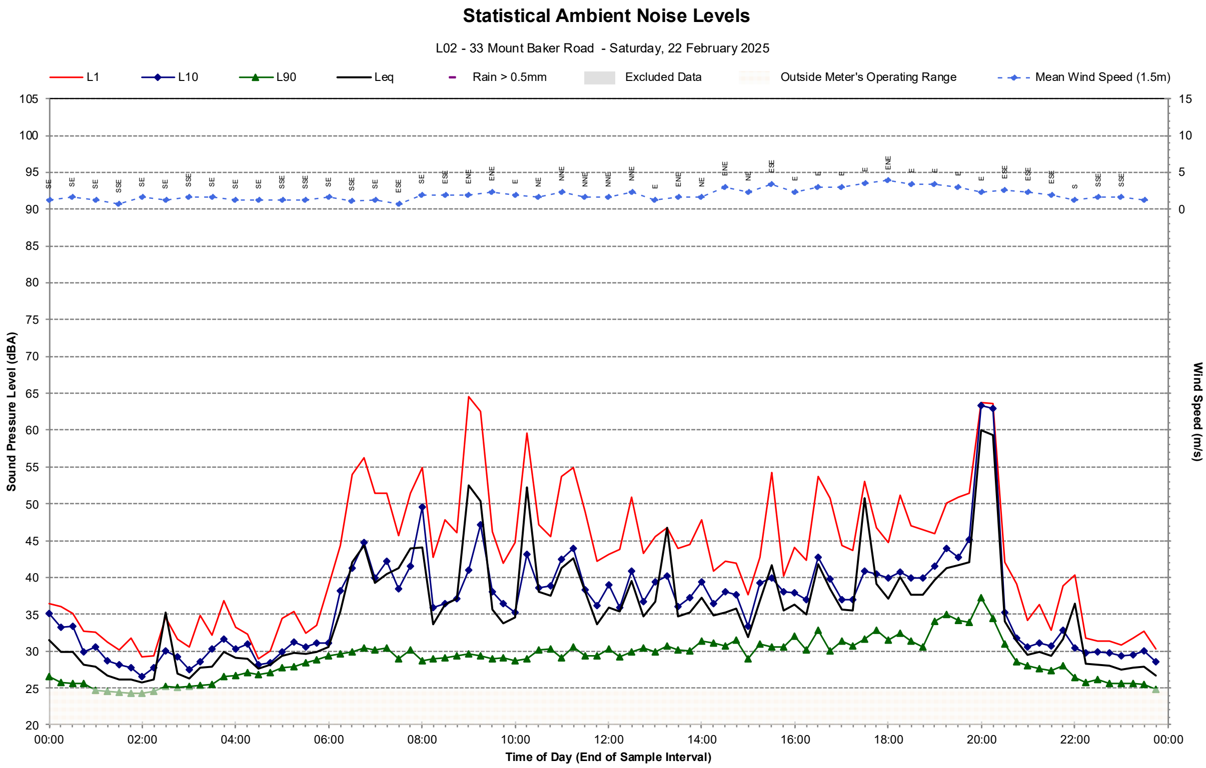
Monitoring Period	Ambient measured noise level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	29	44	39	48
Evening	28	46	42	46
Night-time	25	41	43	45

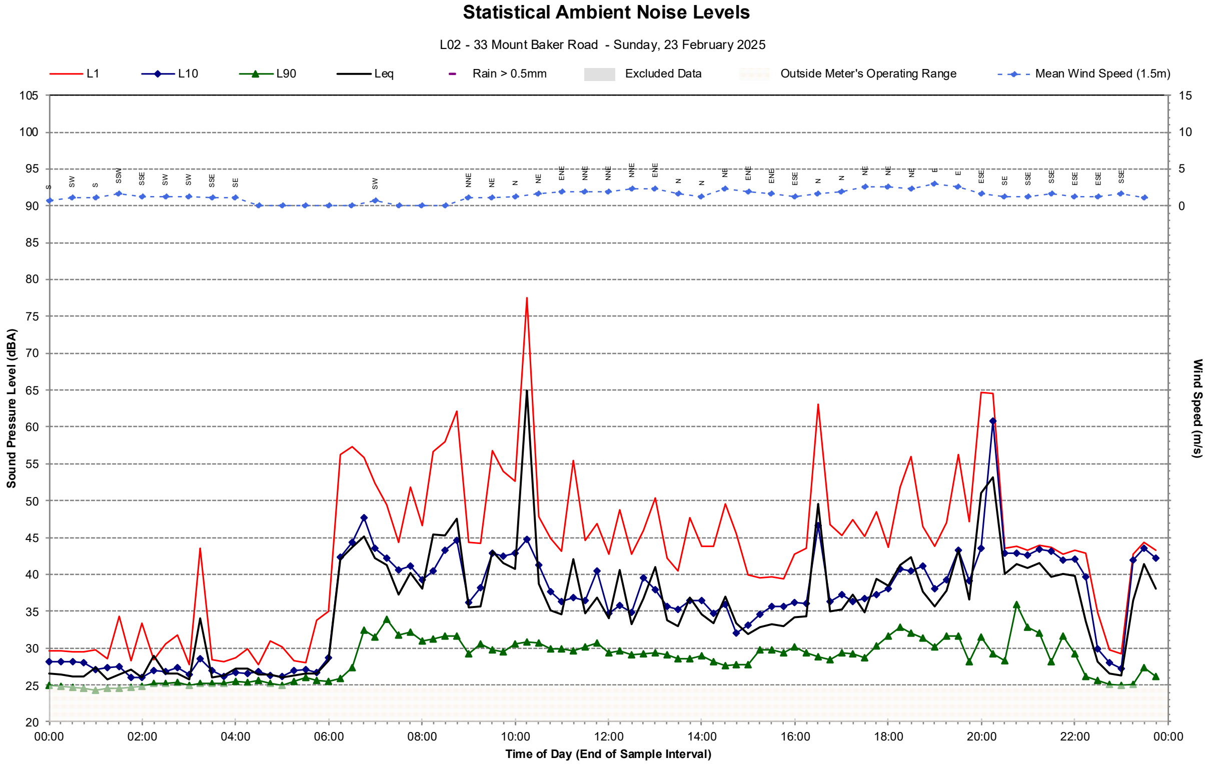
Attended noise measurement results

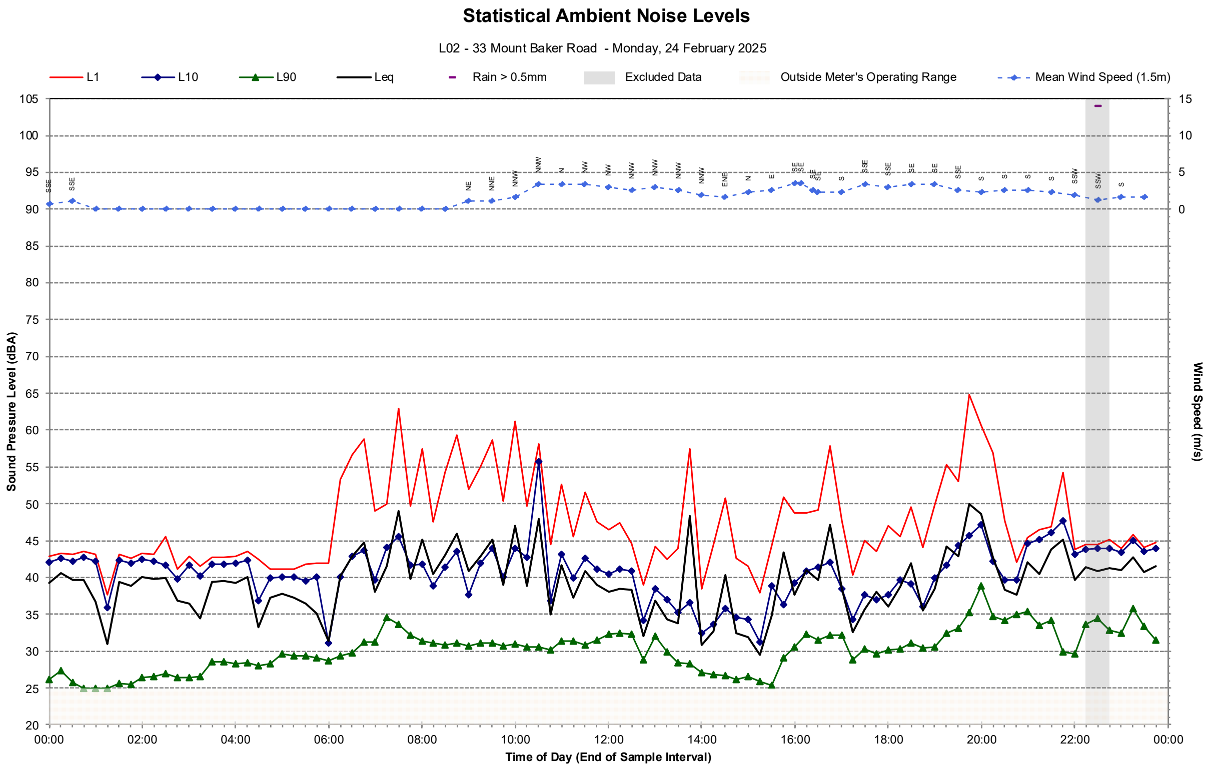
Date and start time	Attended measured noise level (dBA)		
	L_{A90}	L_{Aeq}	L_{Amax}
21/02/2025 12:51	31	41	57

Photo of noise monitoring location


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Friday, 21 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

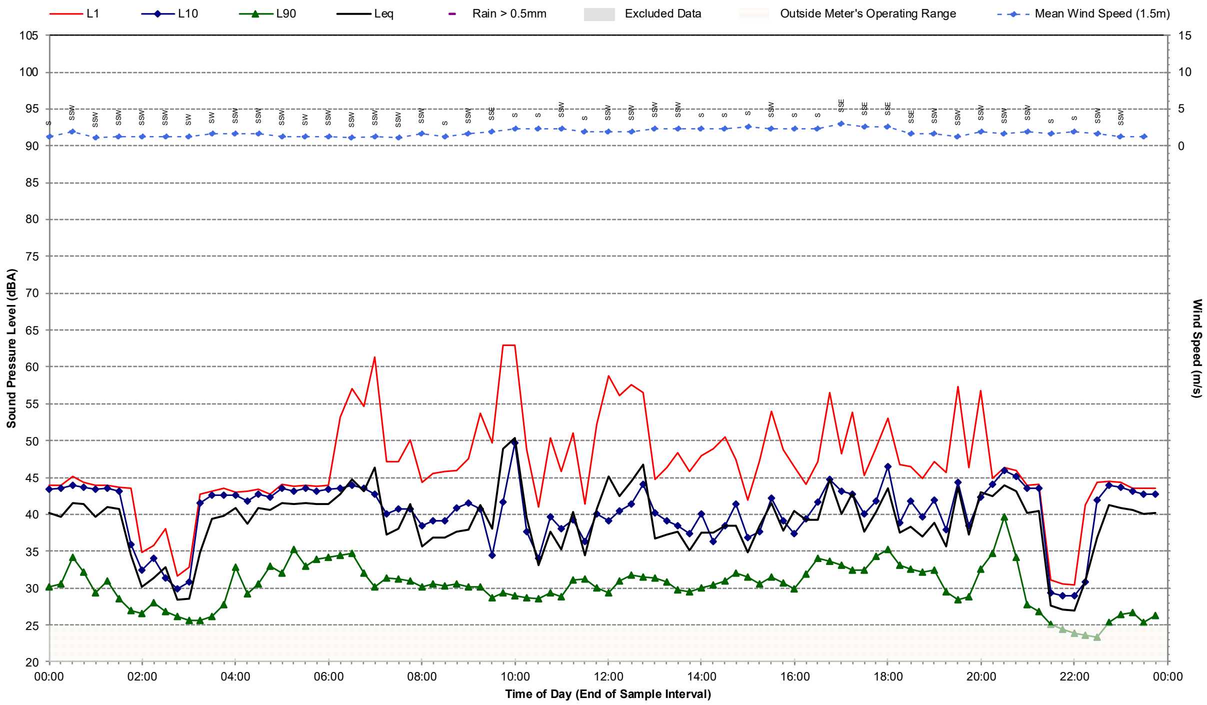

Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Saturday, 22 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Sunday, 23 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Monday, 24 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

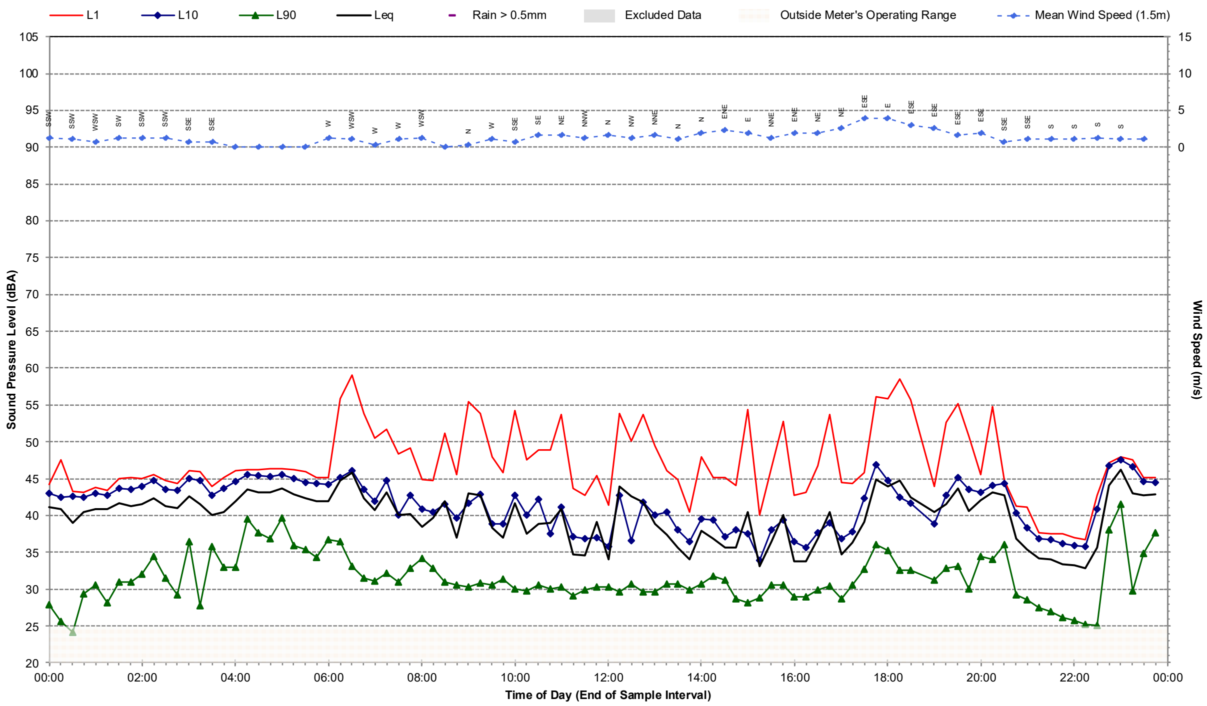
Statistical Ambient Noise Levels

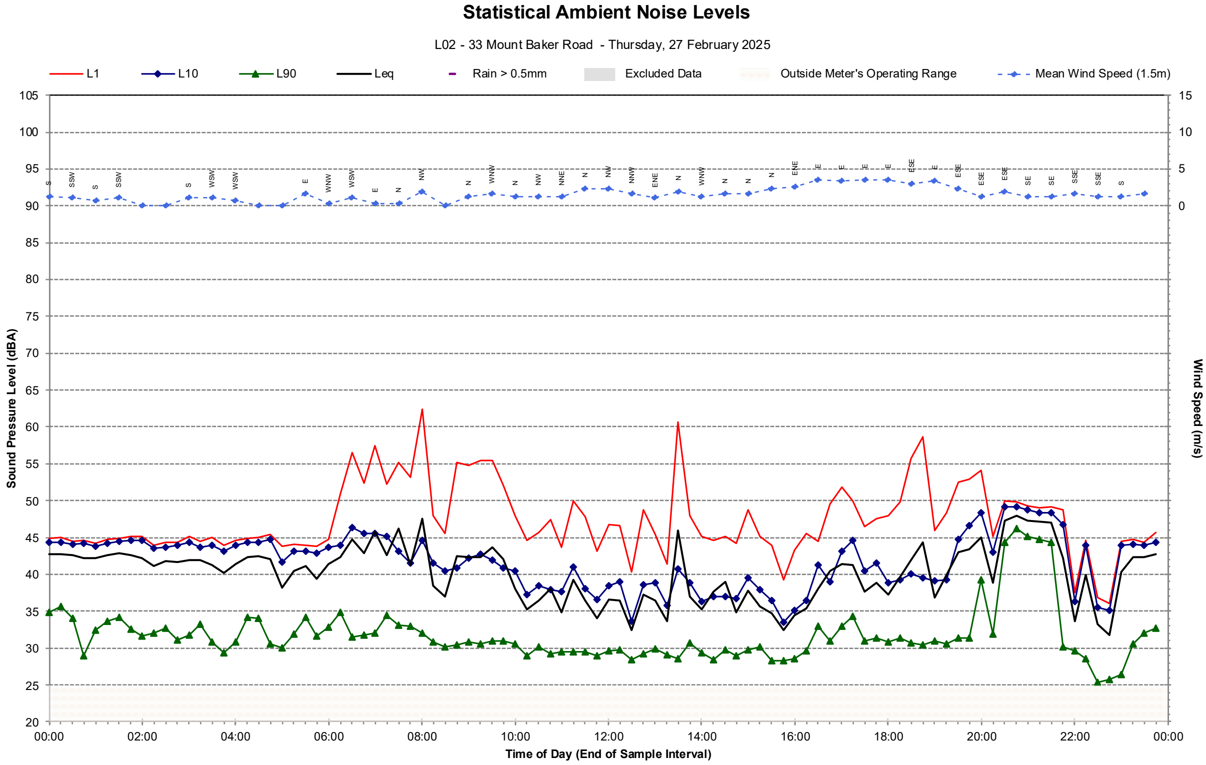
L02 - 33 Mount Baker Road - Tuesday, 25 February 2025

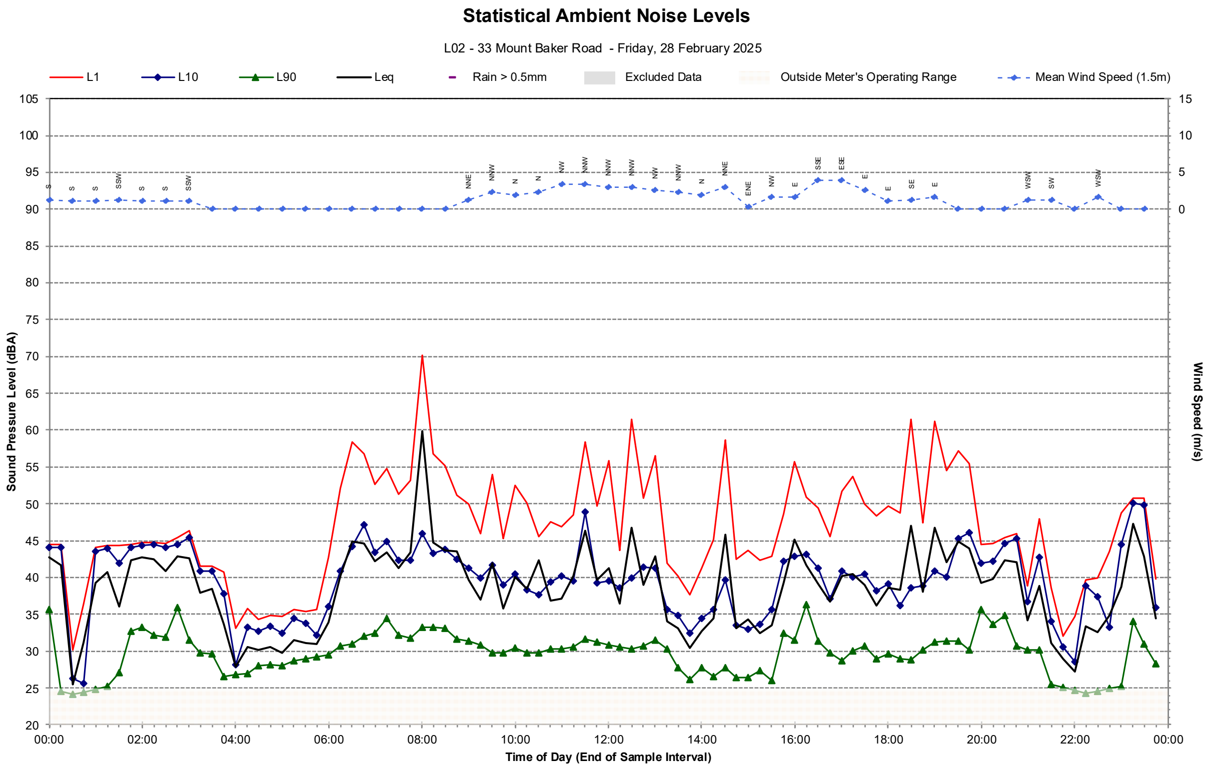


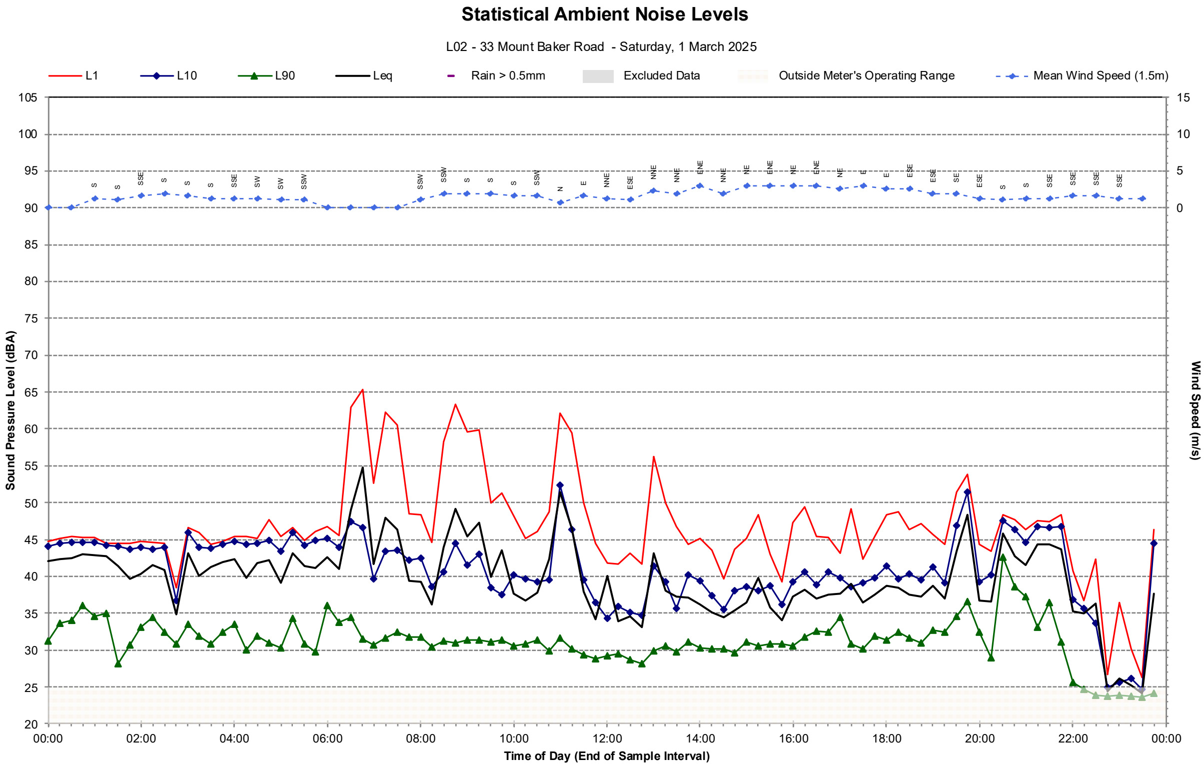
Statistical Ambient Noise Levels

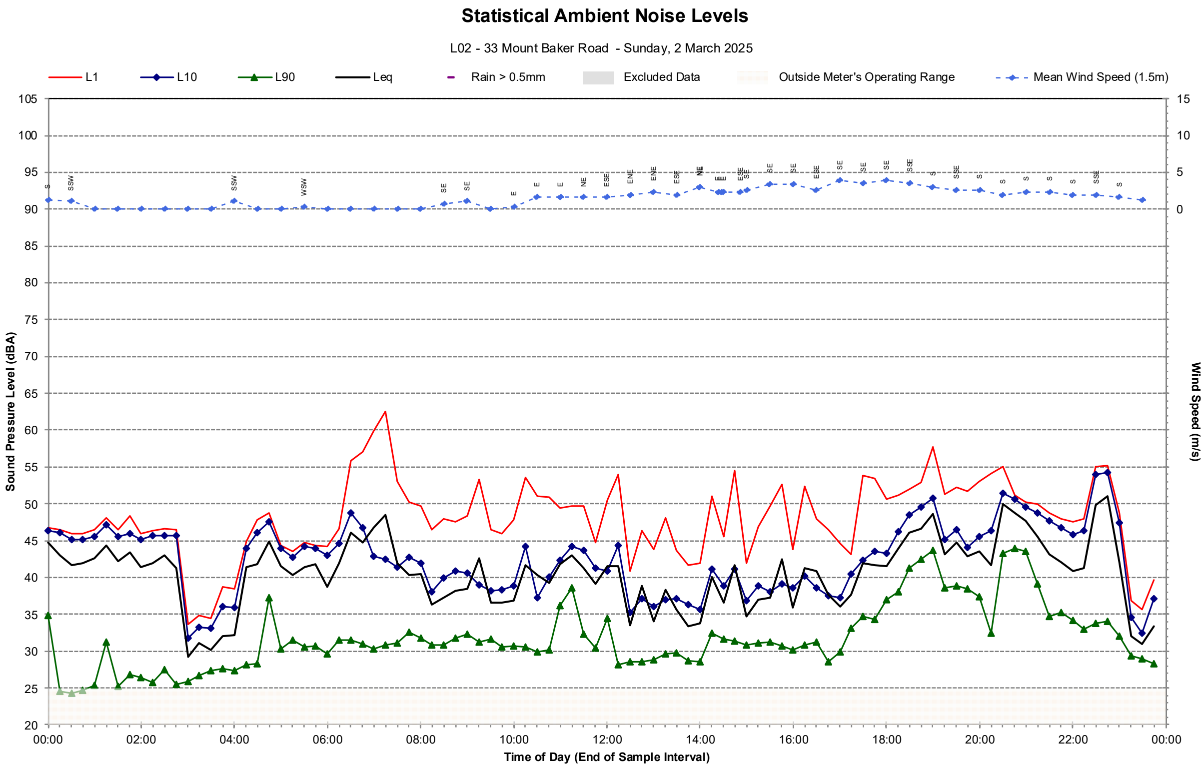
L02 - 33 Mount Baker Road - Wednesday, 26 February 2025

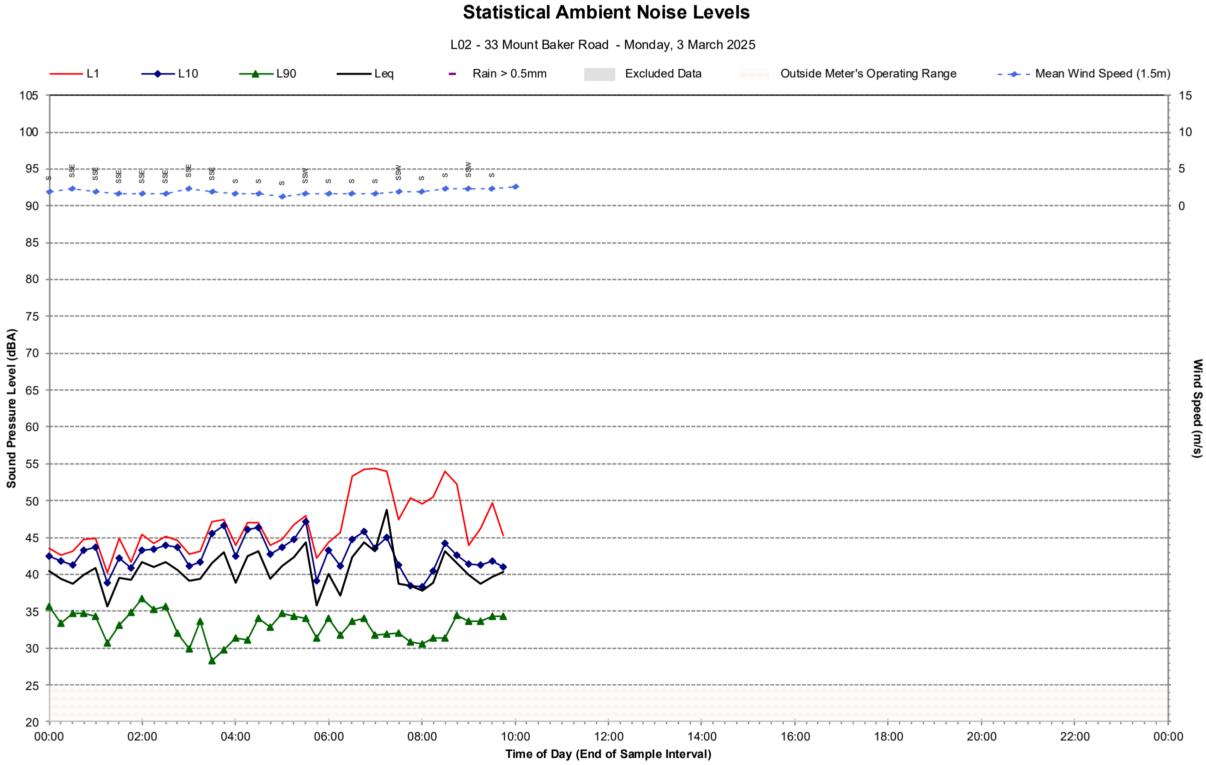



Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Thursday, 27 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Friday, 28 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Saturday, 1 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Sunday, 2 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L02 - 33 Mount Baker Road - Monday, 3 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

L03 Noise monitoring details

Device and monitoring location

Address and coordinates	1611 Wollombi Road Millfield NSW 2325 (333238, 6360535)
Logger device and serial number	ARL EL-316 (SN: 203526)
Sound level meter device and serial number	Brüel & Kjær Type 2250L (SN: 3003389)
Description of location	Logger located in the clearing to the west of the property, in line with the northern façade, approximately 125 m south of Wollombi Road, and 40 km south east of any currently proposed works associated with the HTP.
Description of ambient noise	Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise, birdsong, and road traffic noise.

Map of noise monitoring location

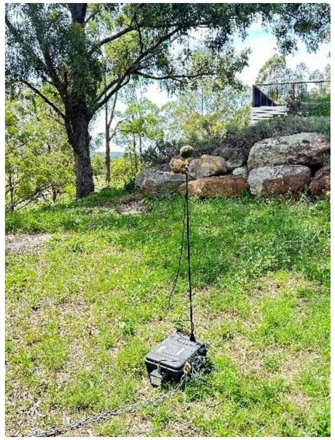
Ambient noise logging results – NPfI defined time periods

Monitoring Period	Ambient measured noise level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	34	55	48	53
Evening	34	44	44	50
Night-time	33	45	37	44

Attended noise measurement results

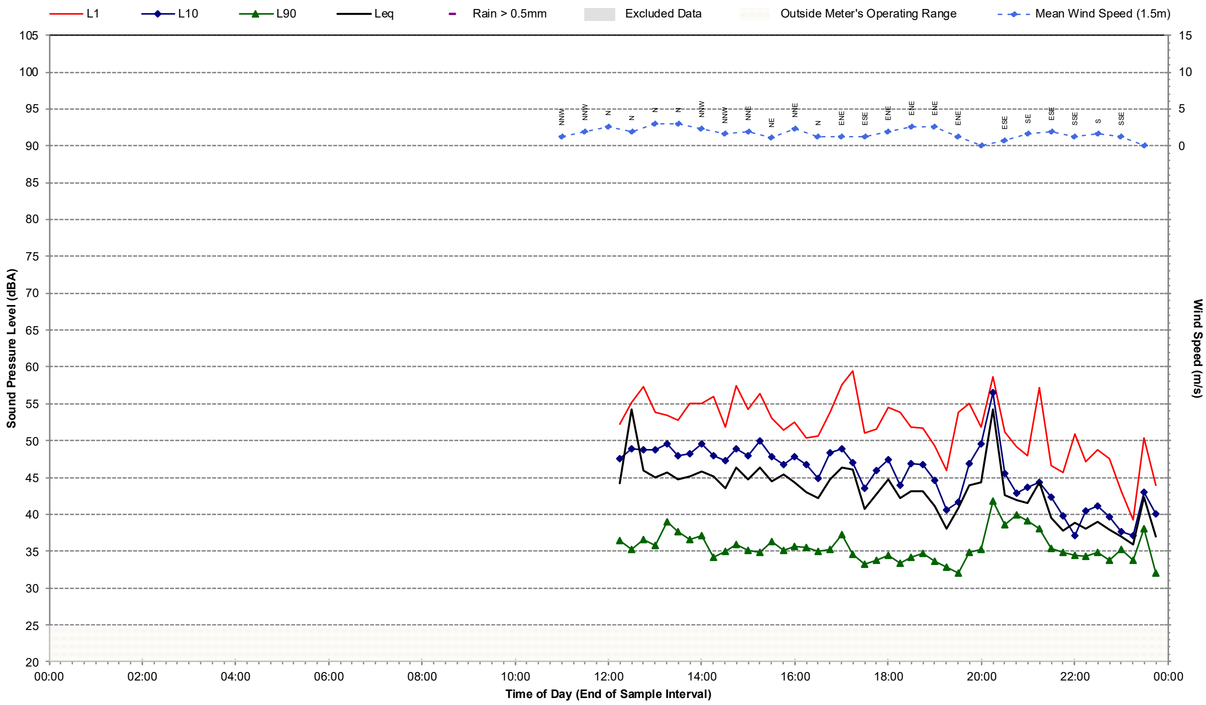
Date and start time	Attended measured noise level (dBA)		
	L_{A90}	L_{Aeq}	L_{Amax}
14/02/2025 11:29	37	43	58

Photo of noise monitoring location



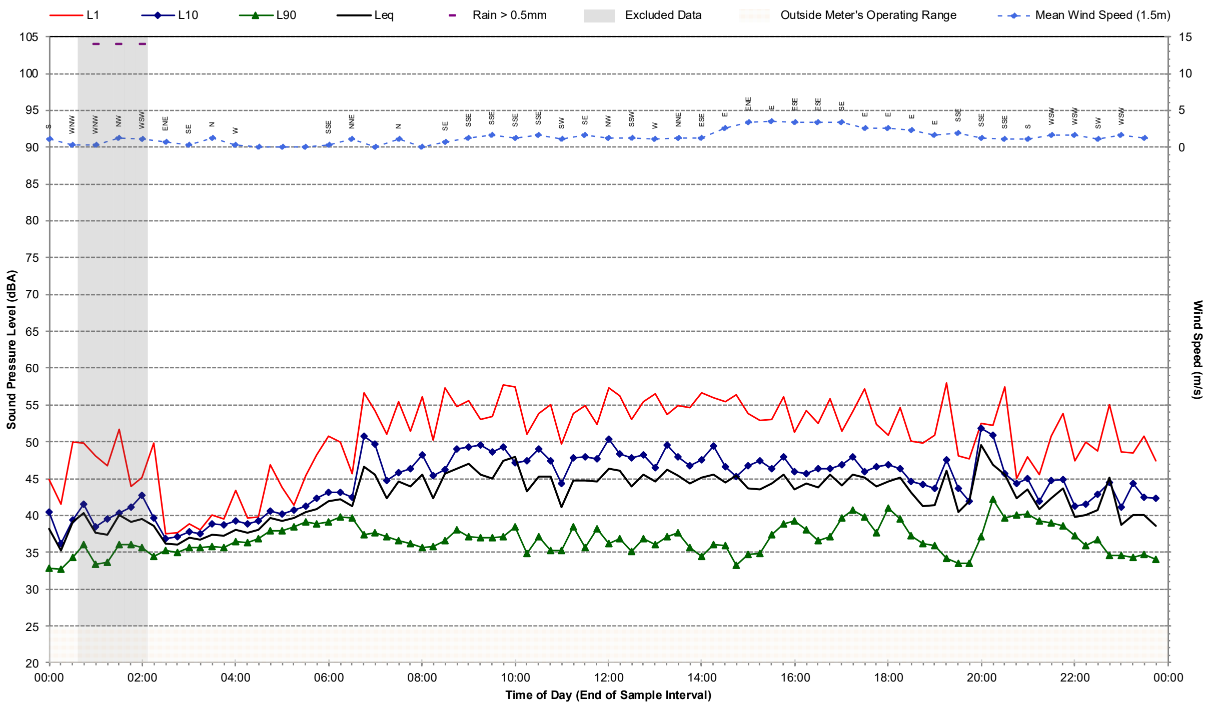
Statistical Ambient Noise Levels

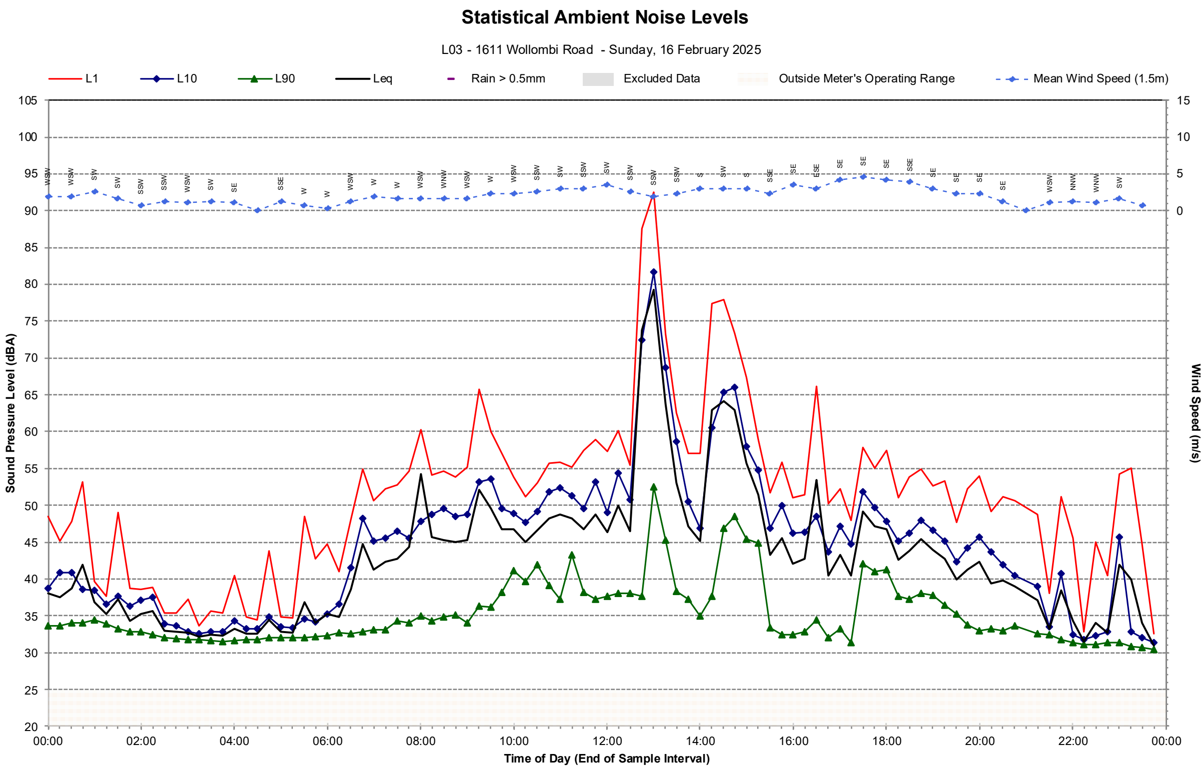
L03 - 1611 Wollombi Road - Friday, 14 February 2025

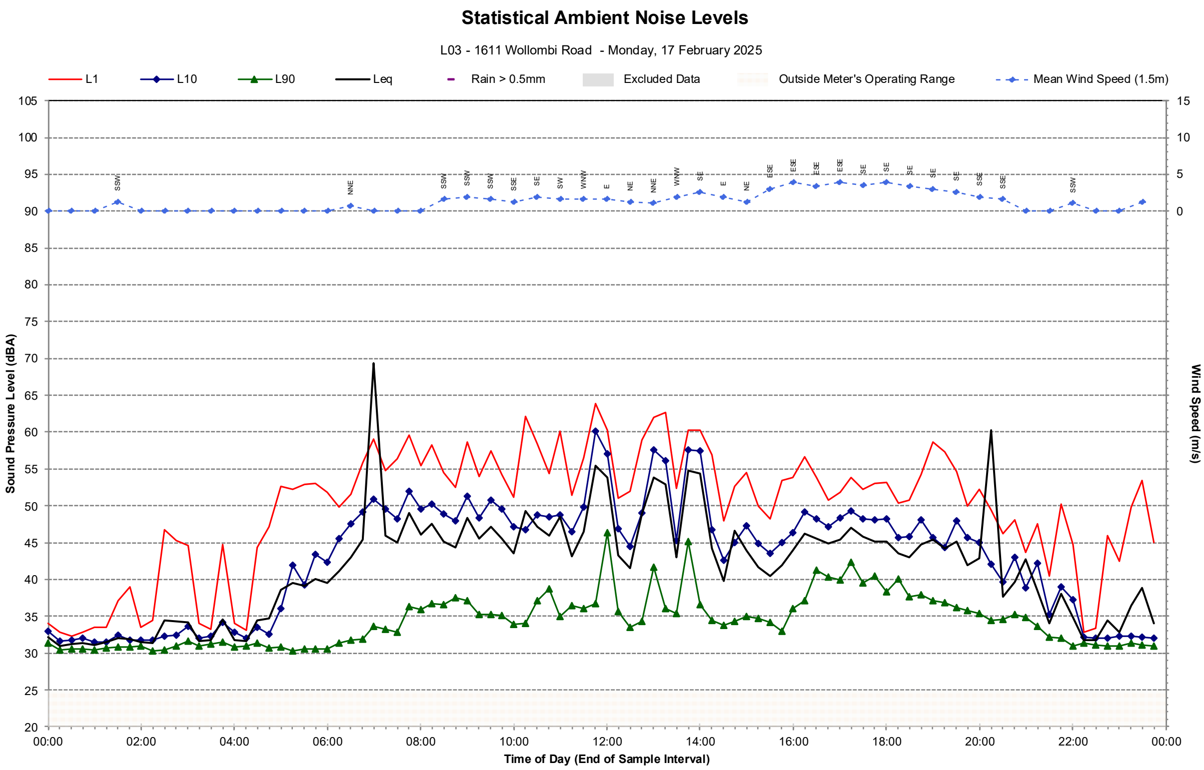


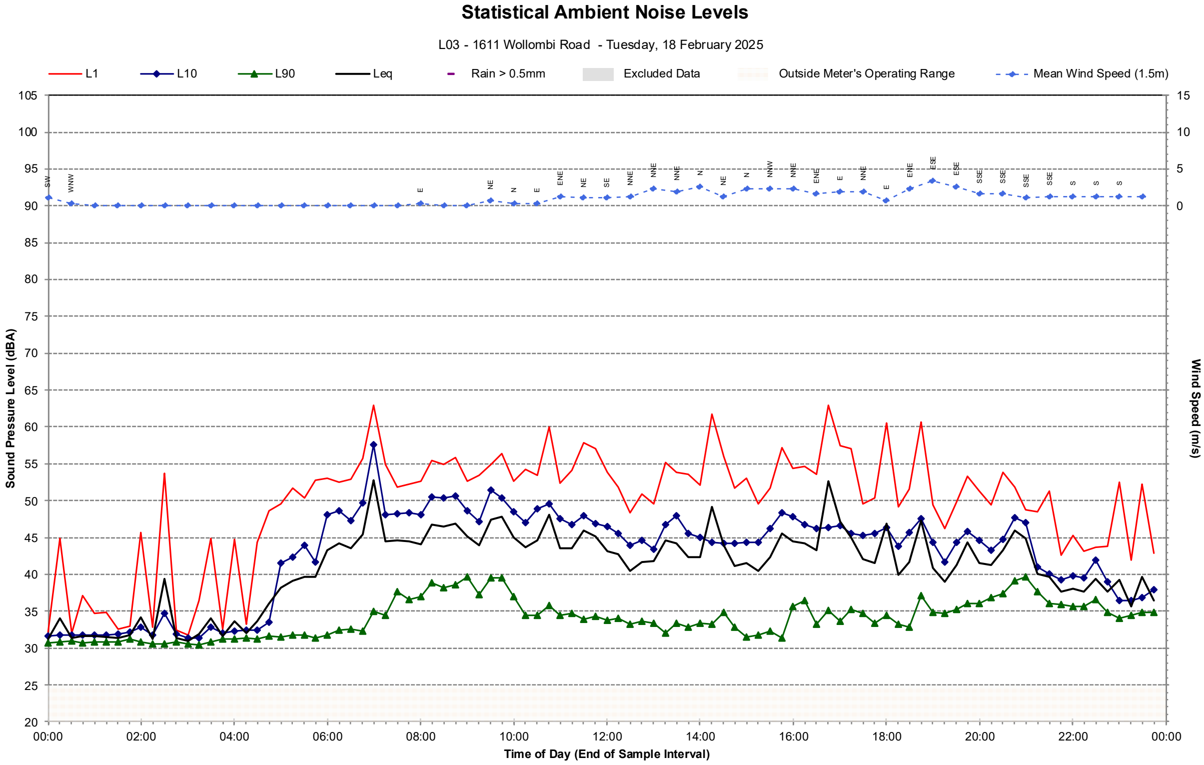
Statistical Ambient Noise Levels

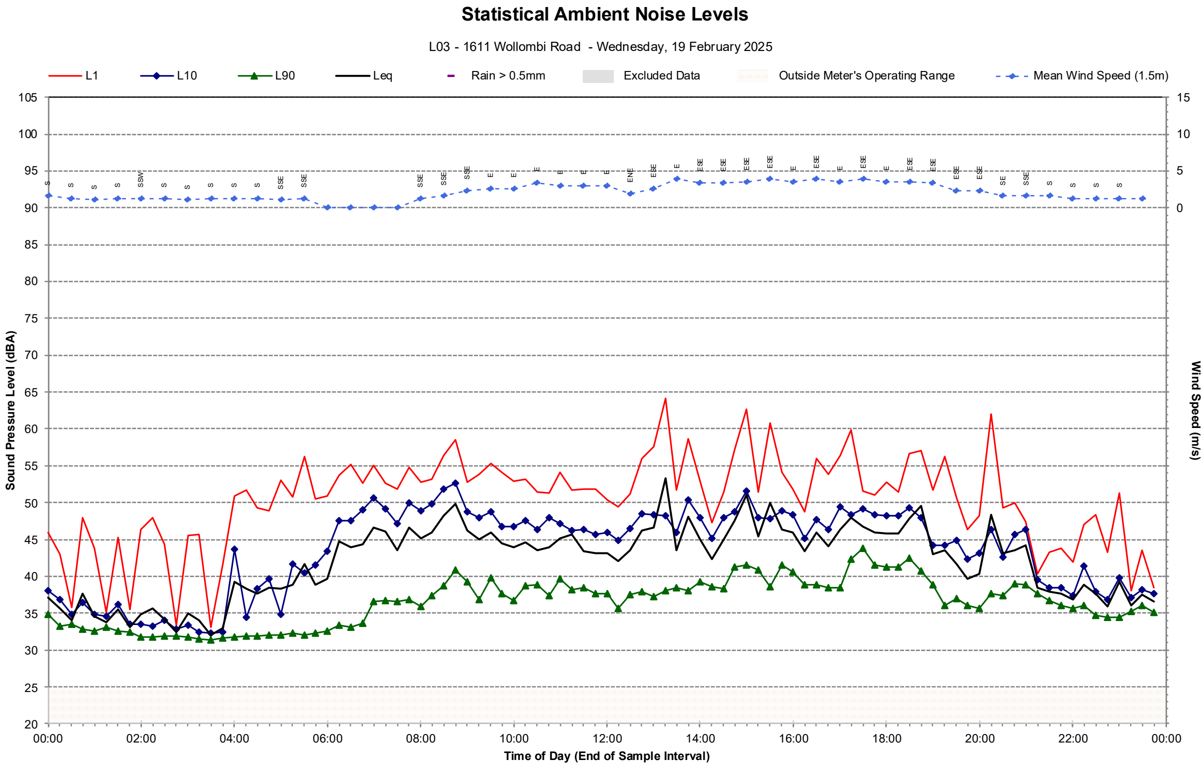
L03 - 1611 Wollombi Road - Saturday, 15 February 2025

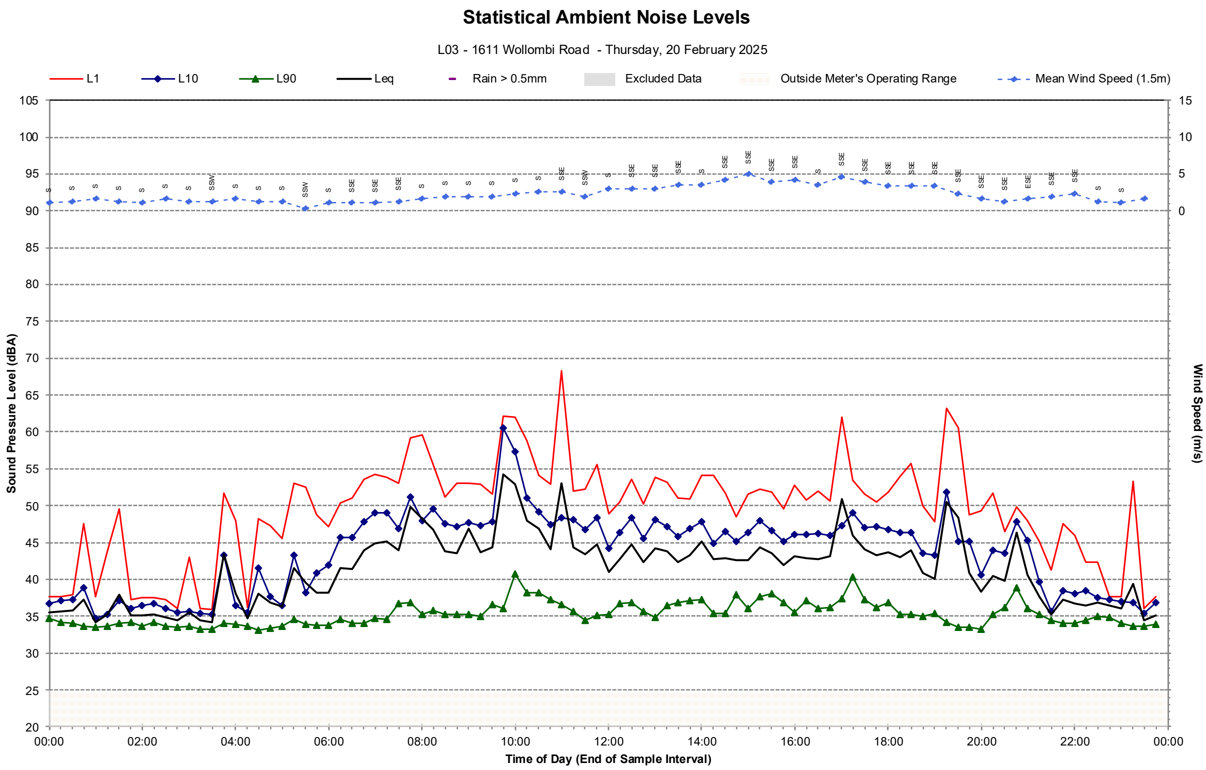


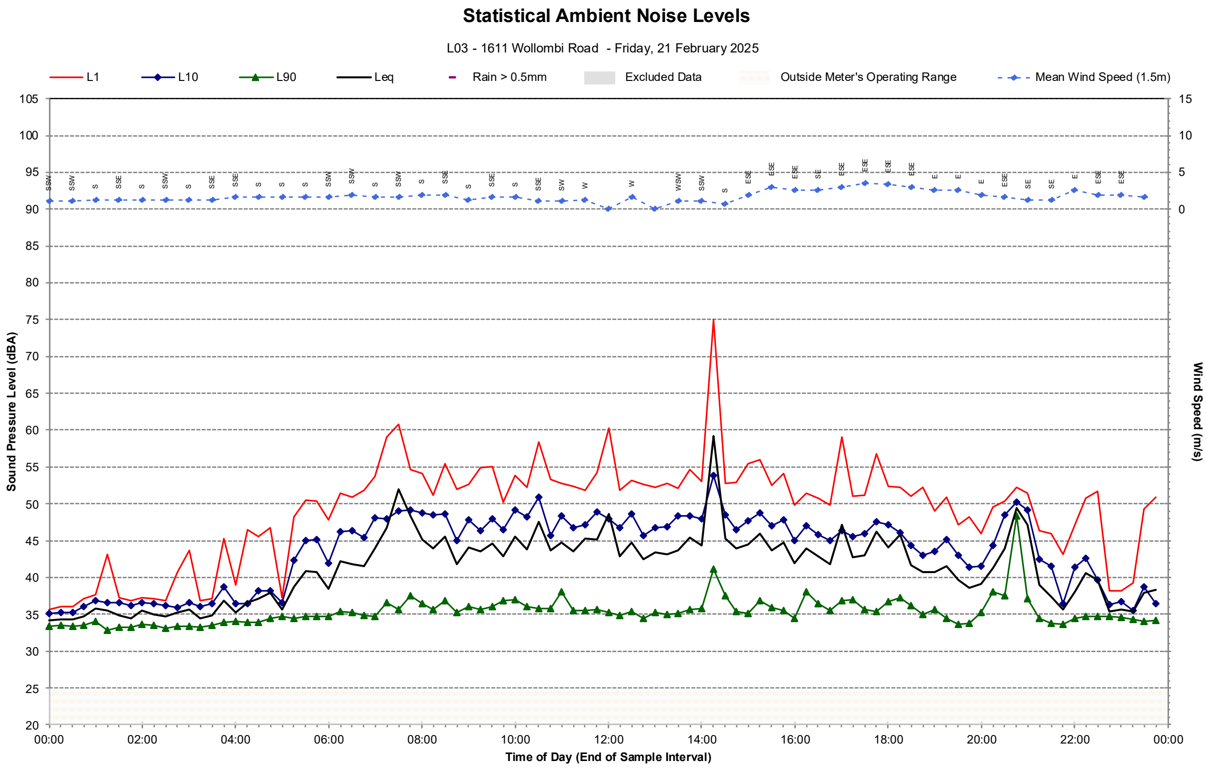

Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Sunday, 16 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

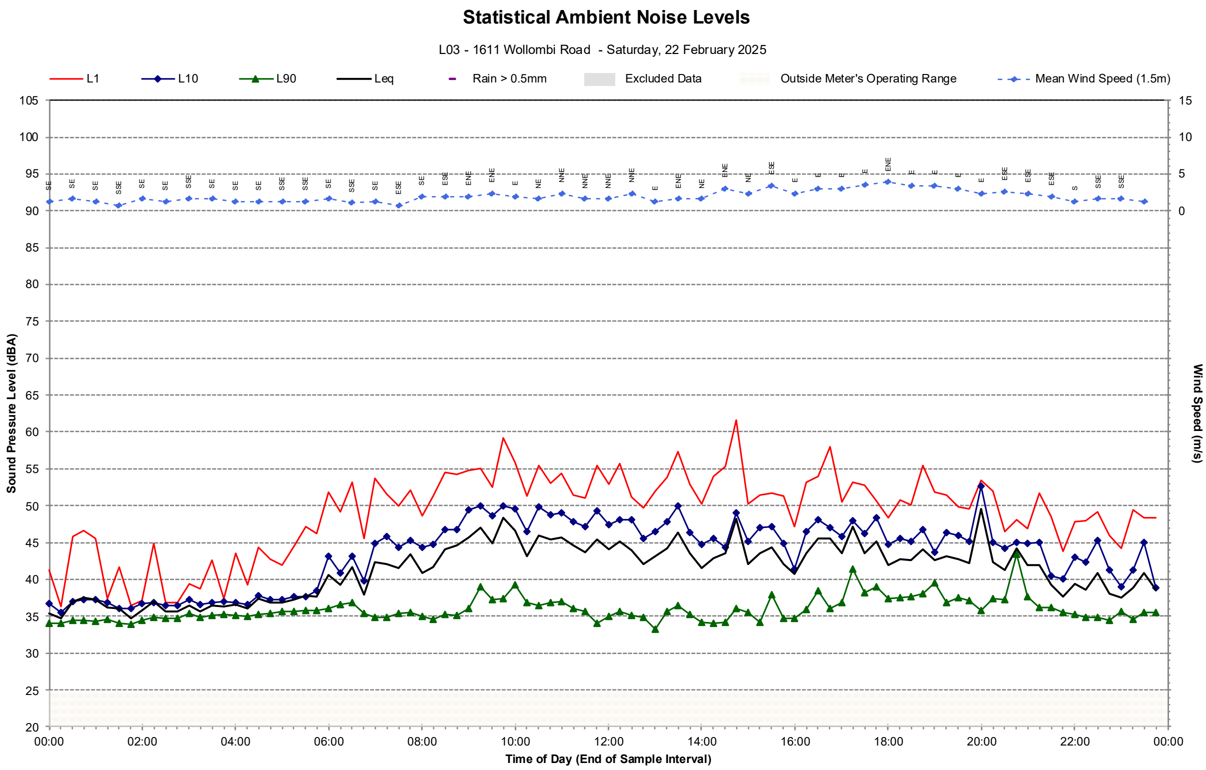

Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Monday, 17 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

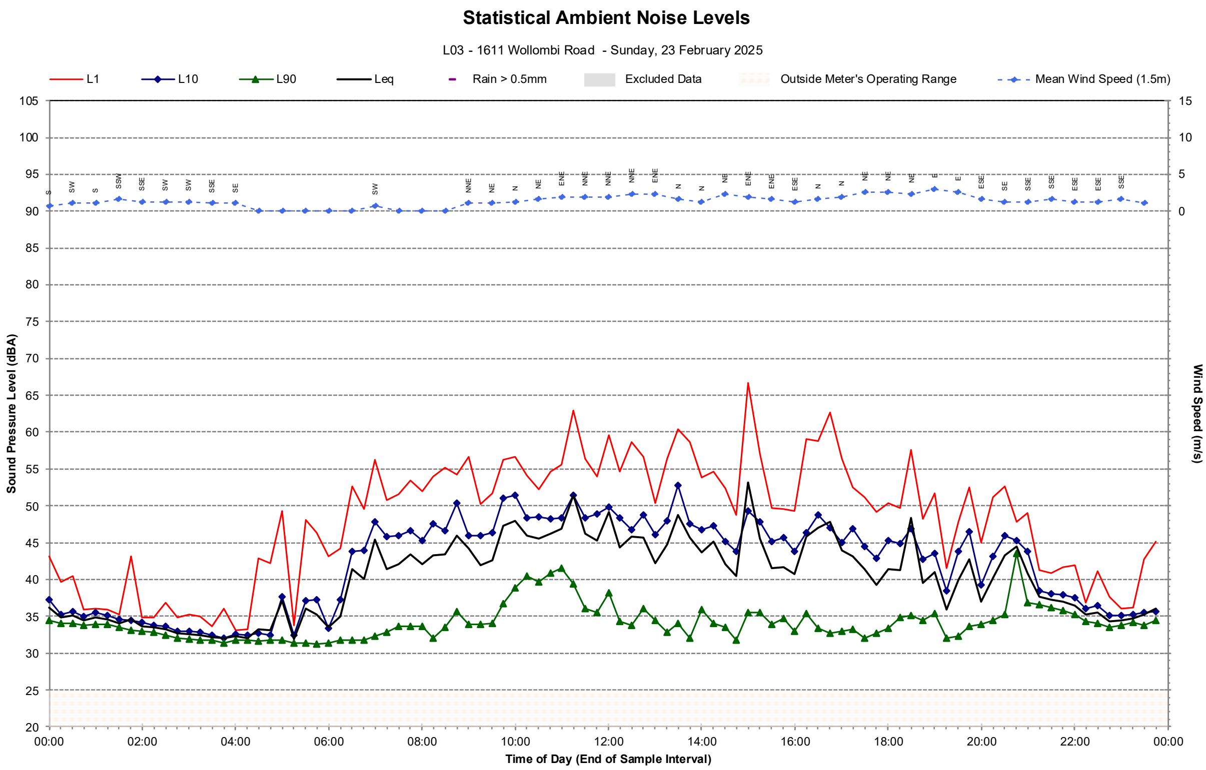

Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Tuesday, 18 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Wednesday, 19 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Thursday, 20 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

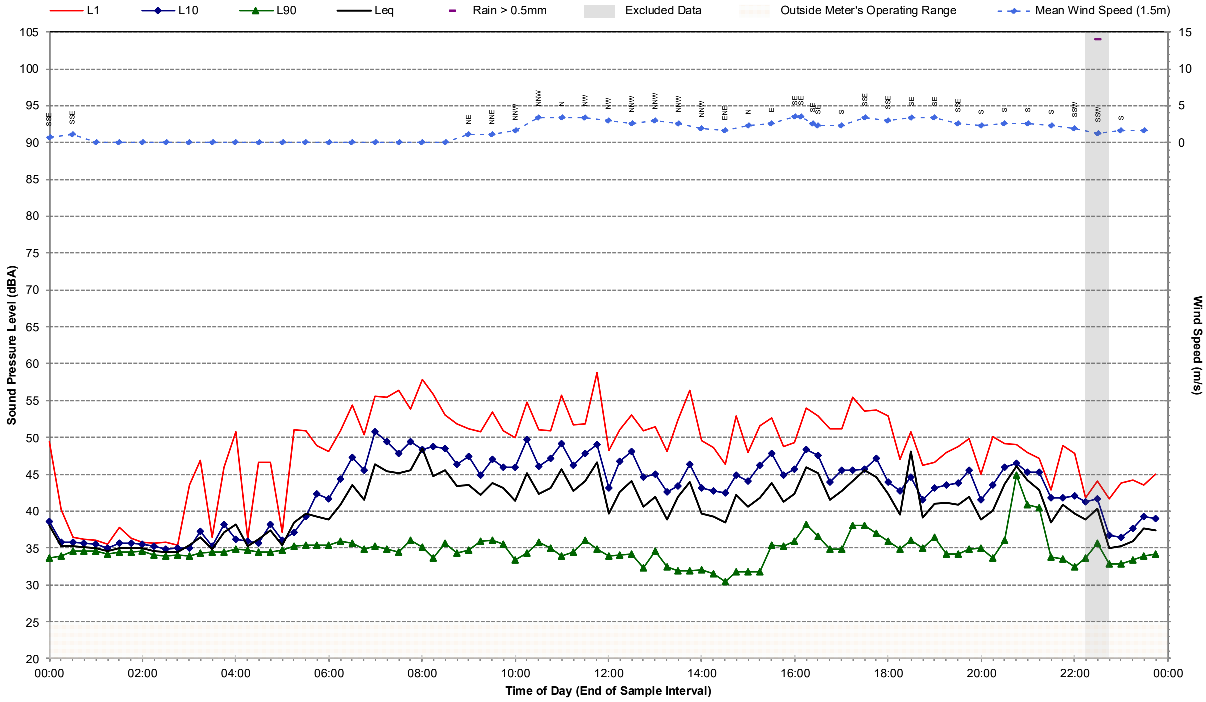

Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Friday, 21 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Saturday, 22 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


Statistical Ambient Noise Levels
L03 - 1611 Wollombi Road - Sunday, 23 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

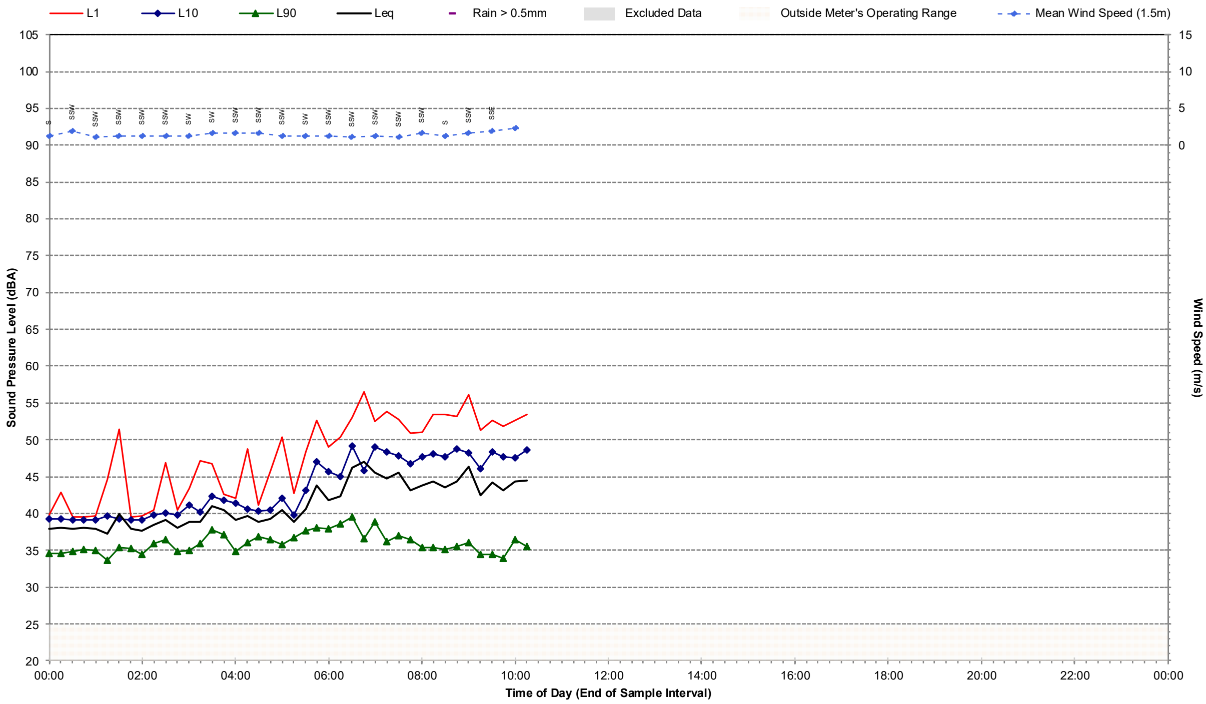
Statistical Ambient Noise Levels

L03 - 1611 Wollombi Road - Monday, 24 February 2025



Statistical Ambient Noise Levels

L03 - 1611 Wollombi Road - Tuesday, 25 February 2025



L04 Noise monitoring details

Device and monitoring location		Map of noise monitoring location
Address and coordinates	192 Mf1 Road Millfield NSW 2325 (335734, 6356415)	
Logger device and serial number	Svantek (SN: 20644)	
Sound level meter device and serial number	Brüel & Kjær Type 2250L (SN: 3003389)	
Description of location	Logger located on fence line south to the south of the property, in line with the western façade, approximately 100 m west of Mf1 Road, and 380 m east of any currently proposed works associated with the HTP.	
Description of ambient noise	Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise, and birdsong.	

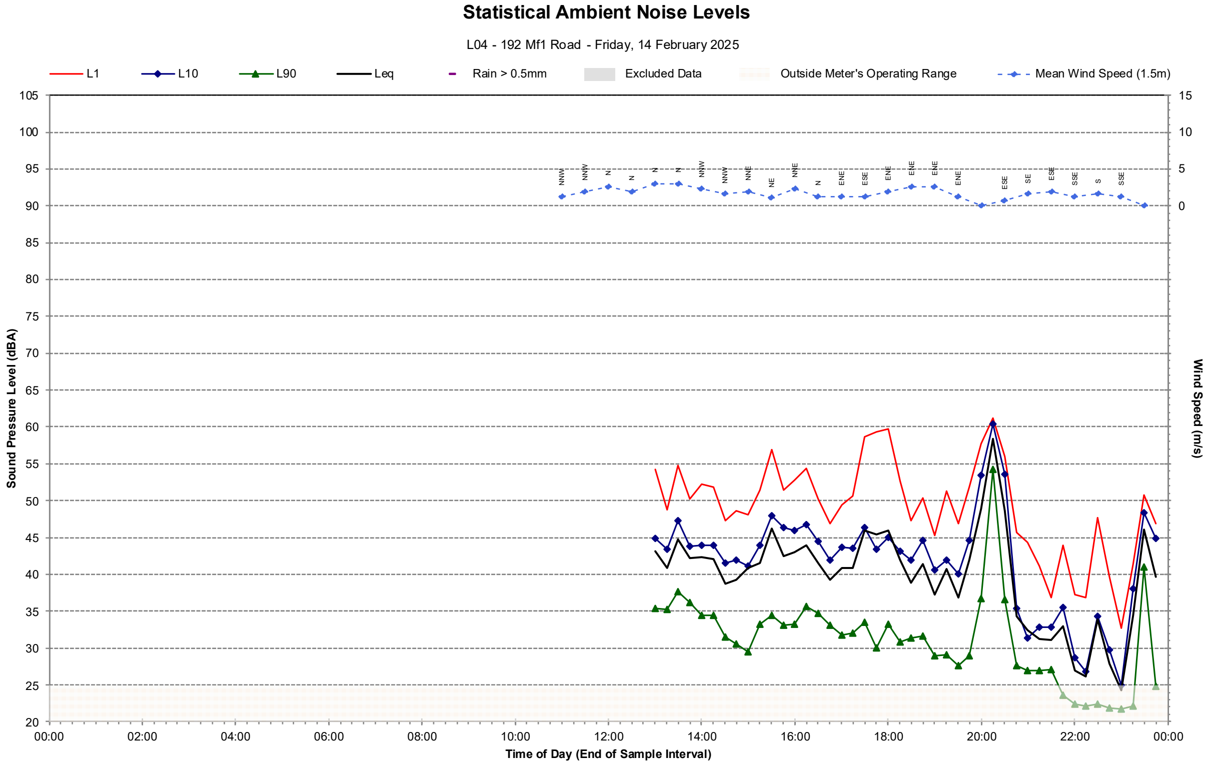
Ambient noise logging results – NPfI defined time periods

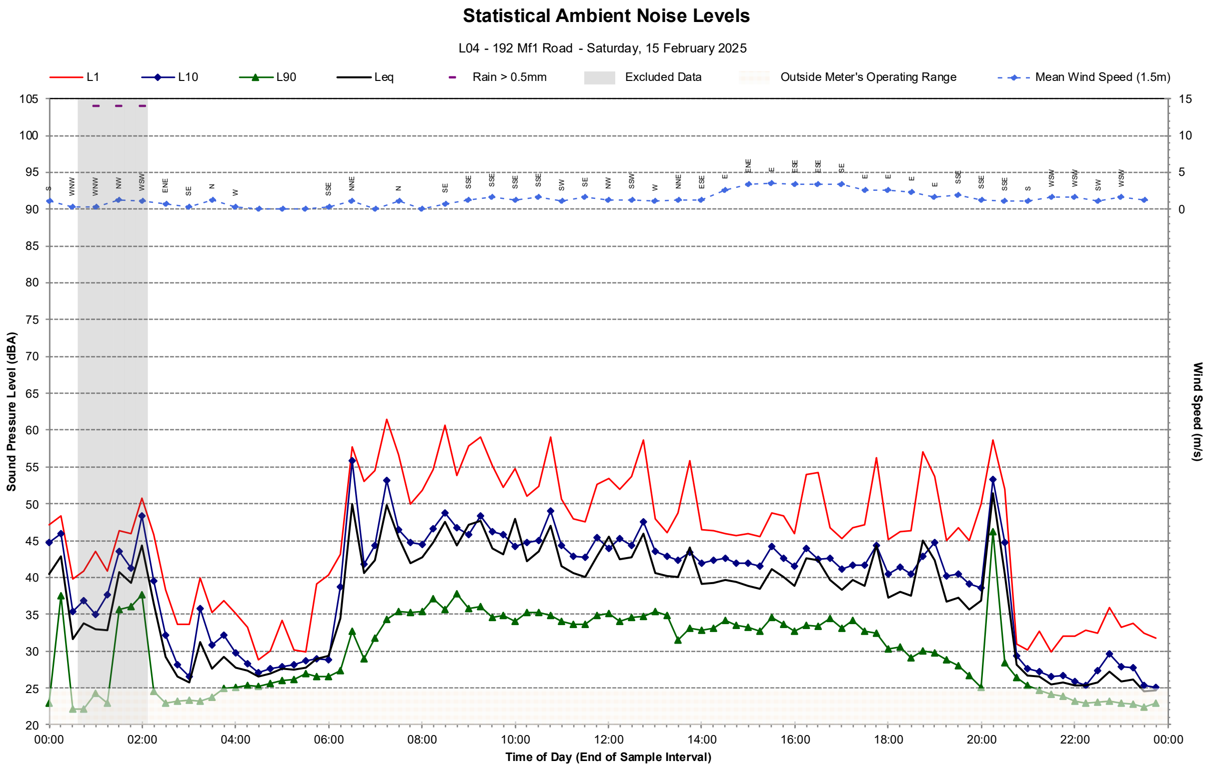
Monitoring Period	Ambient measured noise level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	32	44	44	51
Evening	25	42	41	46
Night-time	22	41	41	46

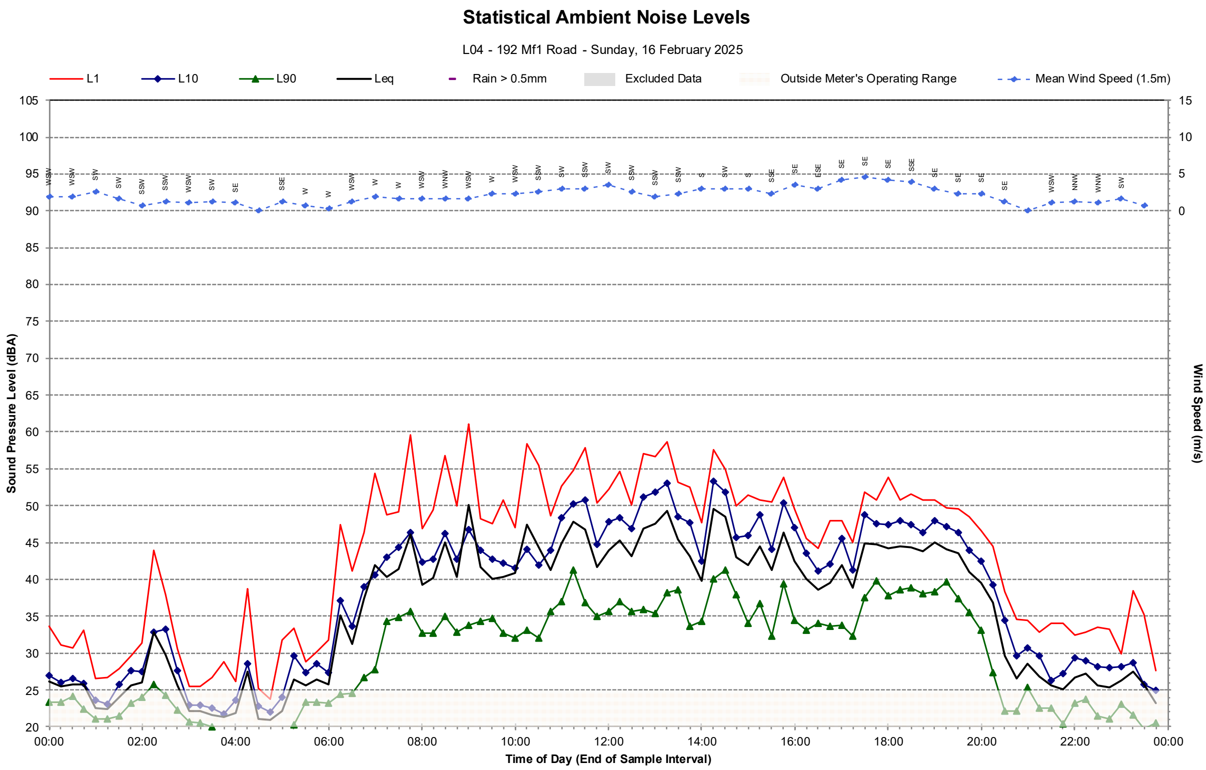
Attended noise measurement results

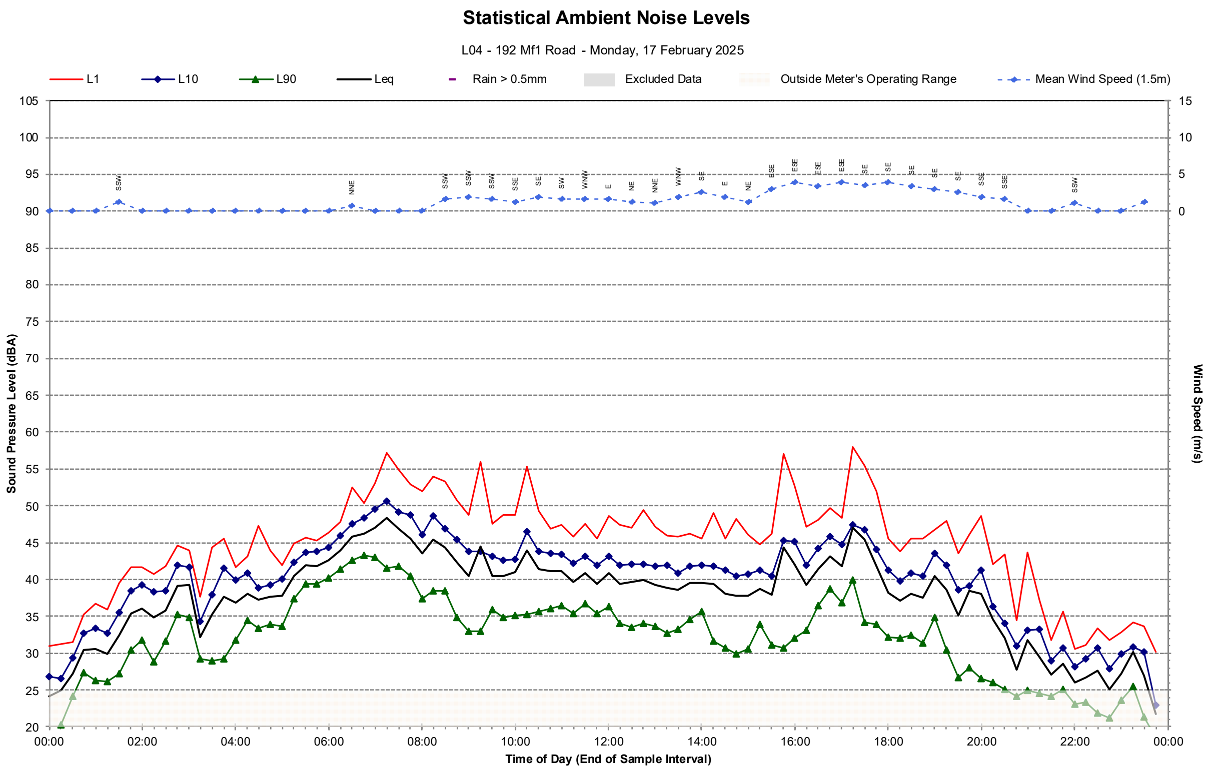
Date and start time	Attended measured noise level (dBA)		
	L_{A90}	L_{Aeq}	L_{Amax}
14/02/2025 12:12	36	41	64

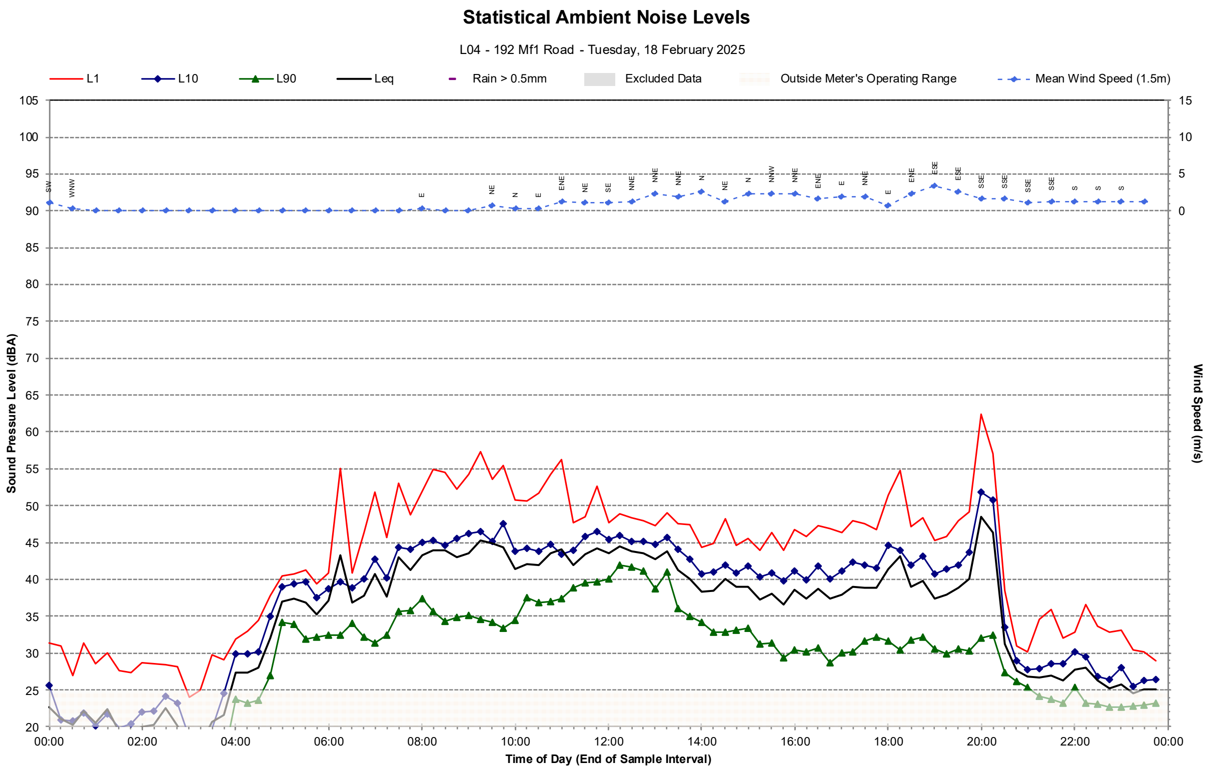
Photo of noise monitoring location

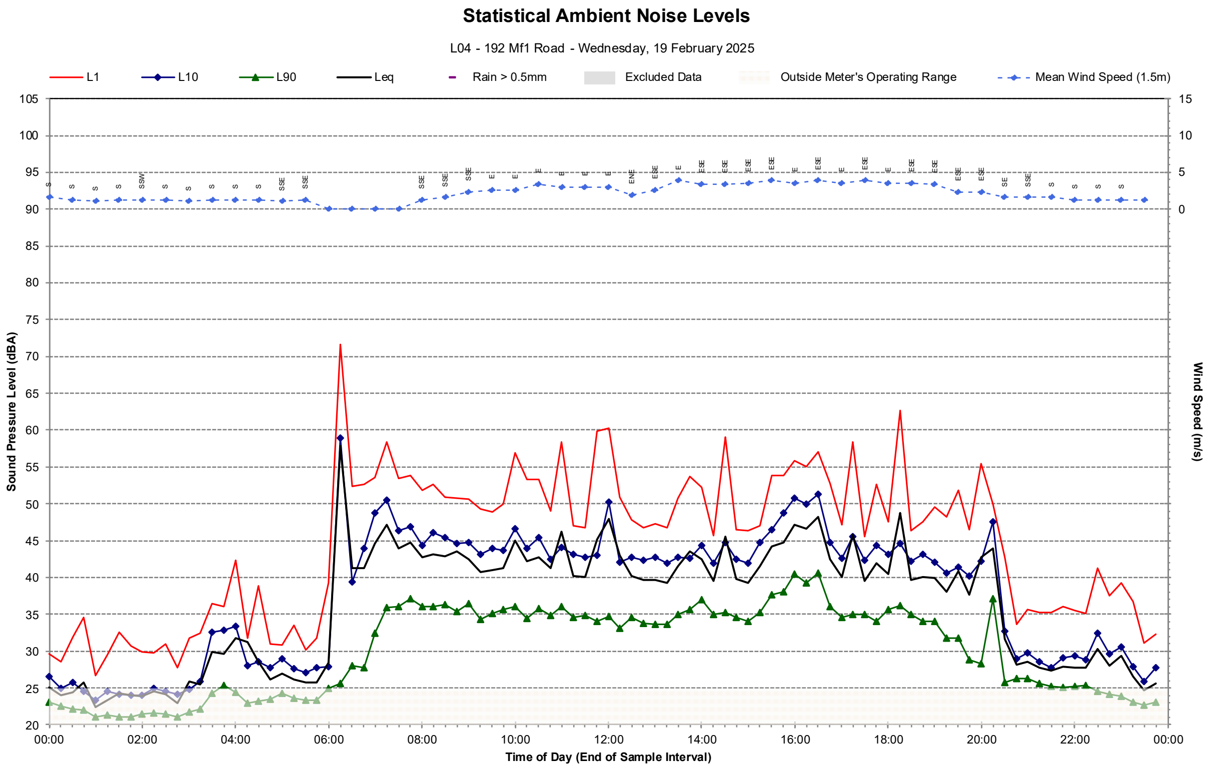

Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Friday, 14 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Saturday, 15 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Sunday, 16 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

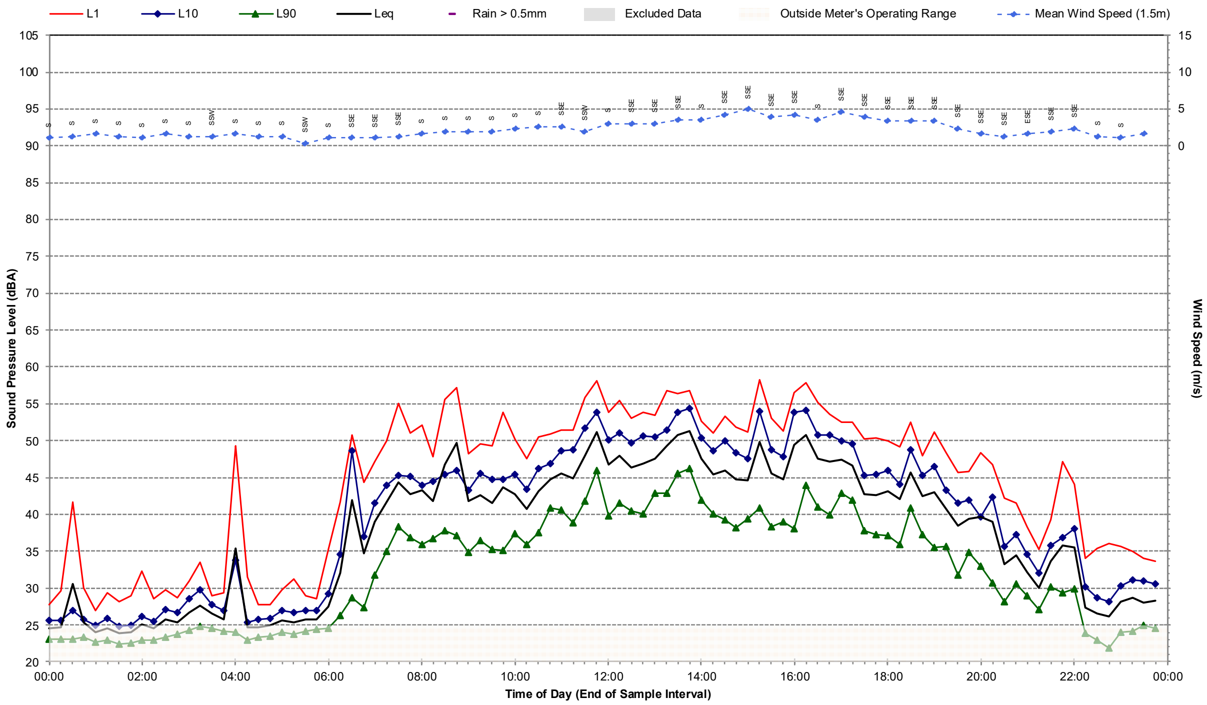

Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Monday, 17 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Tuesday, 18 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Wednesday, 19 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

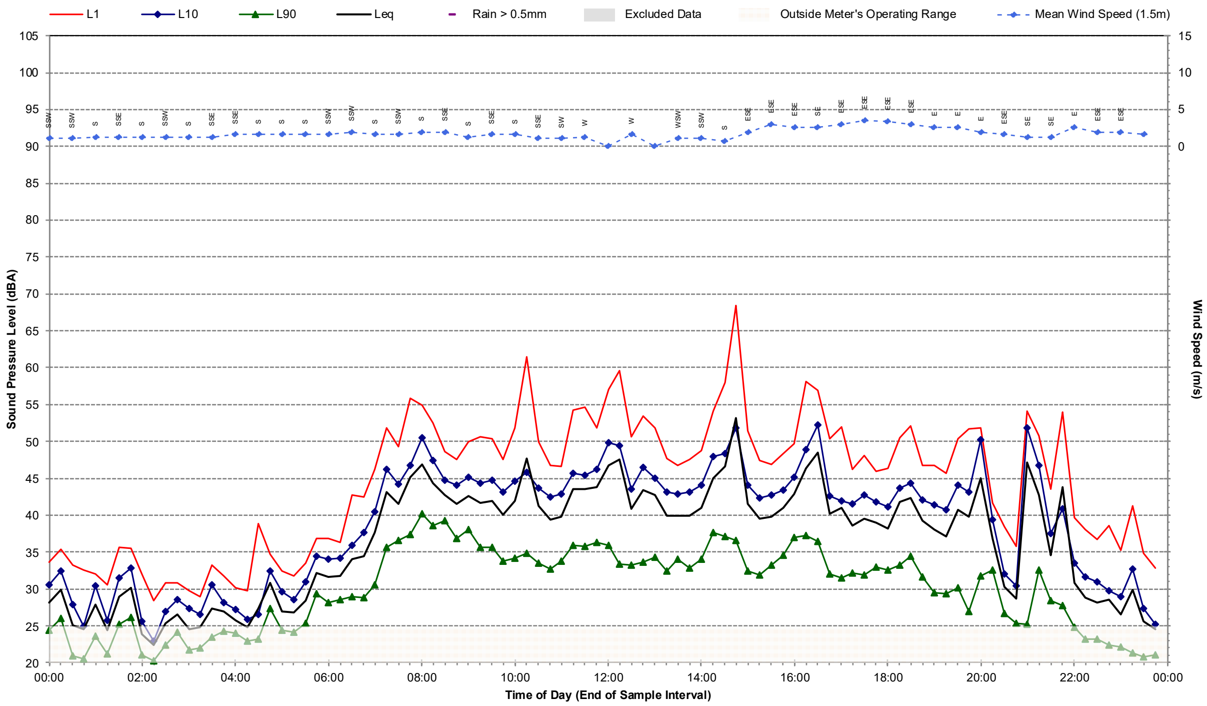
Statistical Ambient Noise Levels

L04 - 192 Mf1 Road - Thursday, 20 February 2025



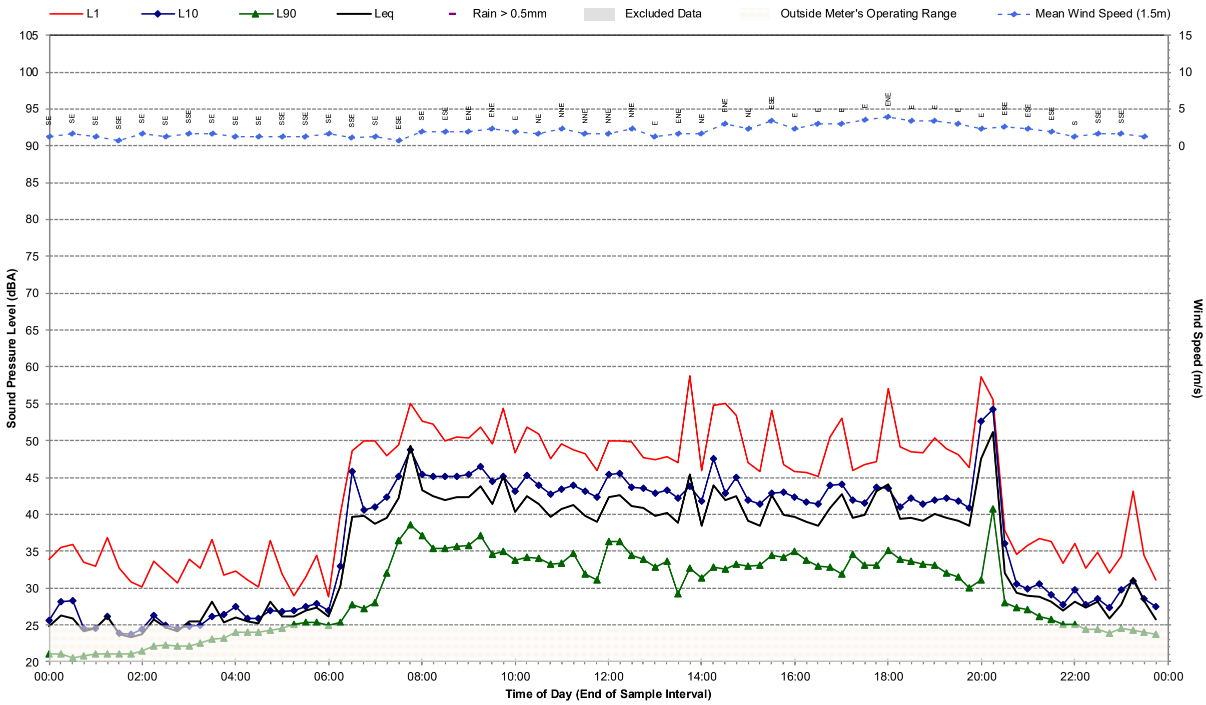
Statistical Ambient Noise Levels

L04 - 192 Mf1 Road - Friday, 21 February 2025



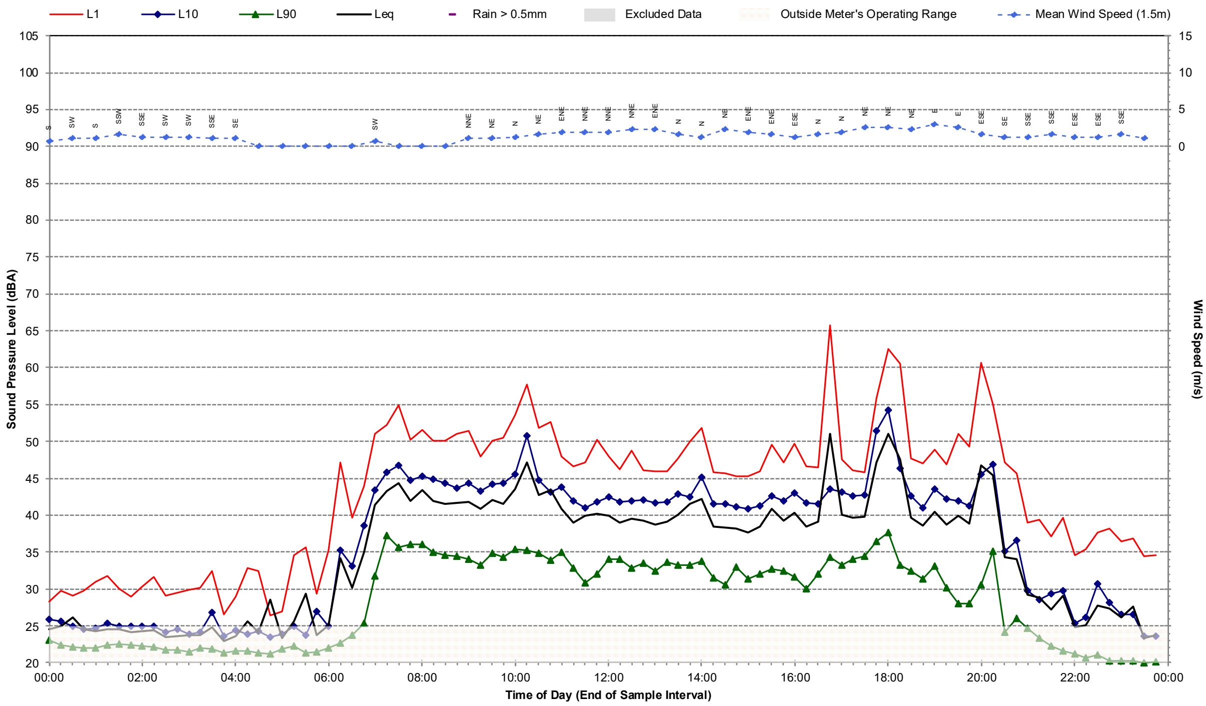
Statistical Ambient Noise Levels

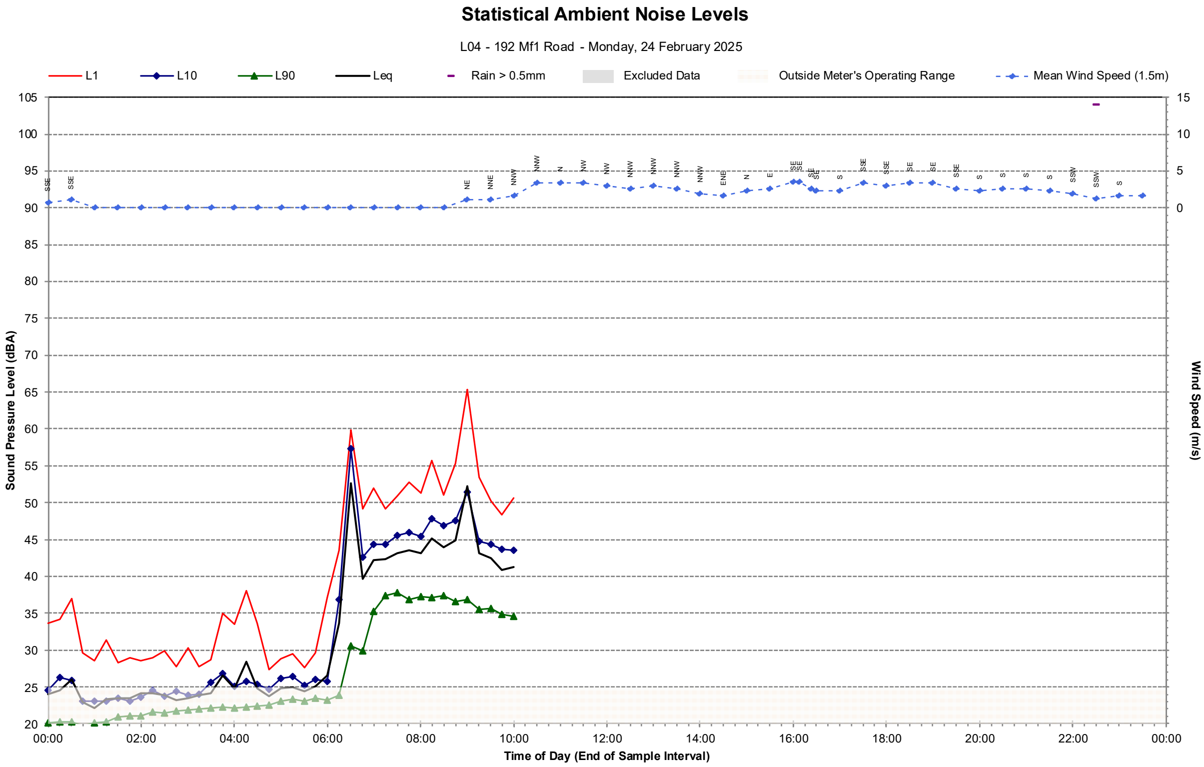
L04 - 192 Mf1 Road - Saturday, 22 February 2025



Statistical Ambient Noise Levels

L04 - 192 Mf1 Road - Sunday, 23 February 2025




Statistical Ambient Noise Levels
L04 - 192 Mf1 Road - Monday, 24 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

L05 Noise monitoring details

Device and monitoring location	
Address and coordinates	1262 Freemans Drive Cooranbong NSW 2265 (358484, 6343710)
Logger device and serial number	ARL EL-316 (SN: 103494)
Sound level meter device and serial number	RION-NA28 (SN: 470370)
Description of location	Logger located to the east of the driveway, in front of the northern façade of the property, approximately 75 m south east of Freemans Drive, and located within the currently proposed works associated with the HTP.
Description of ambient noise	Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise, birdsong, and road traffic noise.

Map of noise monitoring location

Ambient noise logging results – NPfI defined time periods

Monitoring Period	Ambient measured noise level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	43	56	55	60
Evening	44	57	55	59
Night-time	42	51	50	55

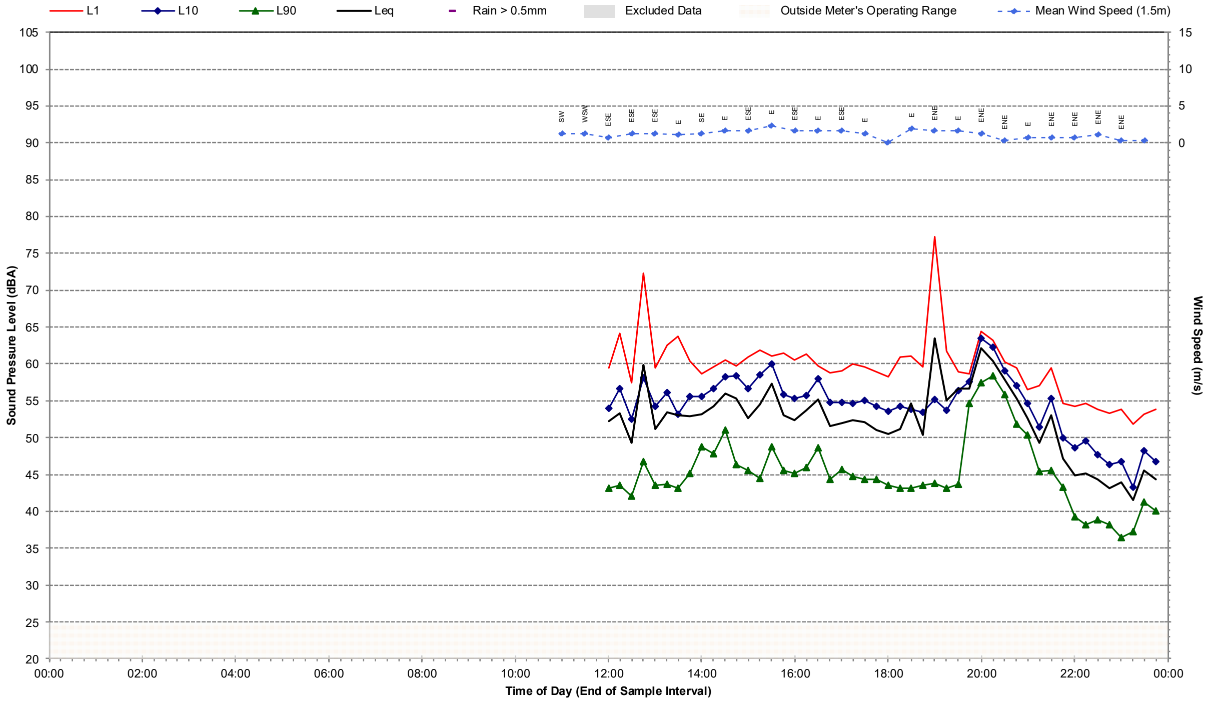
Photo of noise monitoring location

Attended noise measurement results

Date and start time	Attended measured noise level (dBA)		
	L_{A90}	L_{Aeq}	L_{Amax}
21/02/2025 12:35	31	41	57

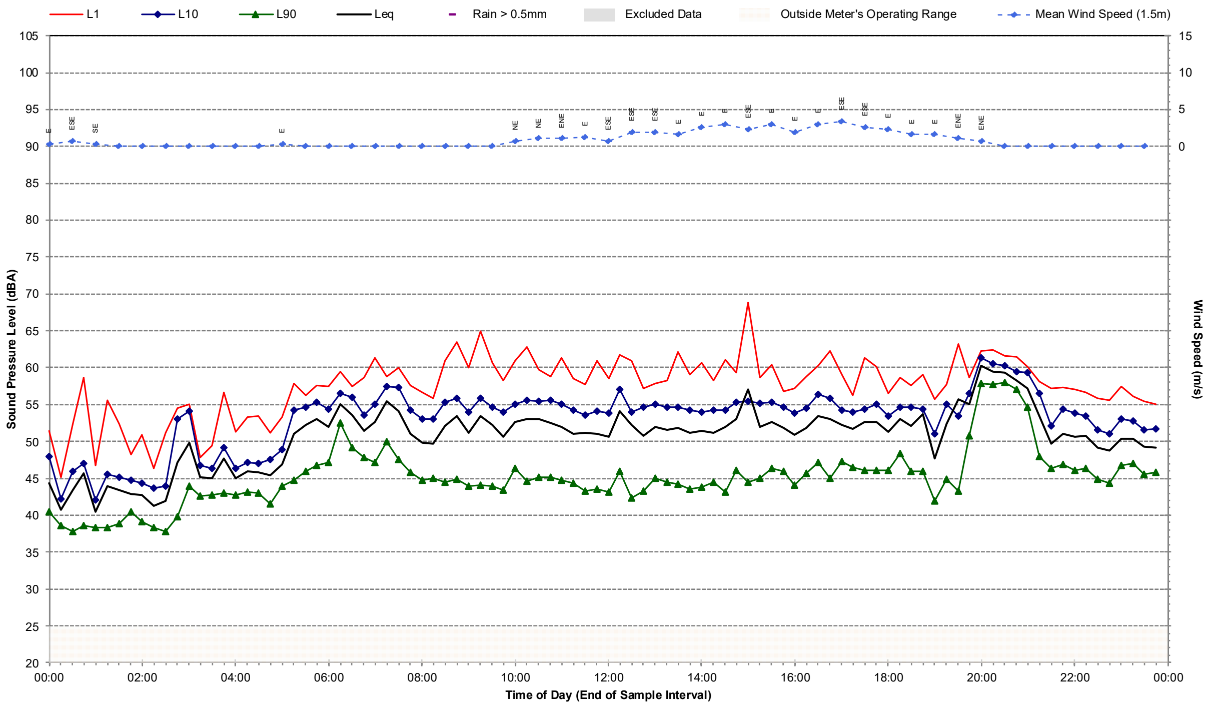
Statistical Ambient Noise Levels

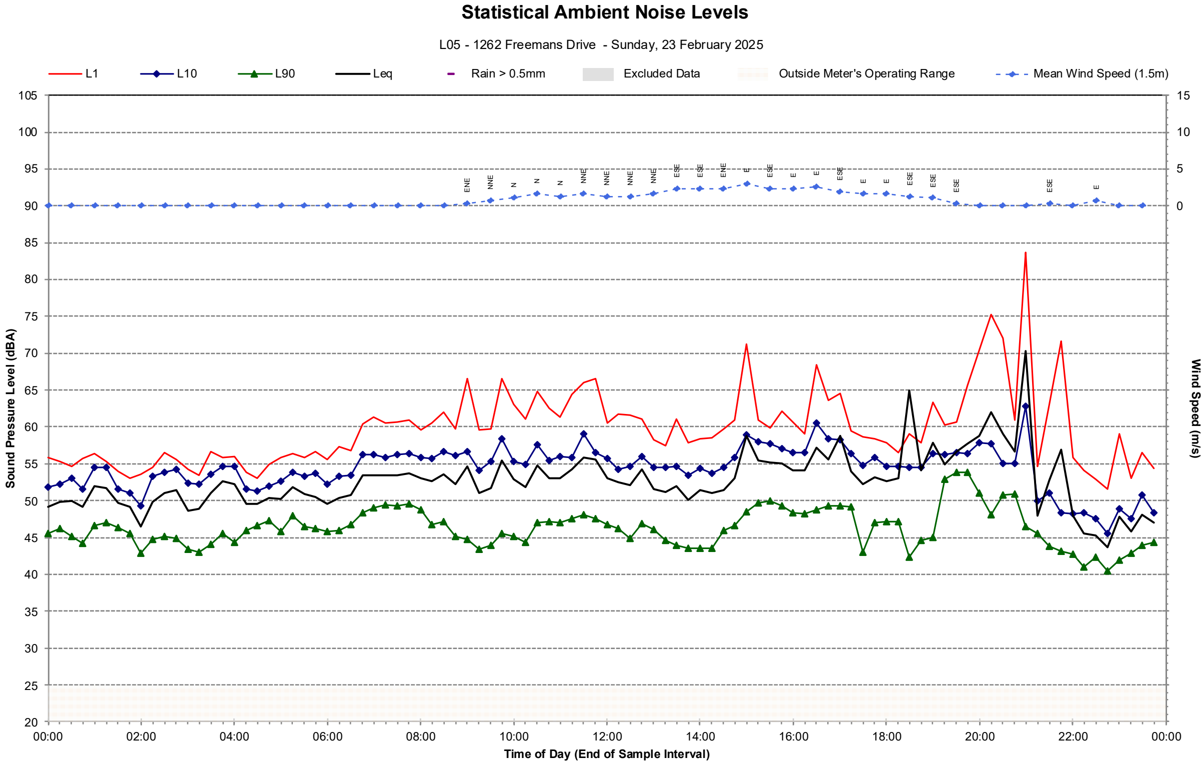
L05 - 1262 Freemans Drive - Friday, 21 February 2025

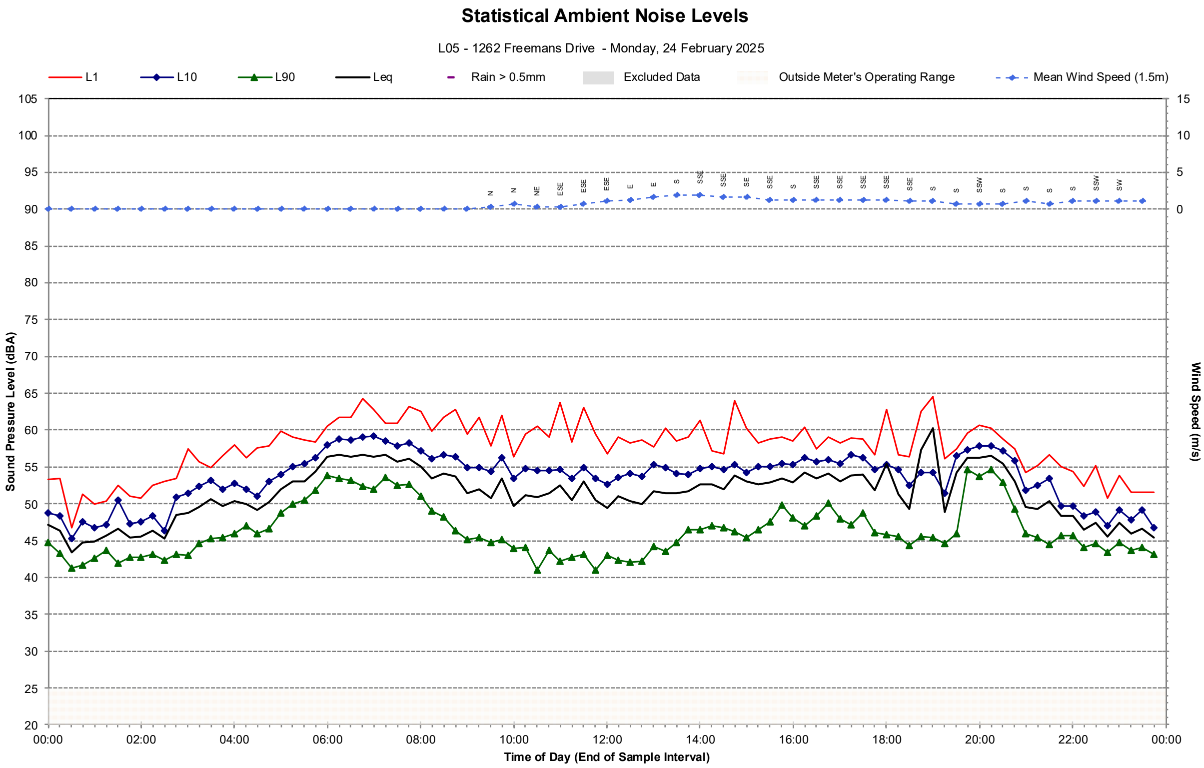


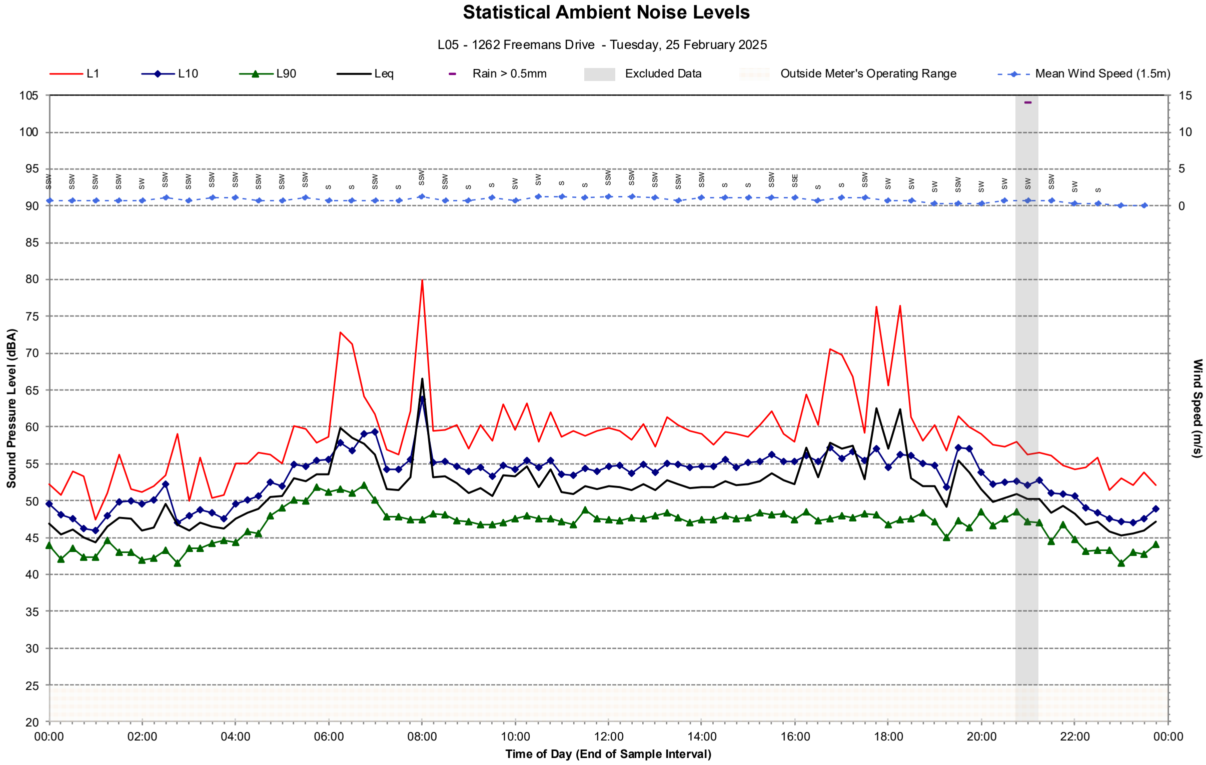
Statistical Ambient Noise Levels

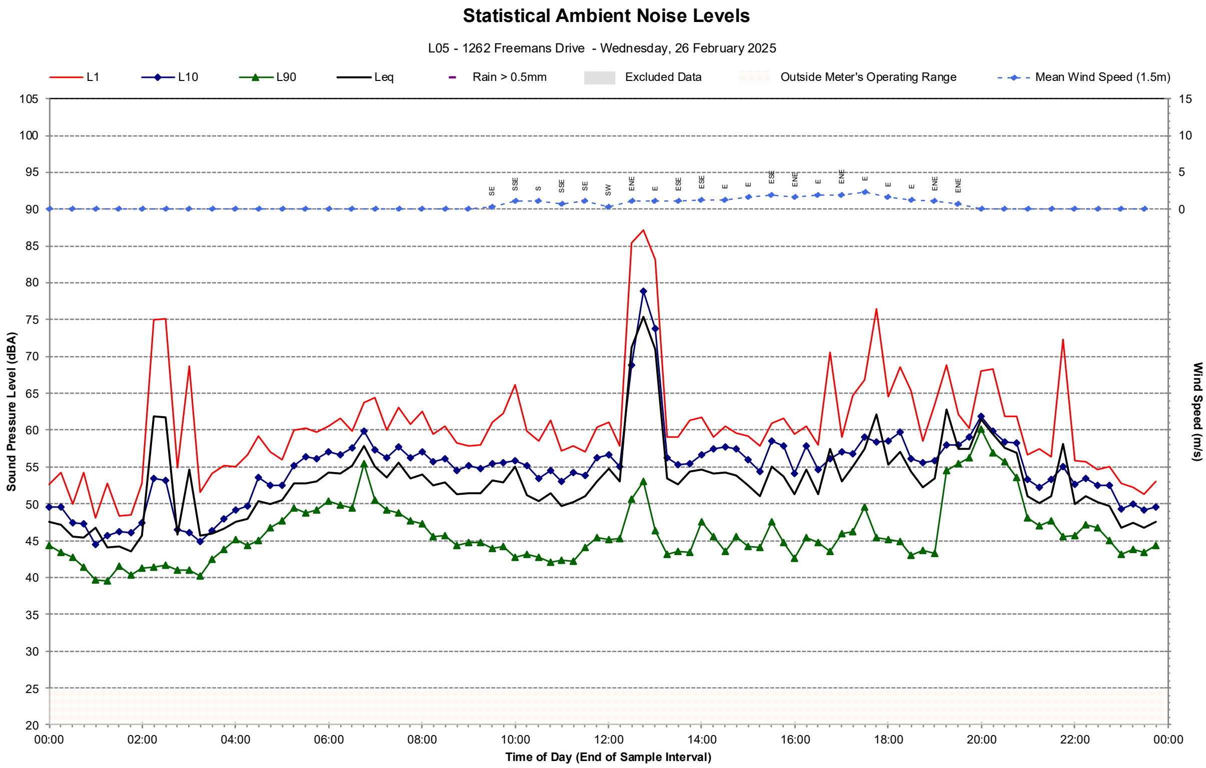
L05 - 1262 Freemans Drive - Saturday, 22 February 2025

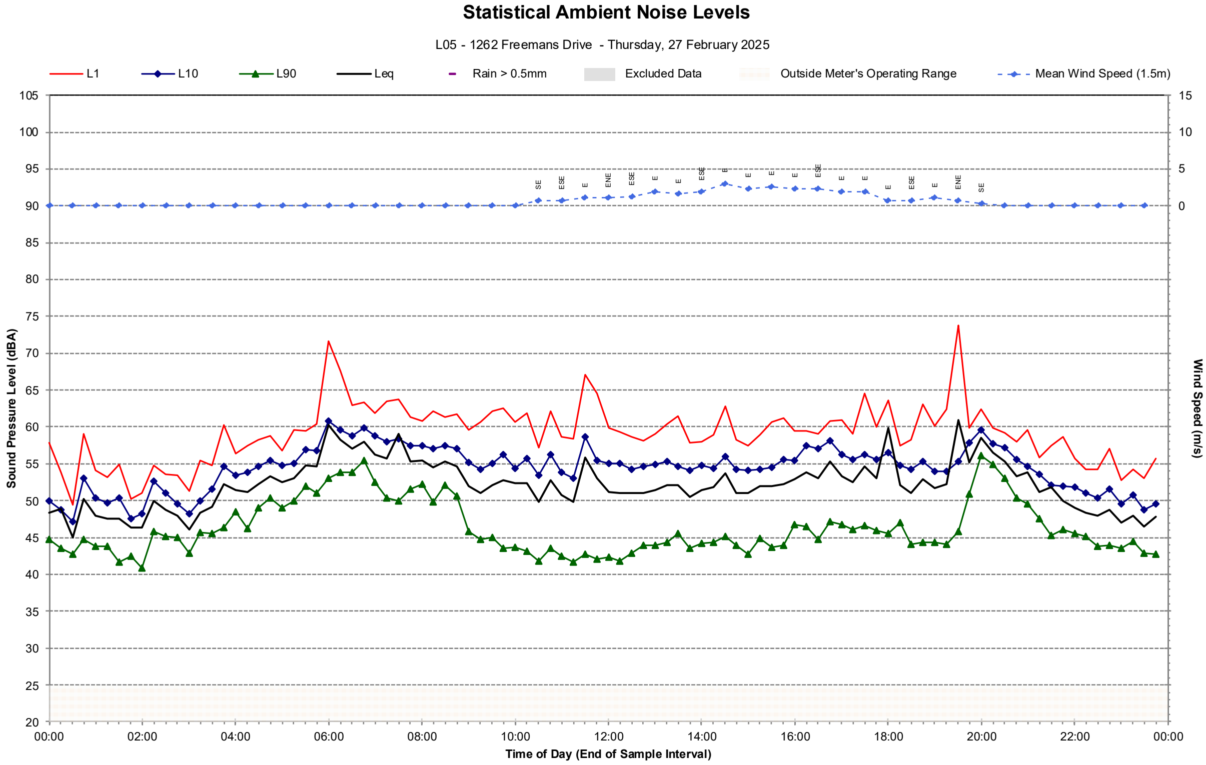


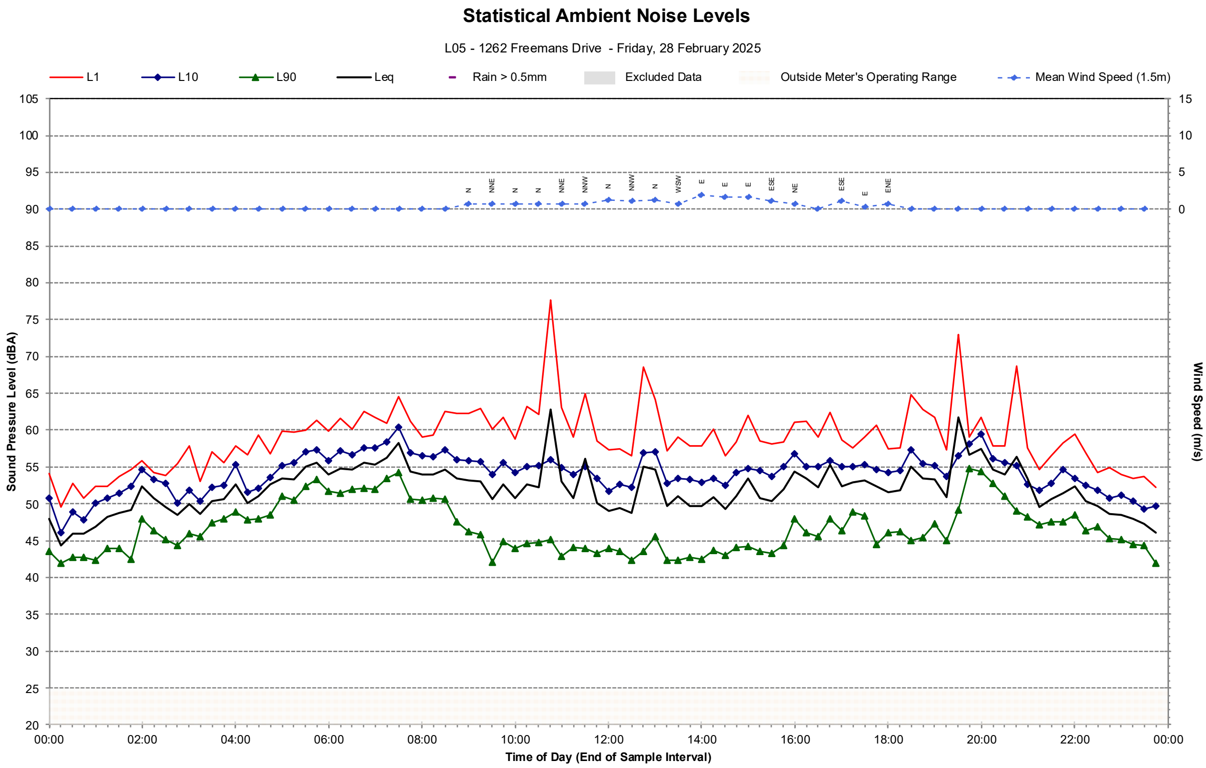

Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Sunday, 23 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Monday, 24 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Tuesday, 25 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

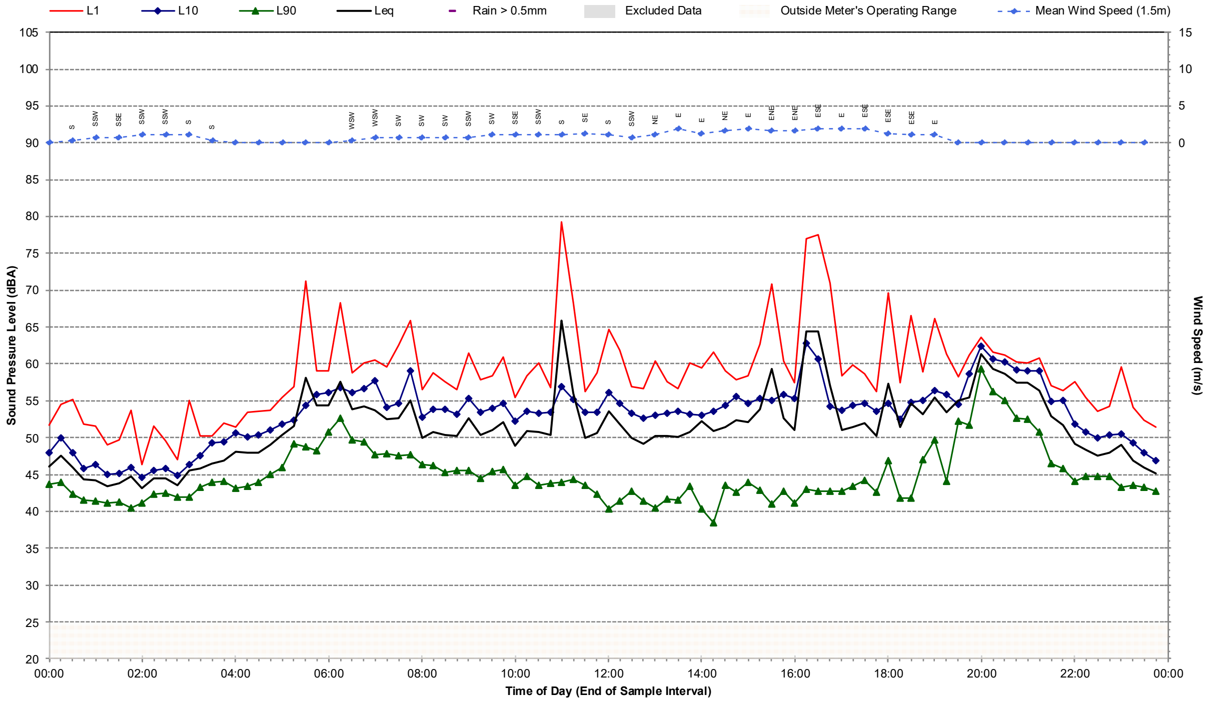

Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Wednesday, 26 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Thursday, 27 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Friday, 28 February 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

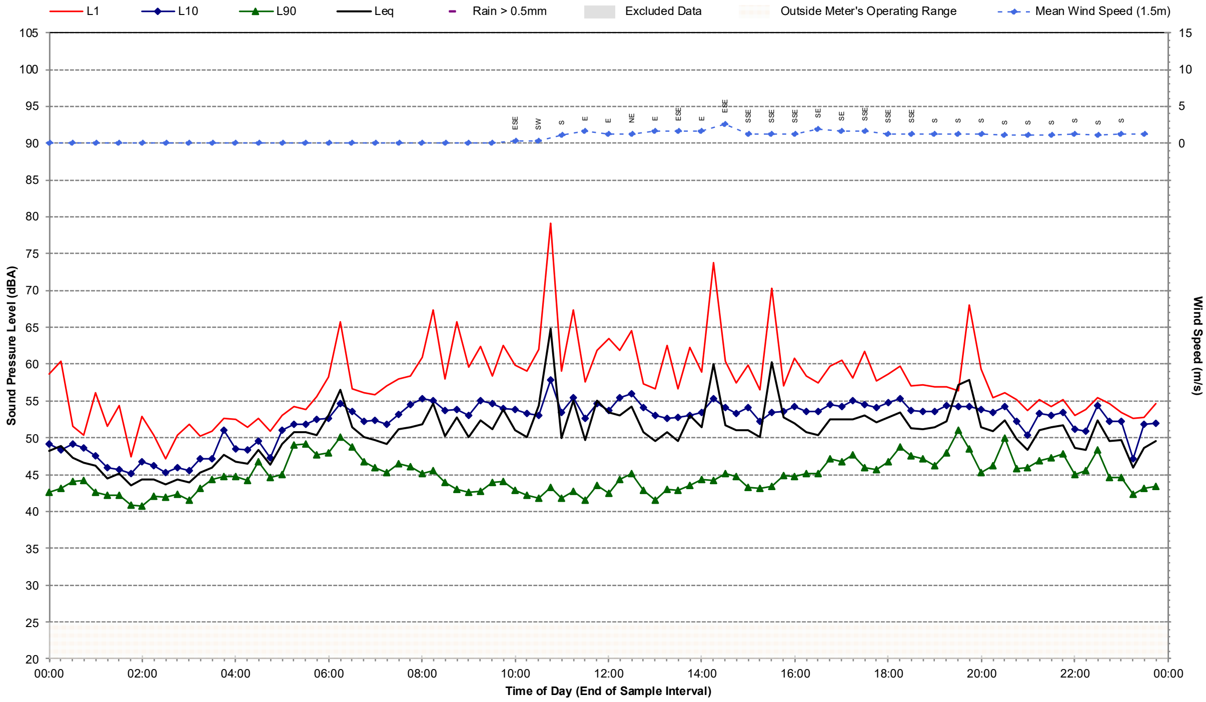
Statistical Ambient Noise Levels

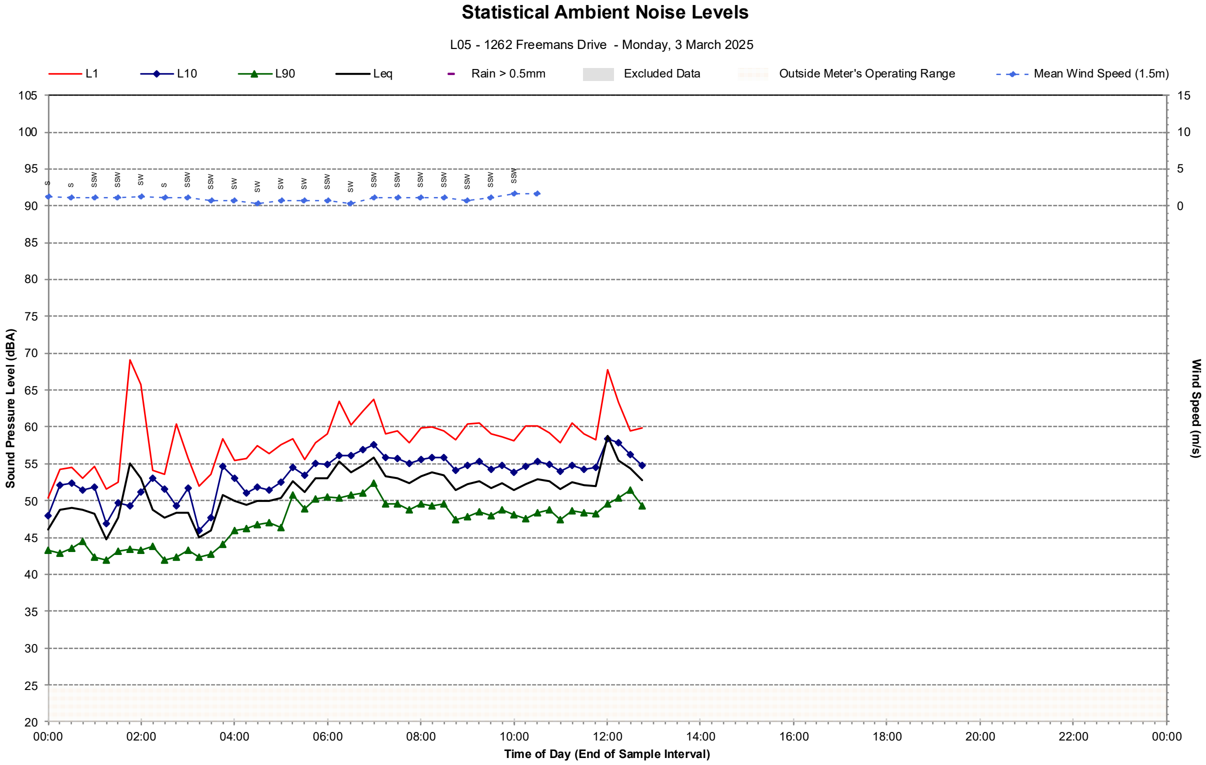
L05 - 1262 Freemans Drive - Saturday, 1 March 2025



Statistical Ambient Noise Levels

L05 - 1262 Freemans Drive - Sunday, 2 March 2025




Statistical Ambient Noise Levels
L05 - 1262 Freemans Drive - Monday, 3 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

L06 Noise monitoring details

Device and monitoring location

Address and coordinates	295 Watagan Road Martinsville NSW 2265 (349510, 6340162)
Logger device and serial number	ARL EL-316 (SN: 306047)
Sound level meter device and serial number	Brüel & Kjær Type 2250L (SN: 3003389)
Description of location	Logger located to the south of the driveway in line with the southern façade of the property, approximately 120 m south east of Watagan Road, and 370 m east of any currently proposed associated works with the HTP.
Description of ambient noise	Attended noise measurements indicate the ambient noise environment at this location is dominated by insect noise, birdsong, and to a lesser extent, road traffic noise.

Map of noise monitoring location

Ambient noise logging results – NPfI defined time periods

Monitoring Period	Ambient measured noise level (dBA)			
	RBL	LAeq	L10	L1
Daytime	33	53	49	53
Evening	32	61	46	49
Night-time	30	42	42	45

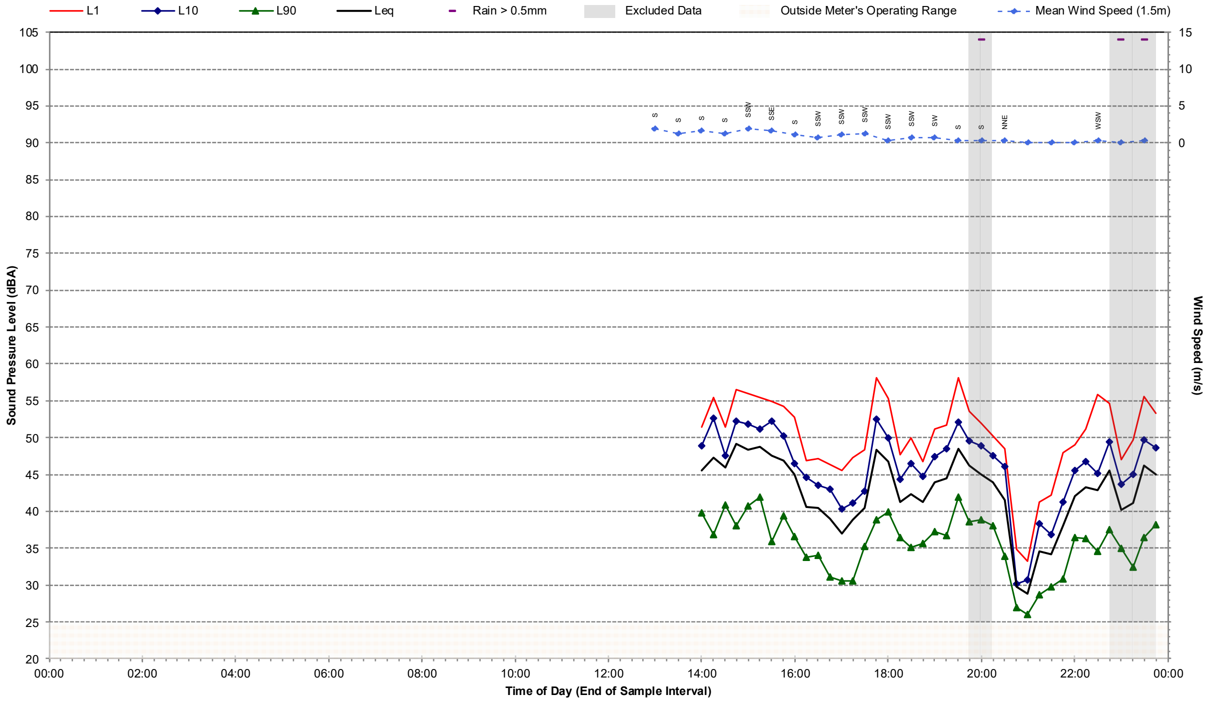
Attended noise measurement results

Date and start time	Attended measured noise level (dBA)		
	LA90	LAeq	LAmax
24/02/2025 08:37	32	44	70

Photo of noise monitoring location

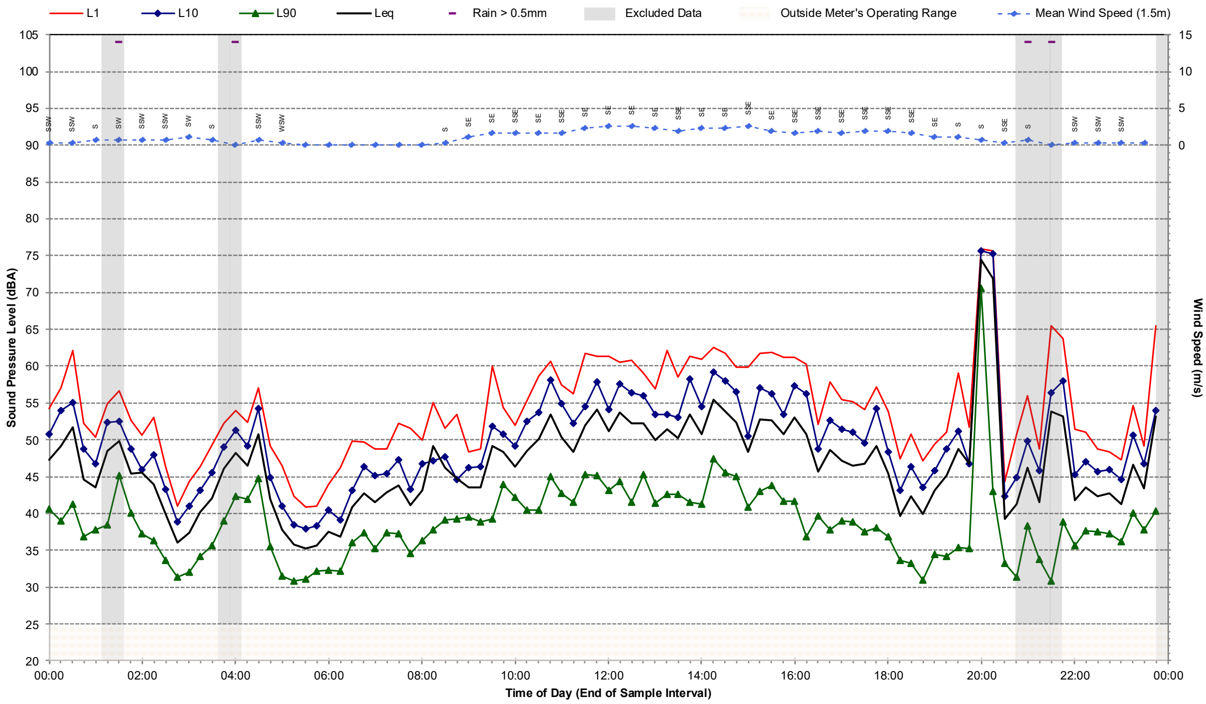
Statistical Ambient Noise Levels

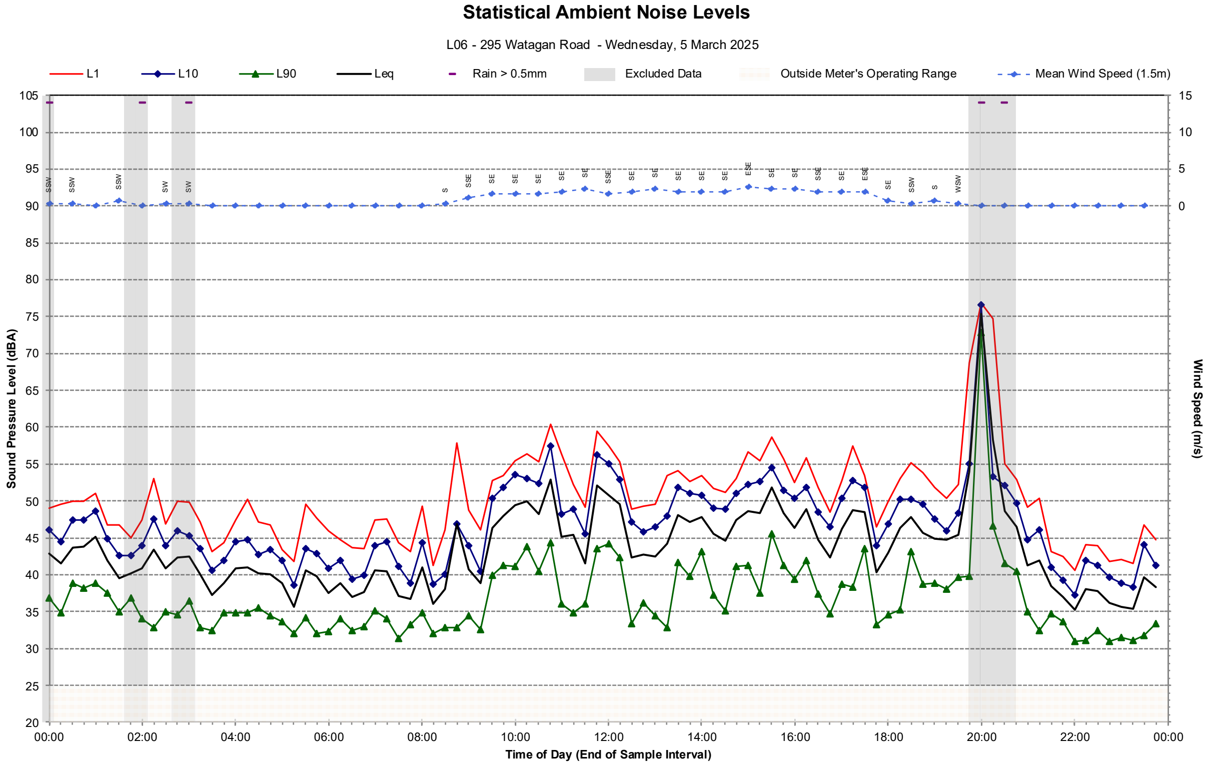
L06 - 295 Watagan Road - Monday, 3 March 2025

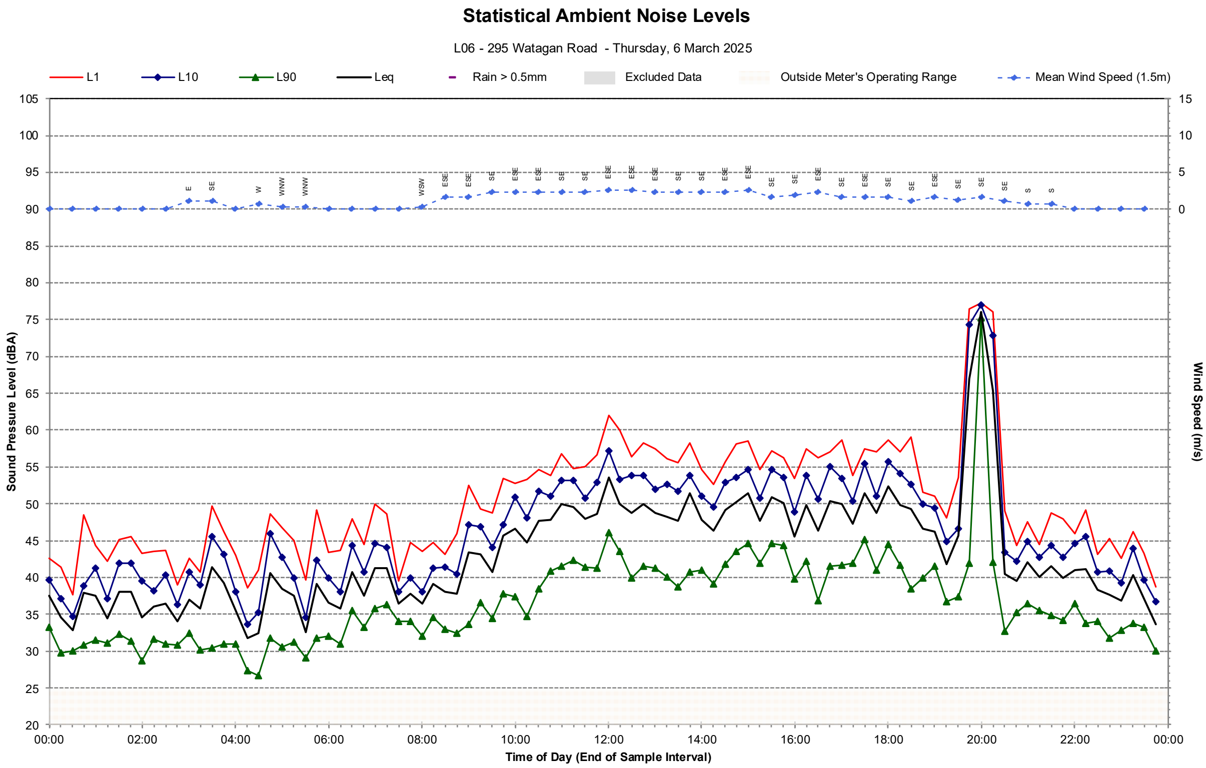


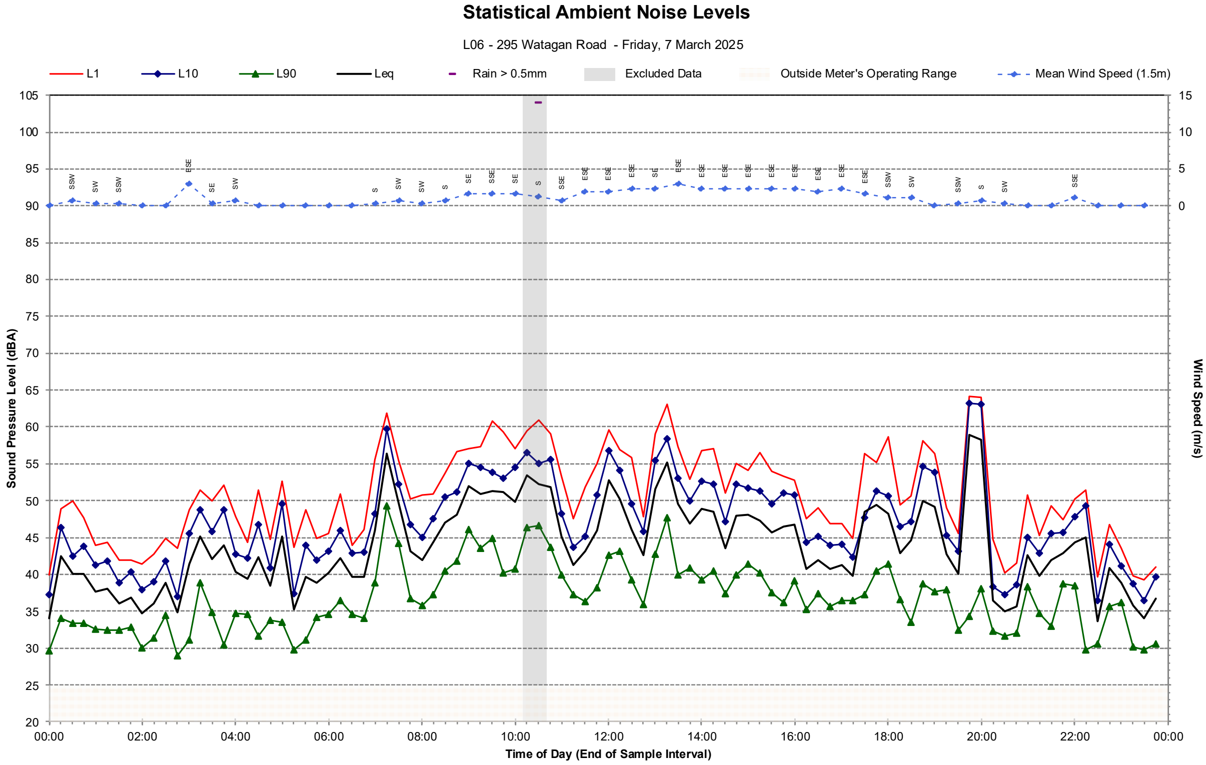
Statistical Ambient Noise Levels

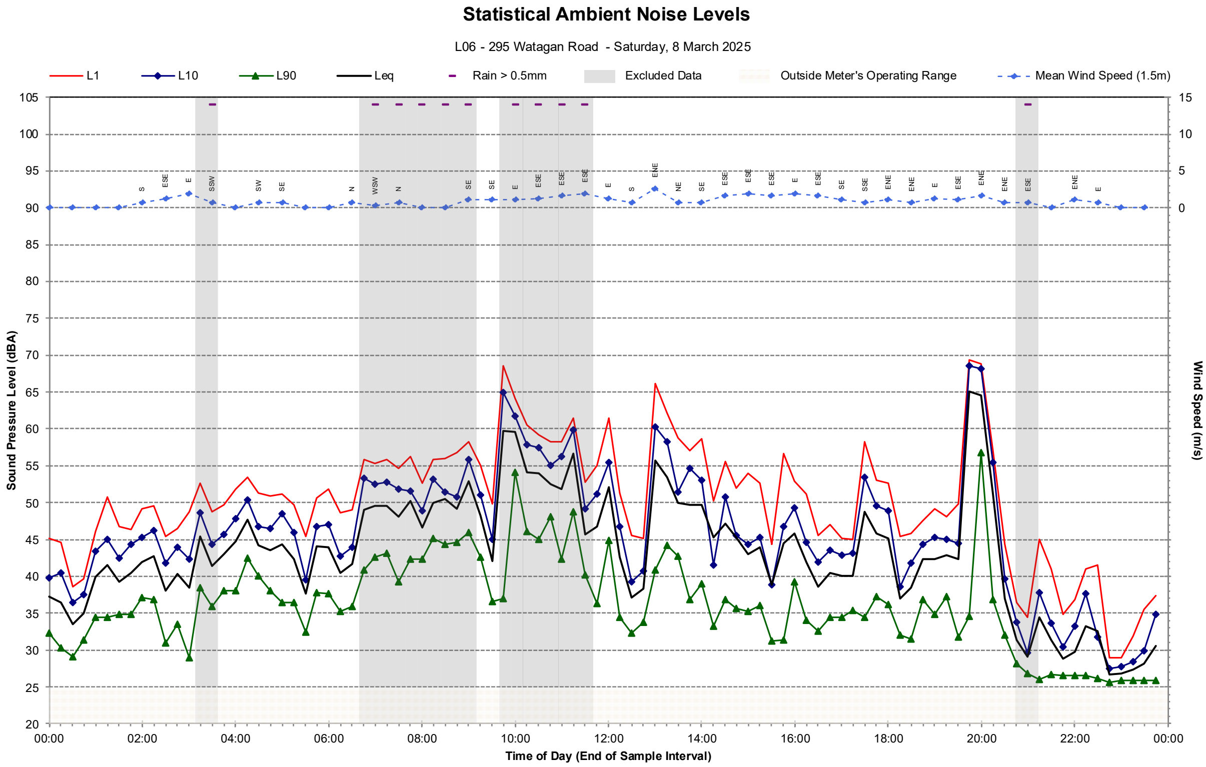
L06 - 295 Watagan Road - Tuesday, 4 March 2025

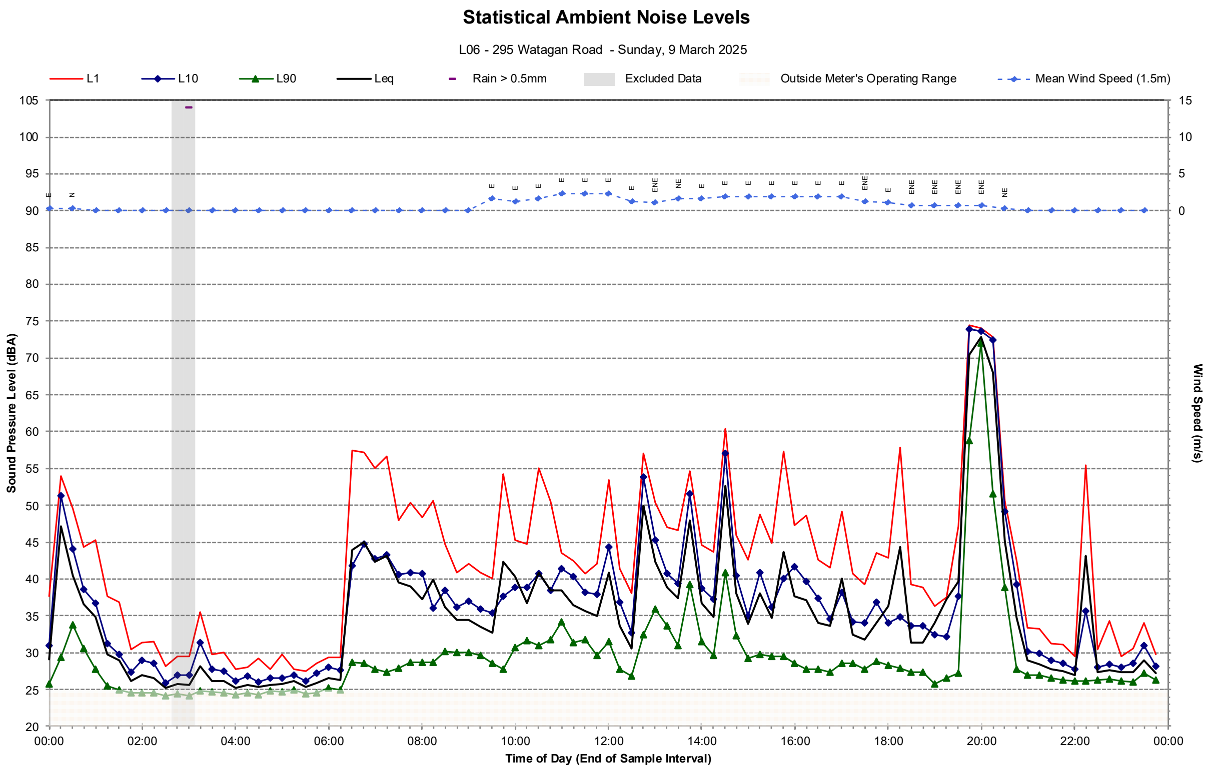


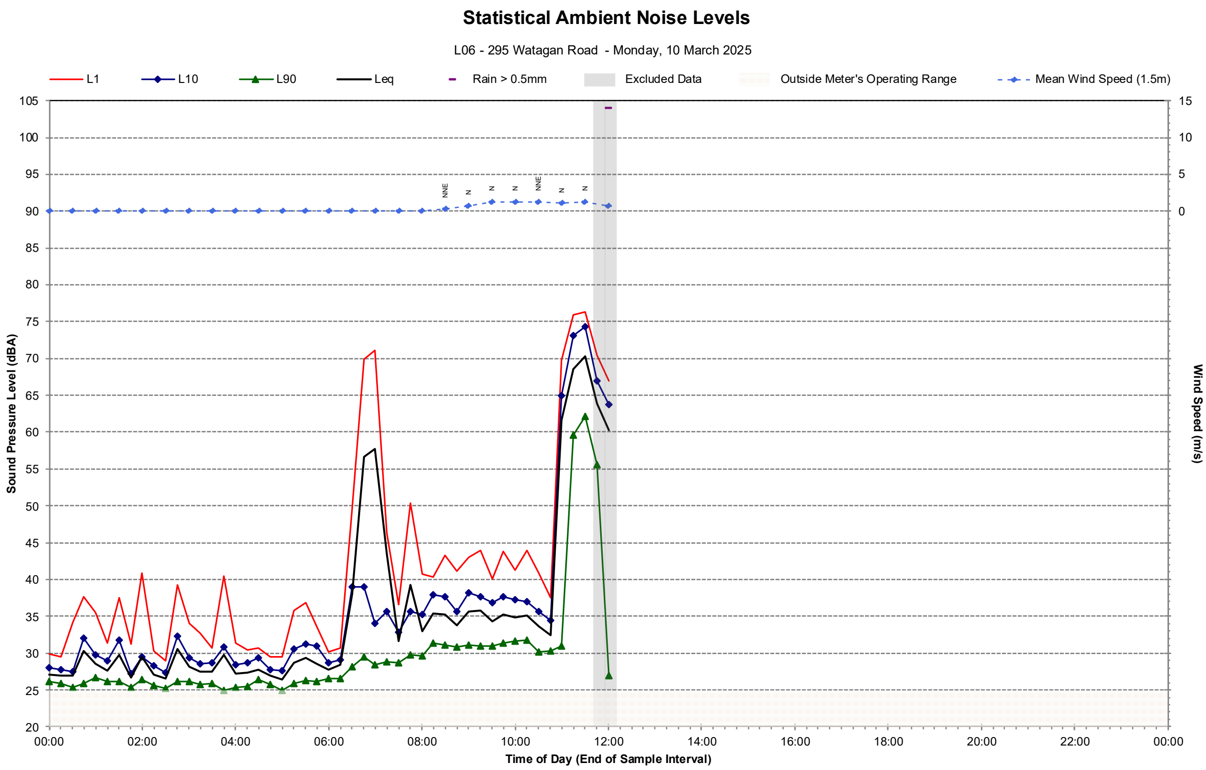

Statistical Ambient Noise Levels
L06 - 295 Watagan Road - Wednesday, 5 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L06 - 295 Watagan Road - Thursday, 6 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L06 - 295 Watagan Road - Friday, 7 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L06 - 295 Watagan Road - Saturday, 8 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L06 - 295 Watagan Road - Sunday, 9 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
L06 - 295 Watagan Road - Monday, 10 March 2025
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Attachment G Construction noise impacts

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

SLR Project No.: 630.032094.00001

14 July 2025

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, Construction support, accommodation, laydown, substation and switching station CONSTRUCTION NOISE IMPACTS

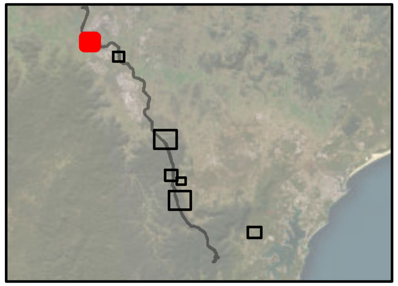
ATTACHMENT G.1

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- > 20 dB (Highly Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:15,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, Construction support, accommodation, laydown, substation and switching station CONSTRUCTION NOISE IMPACTS

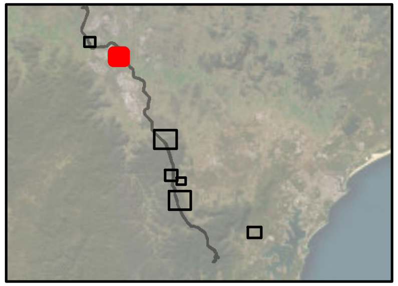
ATTACHMENT G.1

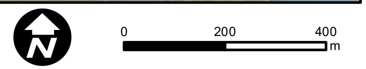
LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection

Noise Impacts

- 1 - 10 dB (Clearly Audible)





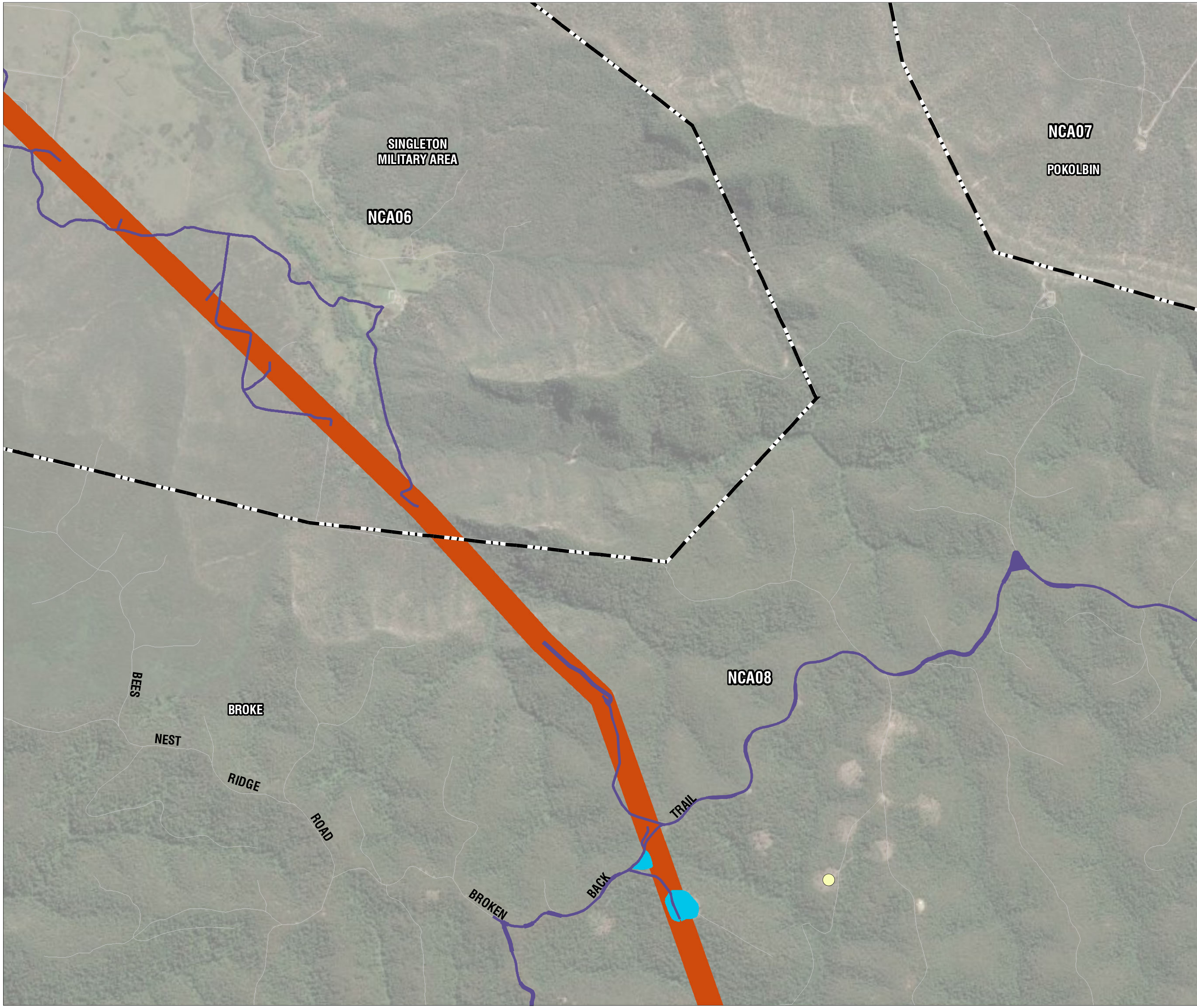
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:15,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

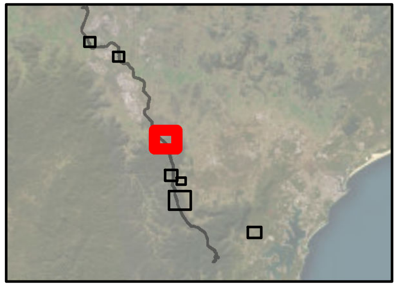
WORST-CASE DAYTIME,
Construction support, accommodation, laydown, substation and switching station
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.1



LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area

Noise Impacts
- 1 - 10 dB (Clearly Audible)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
Construction support, accommodation, laydown, substation and switching station
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.1

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Construction support site
- Intersection
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts
- 1 - 10 dB (Clearly Audible)

0 200 400 m

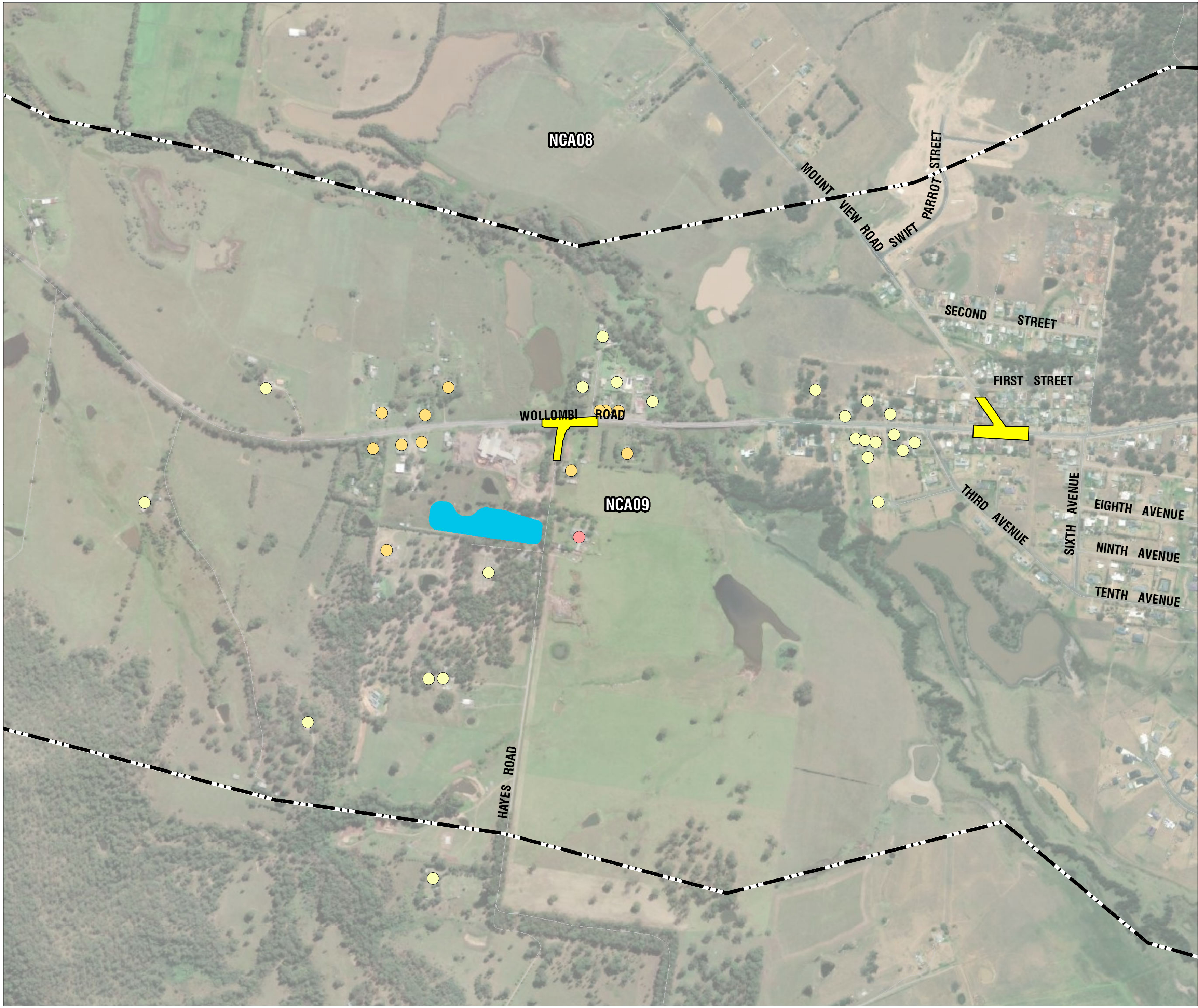
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:17,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME,
Construction support, accommodation, laydown, substation and switching station CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.1



LEGEND
- Study area
- NCA boundary
- Laydown area
- Intersection

Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:12,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

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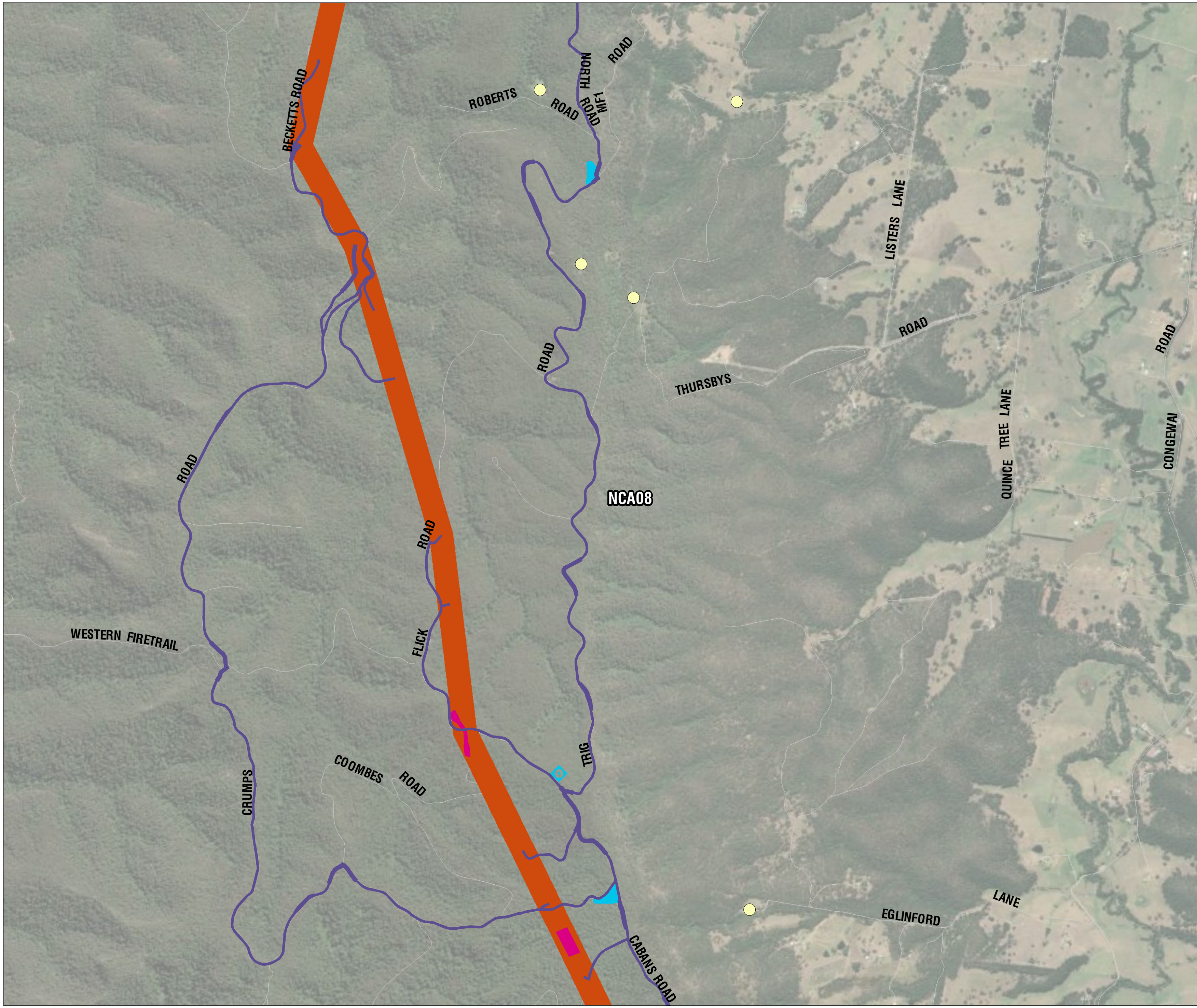


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, Construction support, accommodation, laydown, substation and switching station CONSTRUCTION NOISE IMPACTS

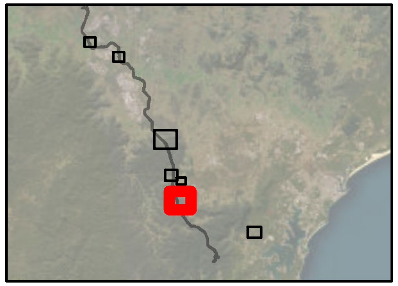
ATTACHMENT G.1

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Stringing station

Noise Impacts

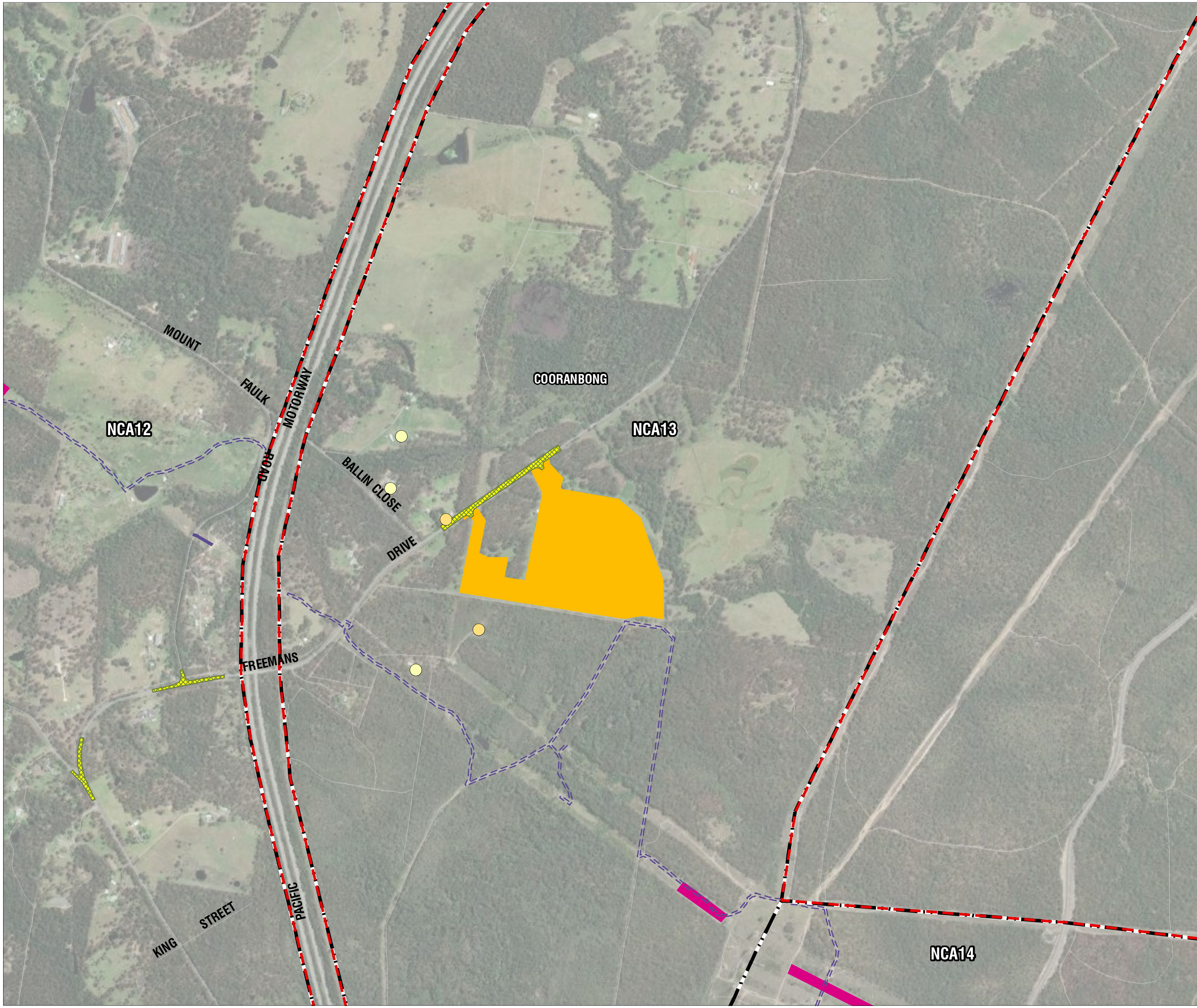
- 1 - 10 dB (Clearly Audible)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, Construction support, accommodation, laydown, substation and switching station CONSTRUCTION NOISE IMPACTS

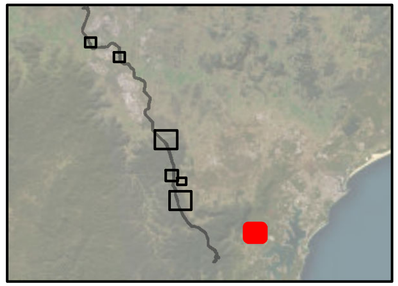
ATTACHMENT G.1

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts

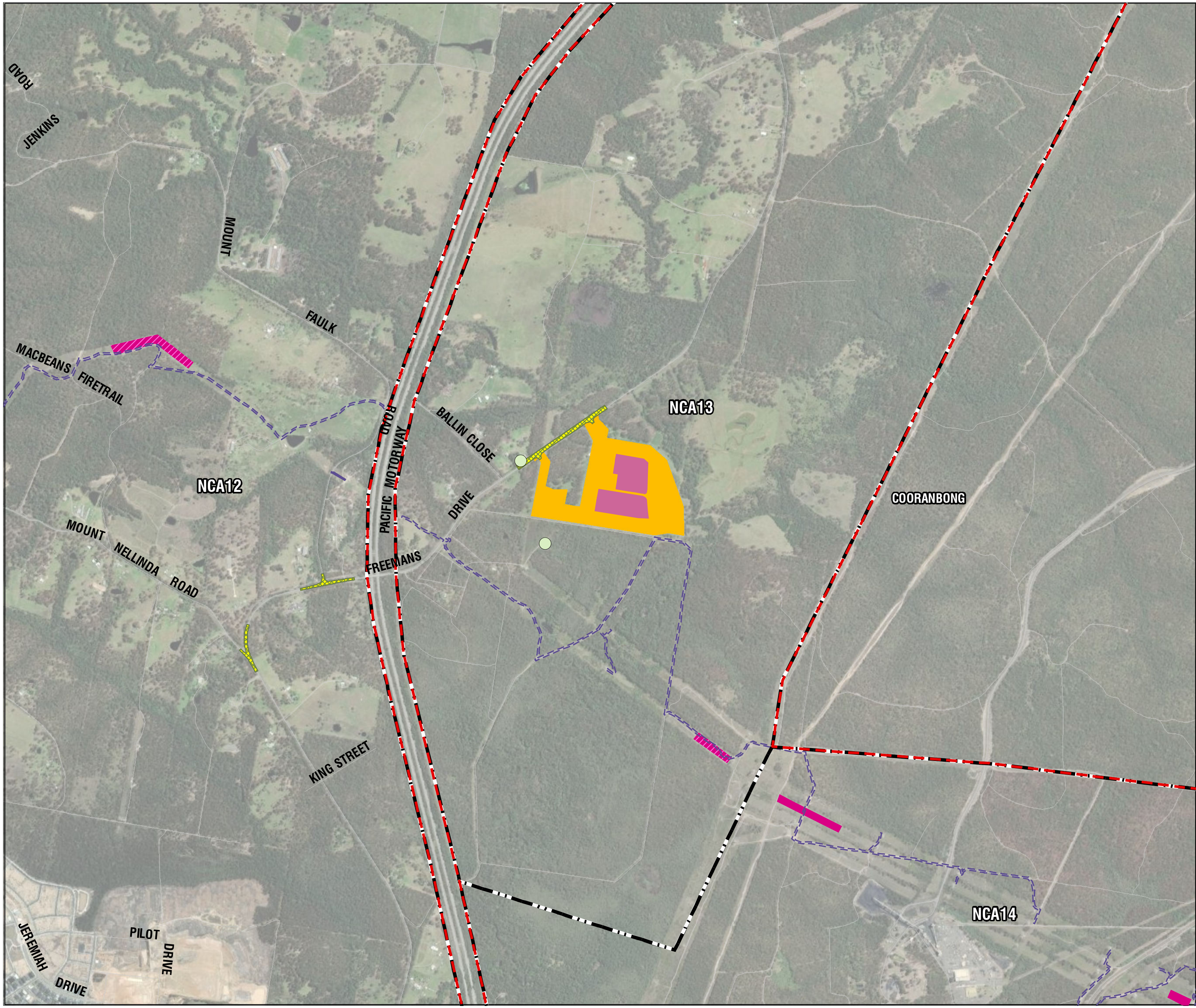
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE NIGHT-TIME, ACCOMMODATION FACILITY, CONSTRUCTION NOISE IMPACTS

Page 1 of 1

ATTACHMENT G.2

LEGEND

- Study area
- NCA boundary
- Construction support site
- Intersection
- Stringing station
- Stringing station OOH
- Accommodation site

Noise Impacts

- 1 - 5 dB (Noticeable)

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

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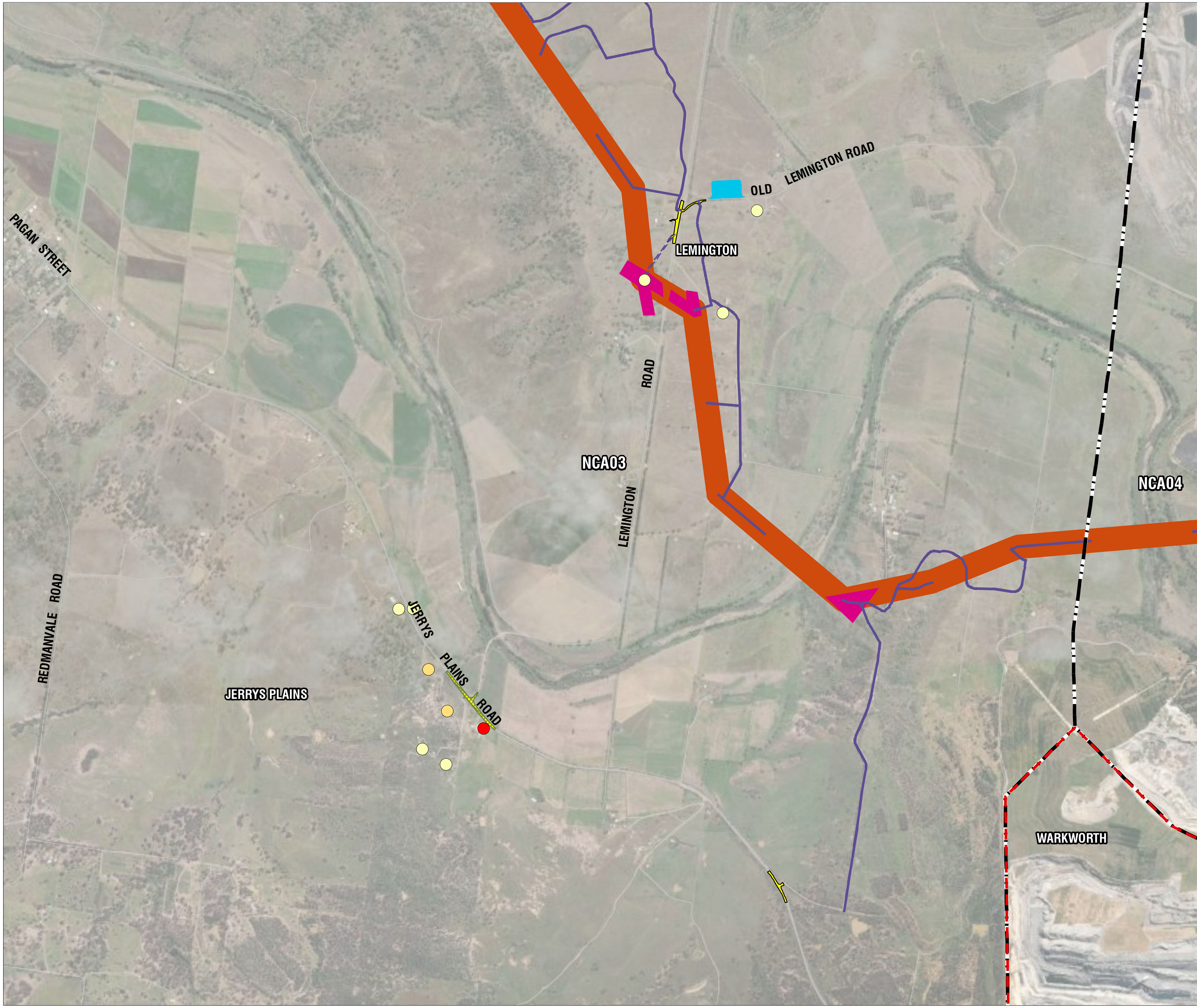


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

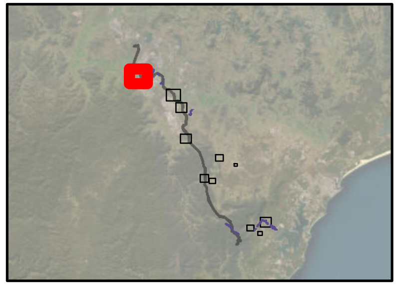
ATTACHMENT G.3

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Intersection (intensive)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 75 dBA (Highly Noise Affective)



0 300 600 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

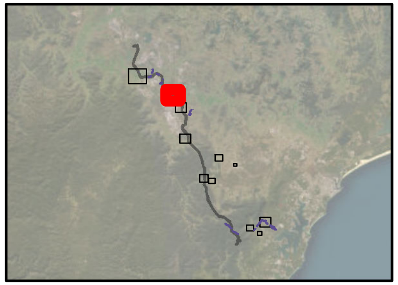
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
INTERSECTIONS (TYPICAL),
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Accommodation site

Noise Impacts
- 1 - 10 dB (Clearly Audible)



0 240 480 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

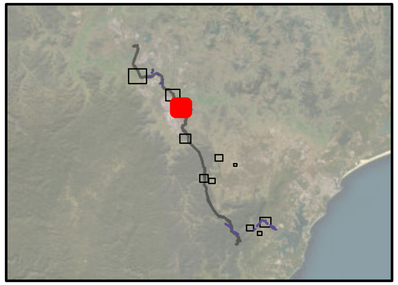
ATTACHMENT G.3

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Intersection (typical)
- Stringing station
- Stringing station OOH

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 190 380 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:19,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

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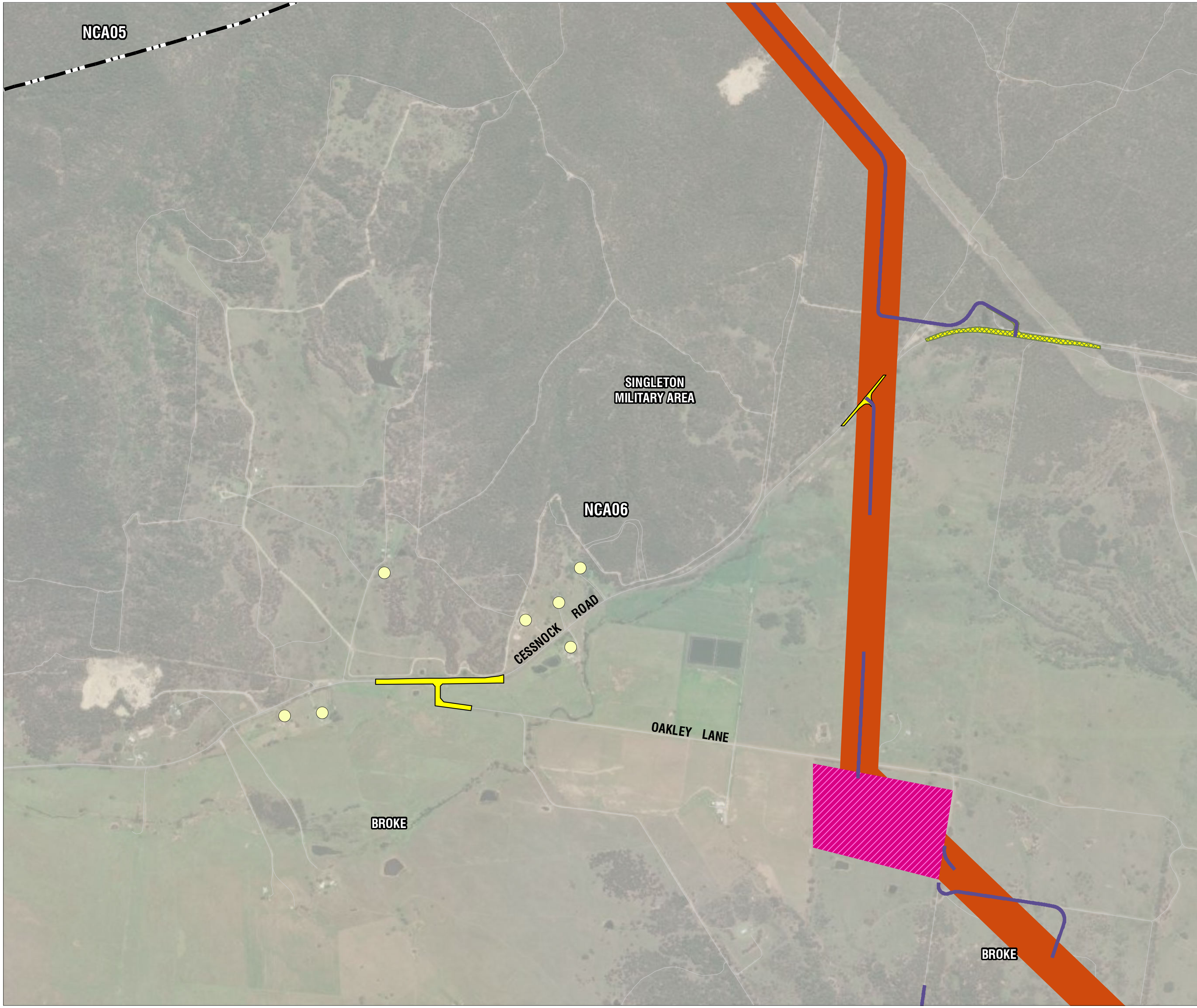
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

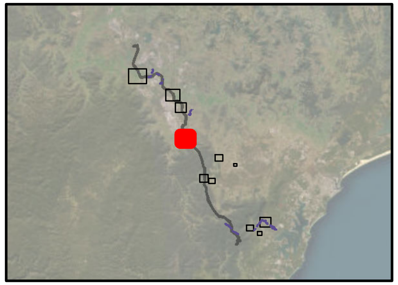


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts

- 1 - 10 dB (Clearly Audible)



0 190 380 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:19,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:13,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
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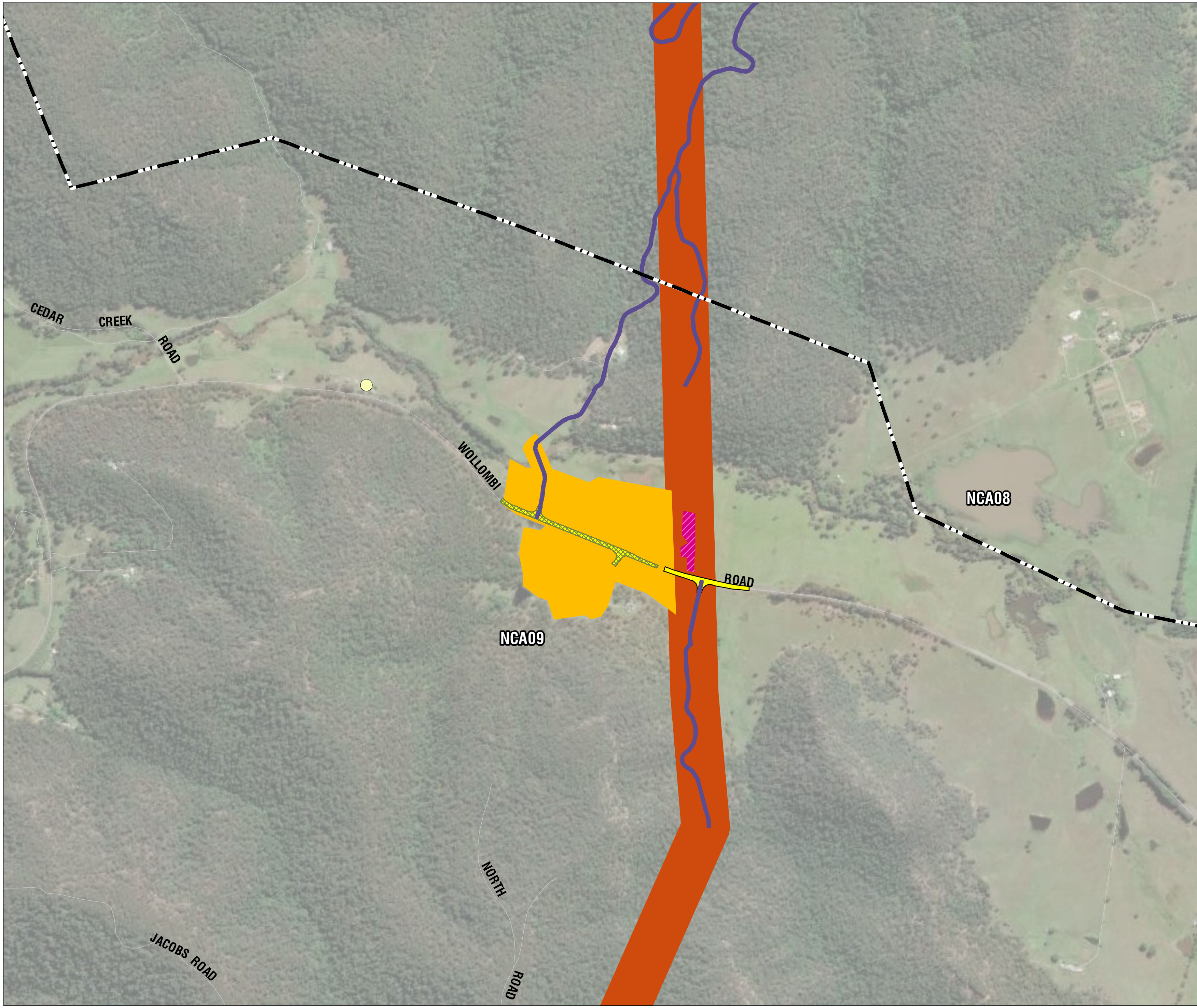
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

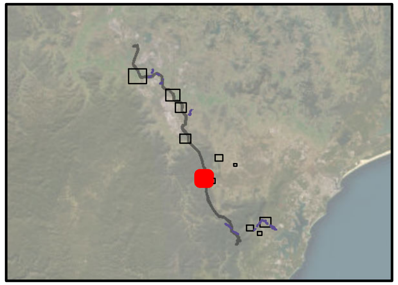


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts

- 1 - 10 dB (Clearly Audible)



0 150 300 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:15,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Intersection (typical)

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)

0 120 240 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:12,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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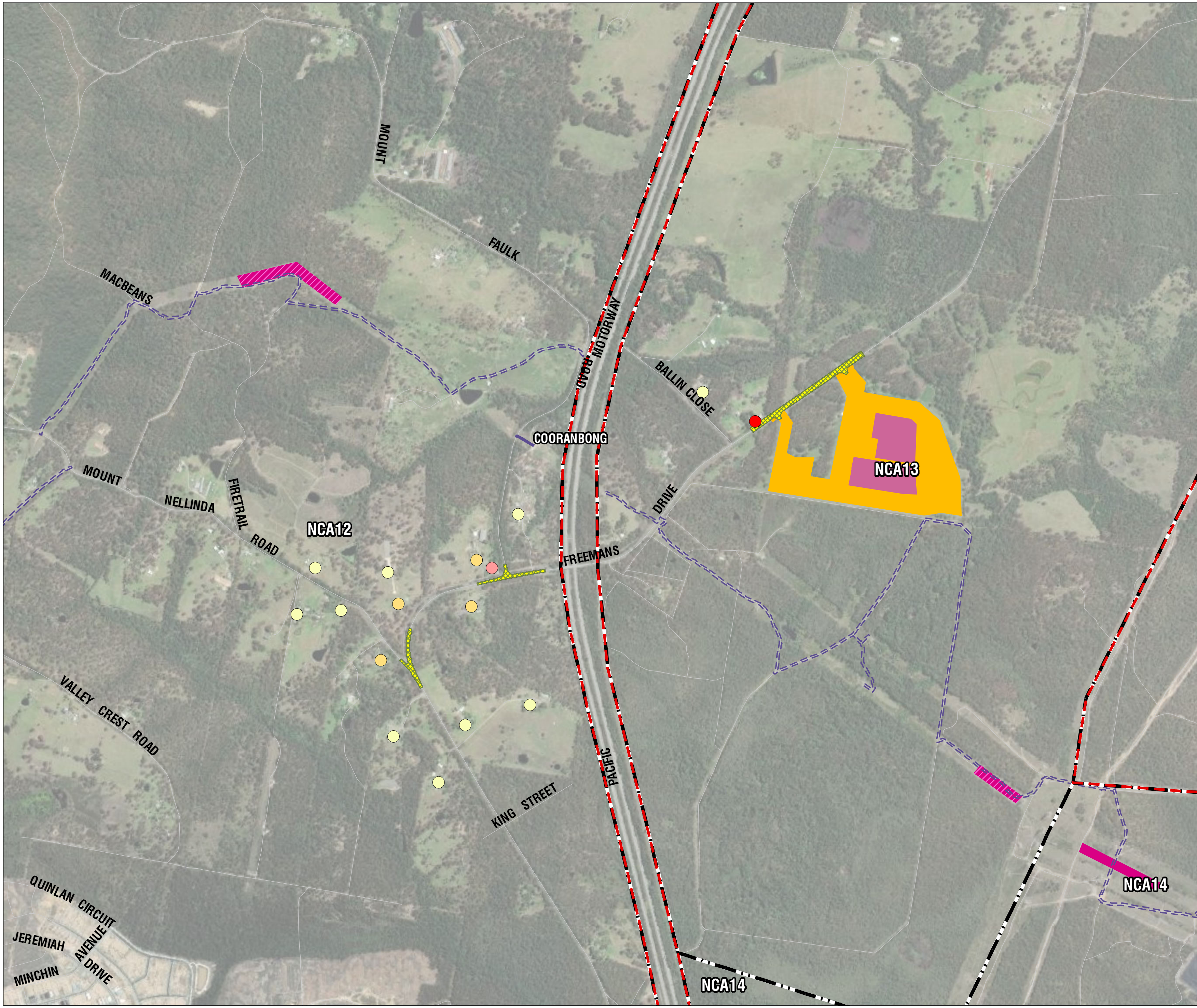


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

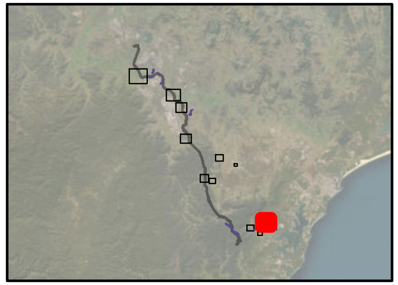
ATTACHMENT G.3

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affective)



0 190 380 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:19,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

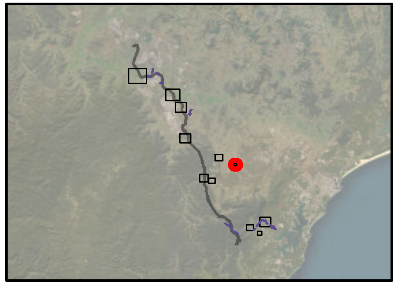
ATTACHMENT G.3

LEGEND

- Study area
- NCA boundary
- Intersection (typical)

Noise Impacts (Buildings)

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 75 dBA (Highly Noise Affective)



0 50 100 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:5,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

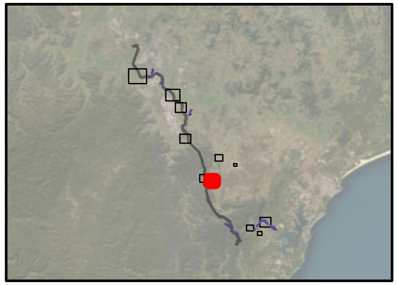
ATTACHMENT G.3

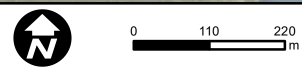
LEGEND

- Study area
- NCA boundary
- Laydown area
- Intersection (typical)

Noise Impacts (Buildings)

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affective)





Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:11,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (TYPICAL), CONSTRUCTION NOISE IMPACTS

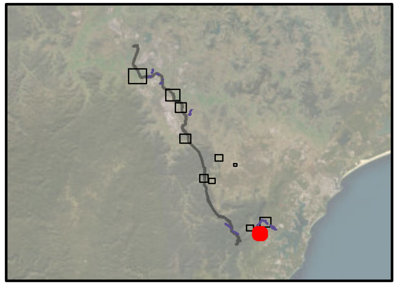
ATTACHMENT G.3

LEGEND

- Study area
- NCA boundary
- Intersection (typical)
- Intersection (intensive)

Noise Impacts (Buildings)

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affective)



0 70 140 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:7,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

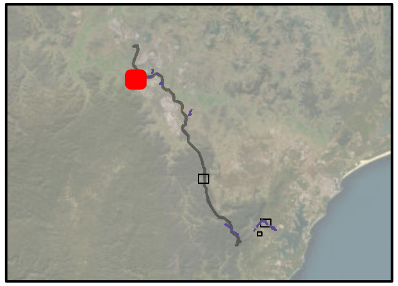
WORST-CASE DAYTIME, INTERSECTIONS (INTENSIVE), CONSTRUCTION NOISE IMPACTS

Page 1 of 4

ATTACHMENT G.4

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Intersection (typical)
- Intersection (intensive)
- Stringing station

Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 75 dBA (Highly Noise Affected)



0 180 360 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (INTENSIVE), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.4

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts
- 1 - 10 dB (Clearly Audible)

0 180 360 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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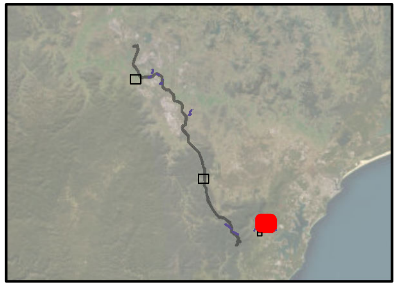
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

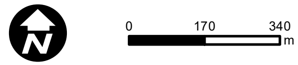
WORST-CASE DAYTIME, INTERSECTIONS (INTENSIVE), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.4

LEGEND
- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)





Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:17,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, INTERSECTIONS (INTENSIVE), CONSTRUCTION NOISE IMPACTS

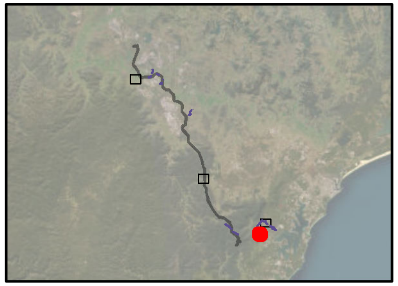
ATTACHMENT G.4

LEGEND

- Study area
- NCA boundary
- Intersection (typical)
- Intersection (intensive)

Noise Impacts (Buildings)

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)



0 70 140 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:7,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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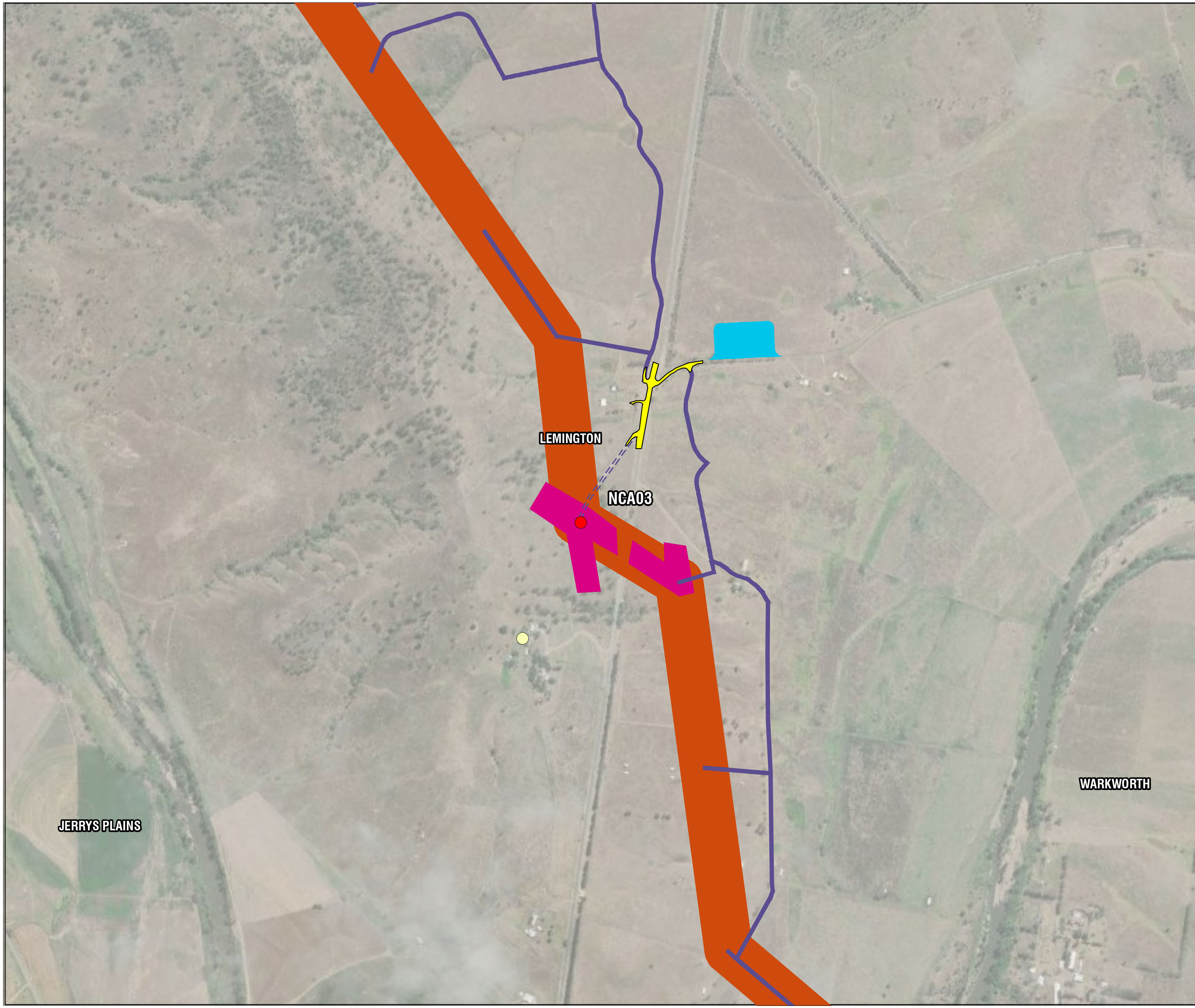

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
ACCESS TRACKS (MINOR),
CONSTRUCTION NOISE IMPACTS

Page 1 of 6

ATTACHMENT G.5

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- > 75 dBA (Highly Noise Affected)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:15,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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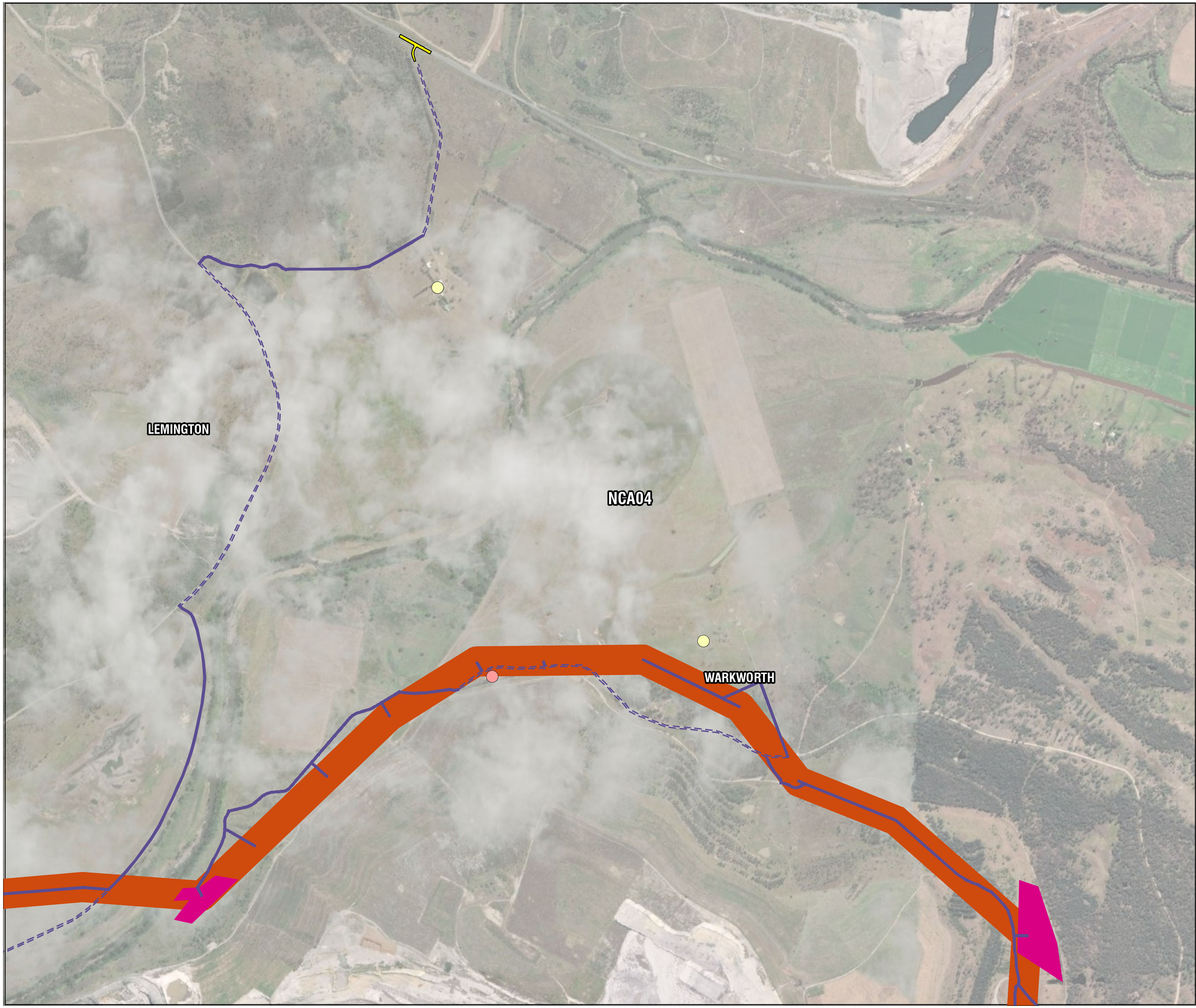

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MINOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.5

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- > 20 dB (Highly Intrusive)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
ACCESS TRACKS (MINOR),
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.5

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)

Noise Impacts

- 1 - 10 dB (Clearly Audible)

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

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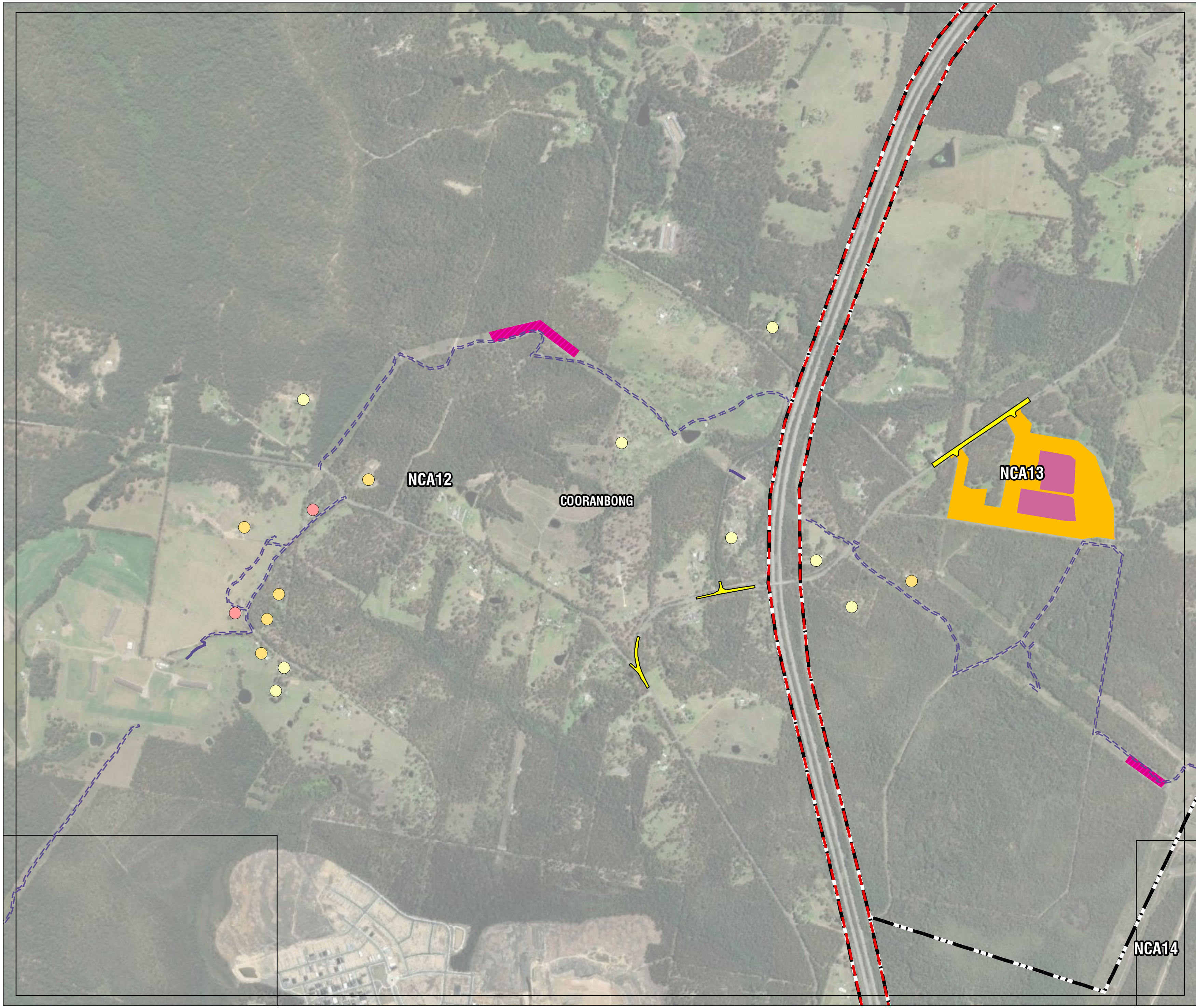

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MINOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.5

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:22,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
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HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
ACCESS TRACKS (MINOR),
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.5

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Intersection (intensive)
- Stringing station

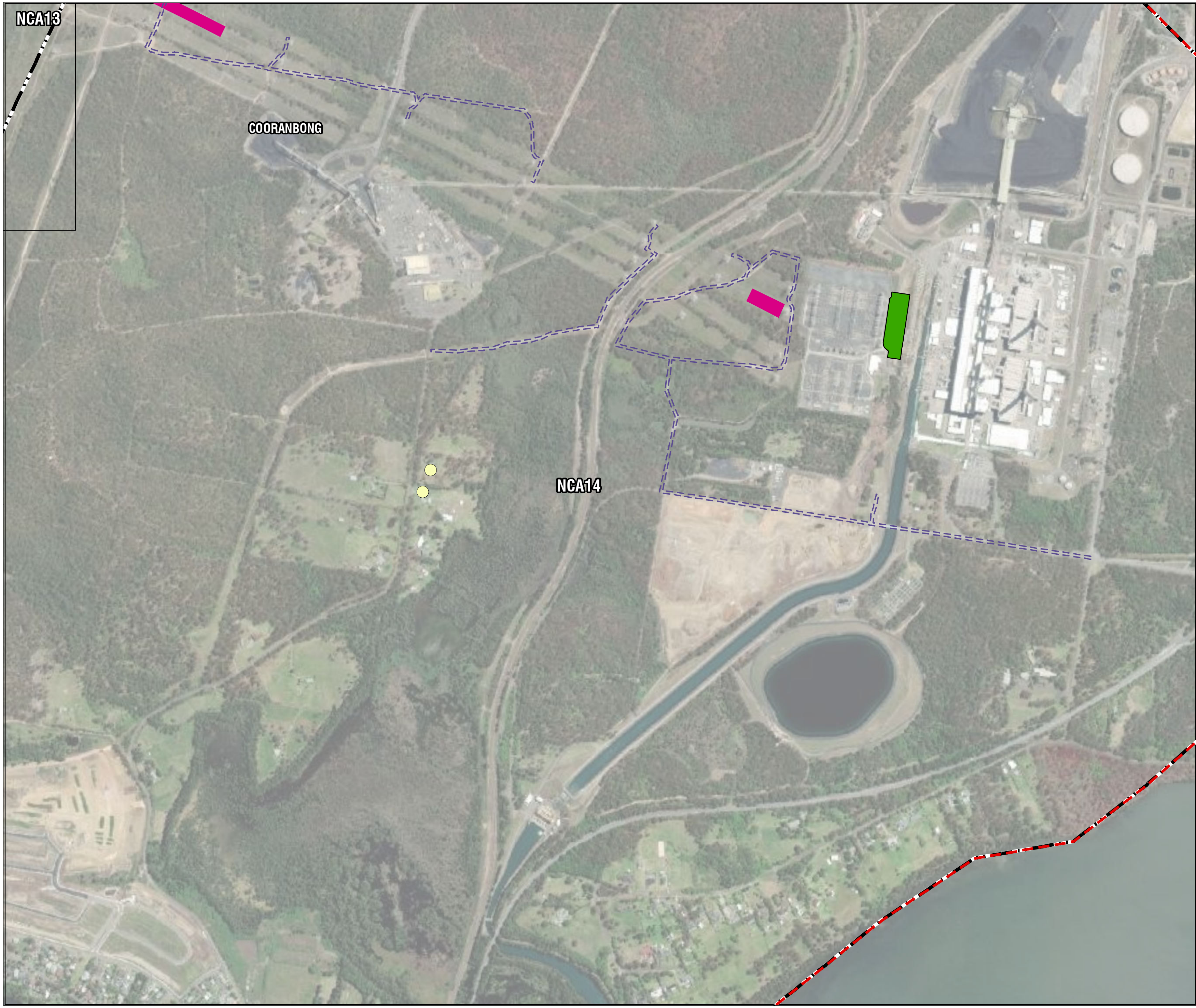
Noise Impacts

- 1 - 10 dB (Clearly Audible)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MINOR), CONSTRUCTION NOISE IMPACTS

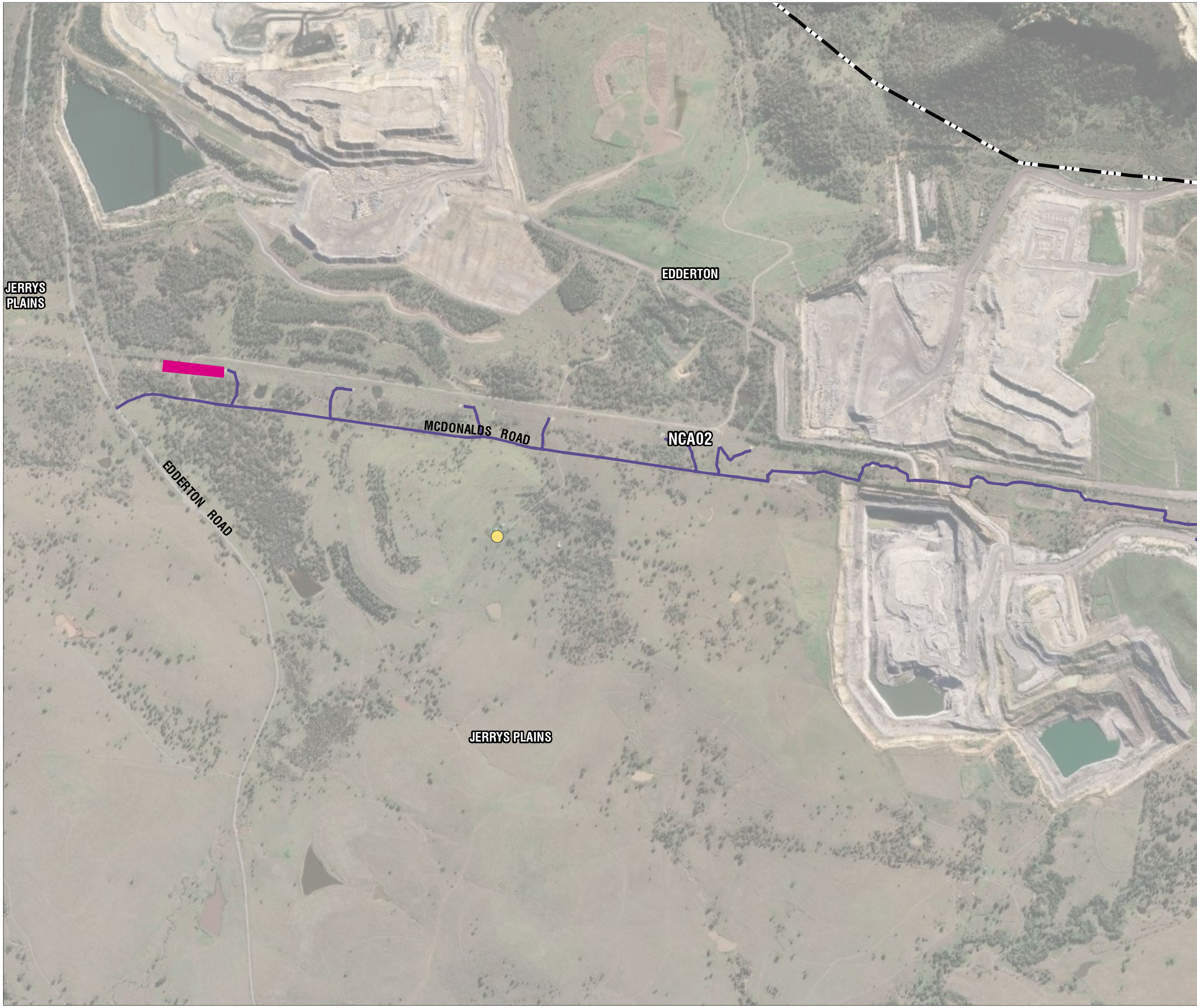
ATTACHMENT G.5

LEGEND
- Study area
- NCA boundary
- Access tracks (minor)
- Substation
- Stringing station

Noise Impacts
- 1 - 10 dB (Clearly Audible)

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:15,000 at A4
Project Number:	630.032094
Date:	07-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

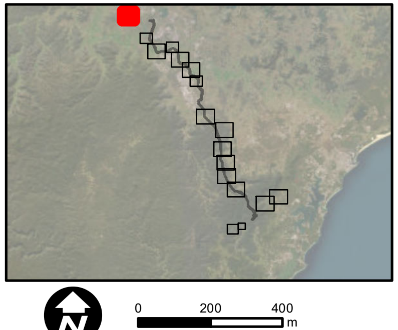
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- Access Tracks (major)
- Stringing station

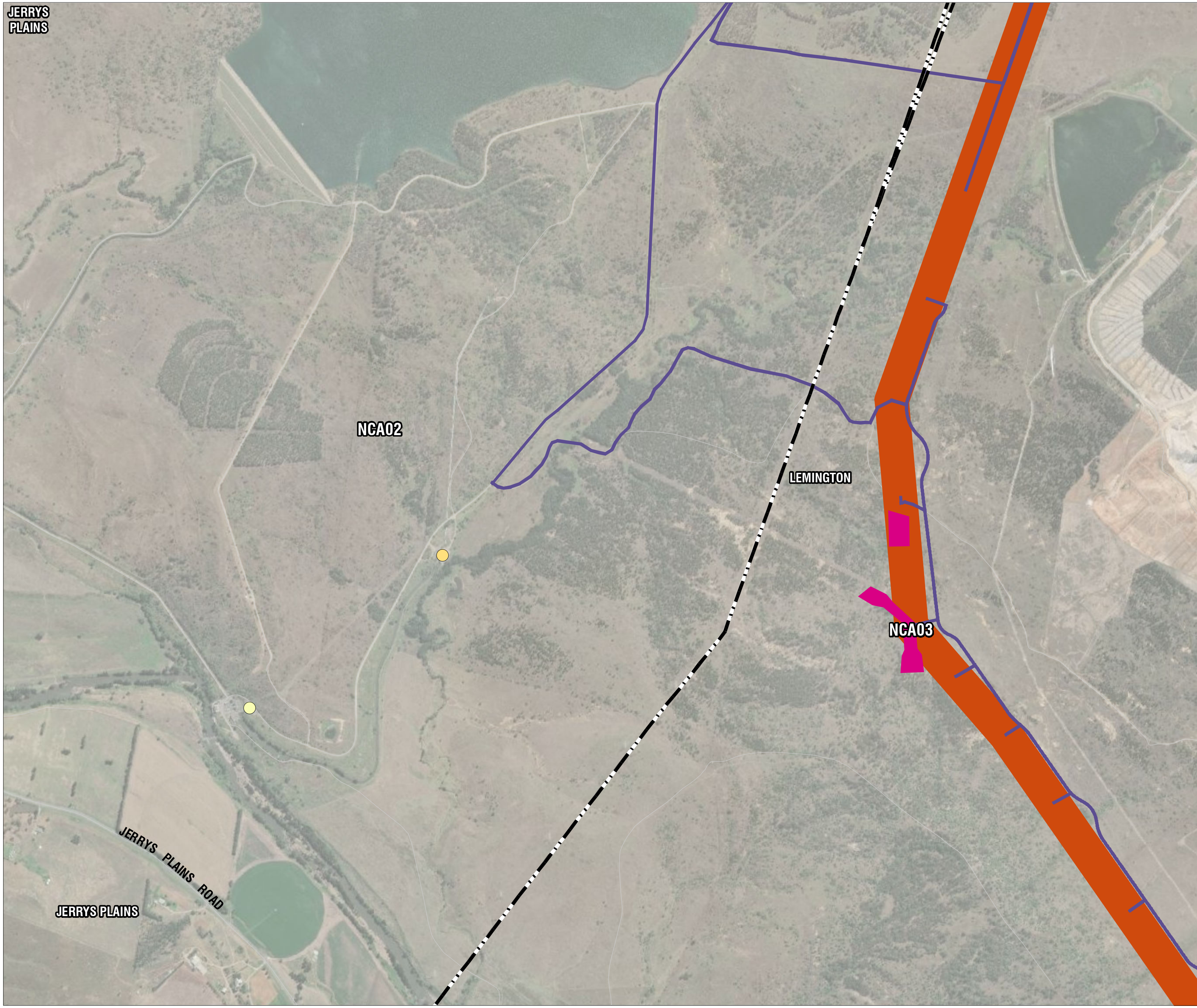
Noise Impacts

- 11 - 20 dB (Moderately Intrusive)



Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

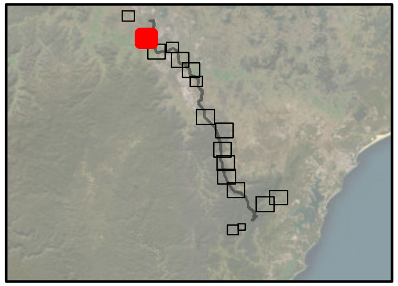
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Stringing station

Noise Impacts

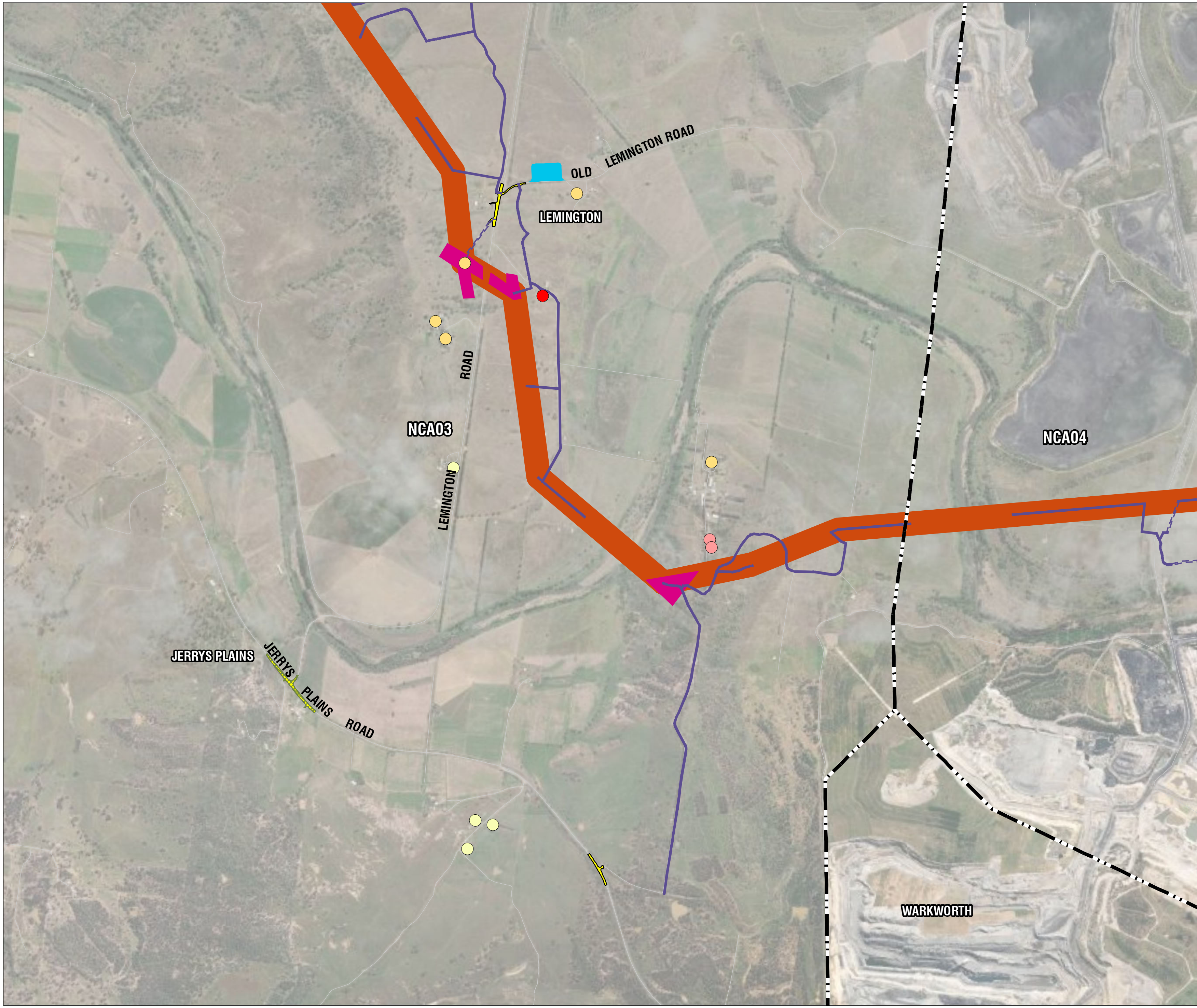
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

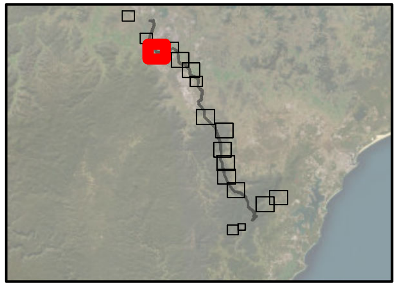
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Intersection (intensive)
- Stringing station

Noise Impacts

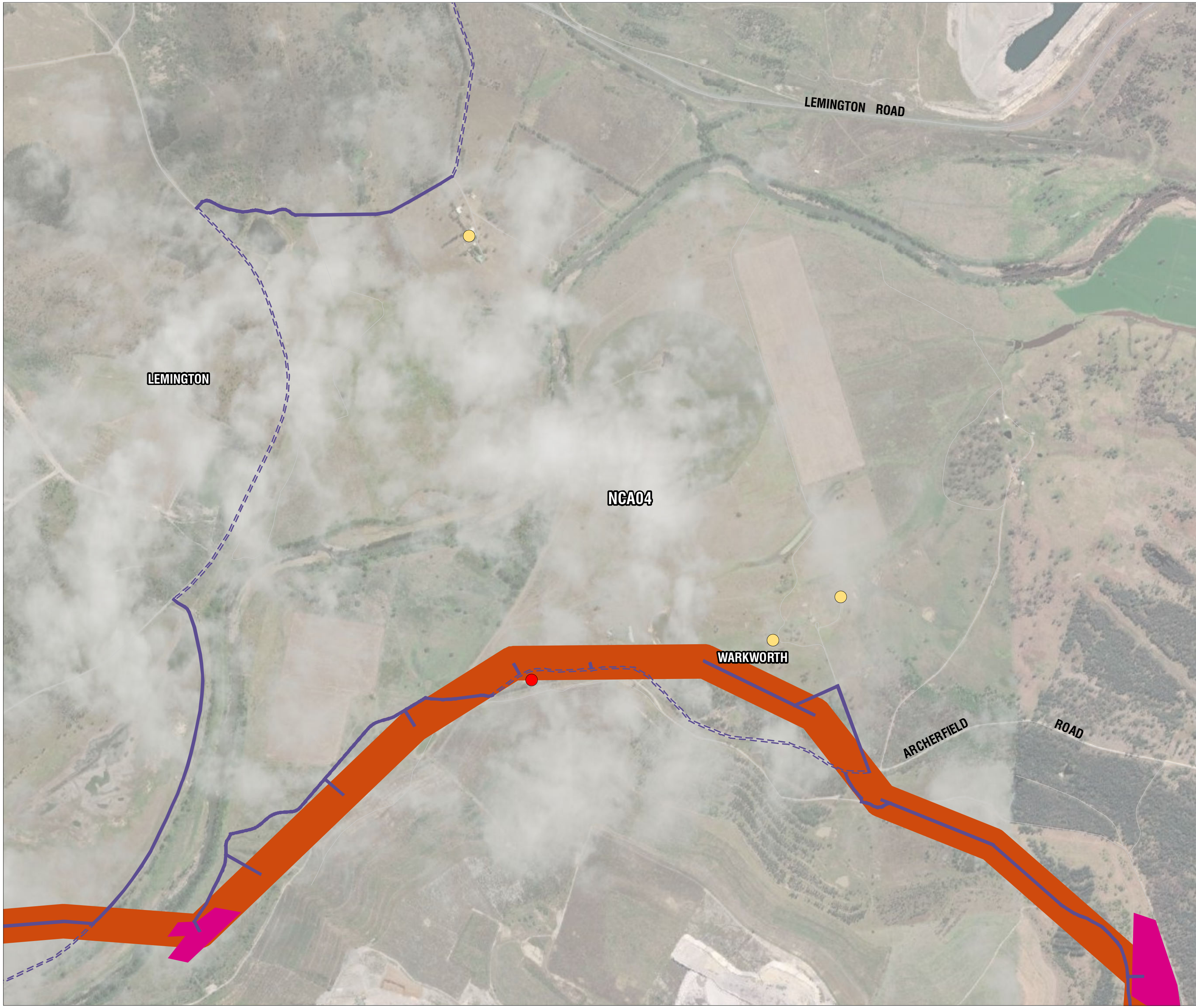
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

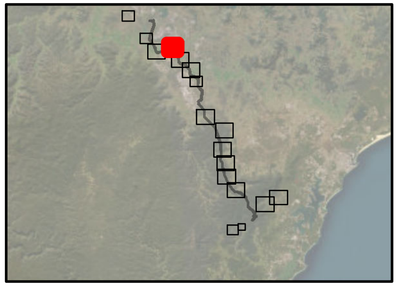
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Access tracks (minor)
- Stringing station

Noise Impacts

- 11 - 20 dB (Moderately Intrusive)
- > 75 dBA (Highly Noise Affected)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

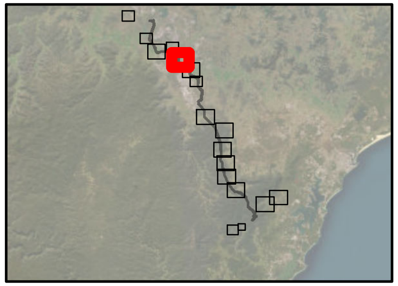
ATTACHMENT G.6

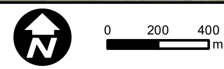
LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

Noise Impacts

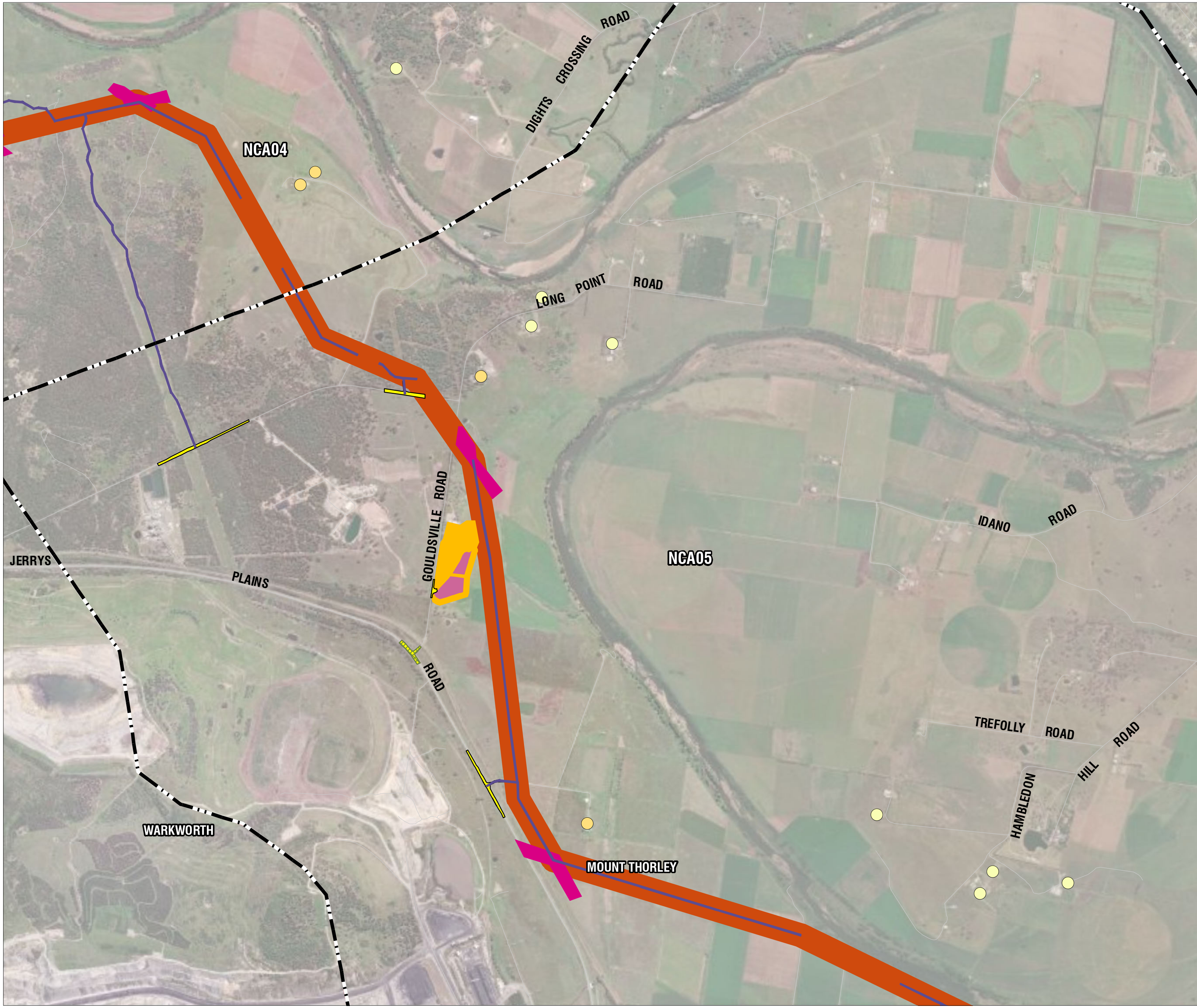
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)





Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Accommodation site

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
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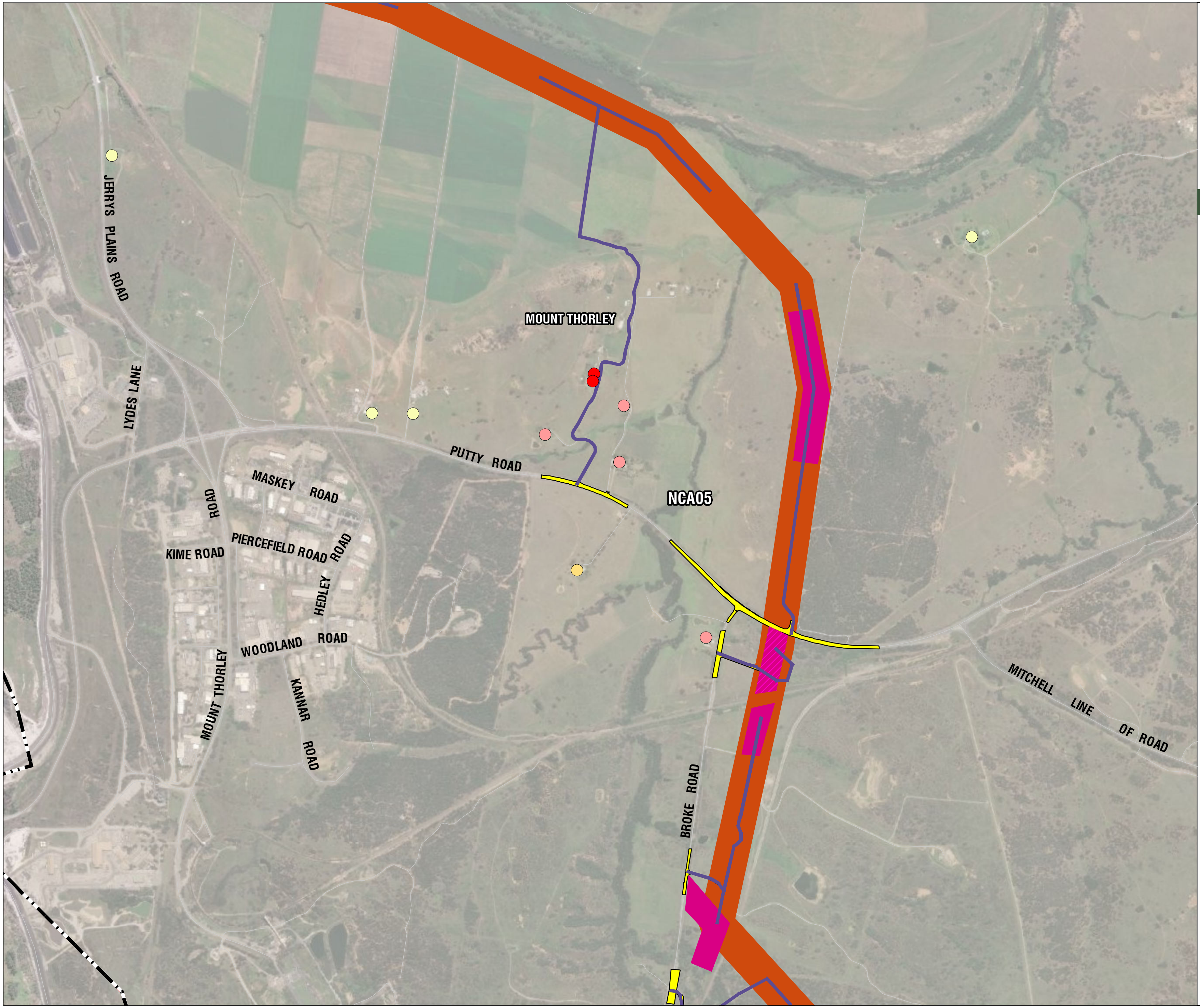
SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

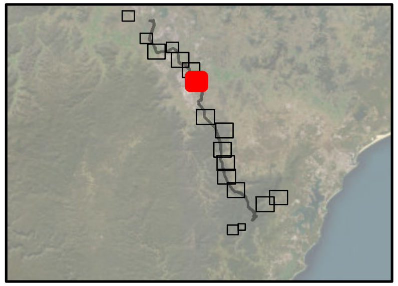


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Intersection (typical)
- Stringing station
- Stringing station OOH

Noise Impacts

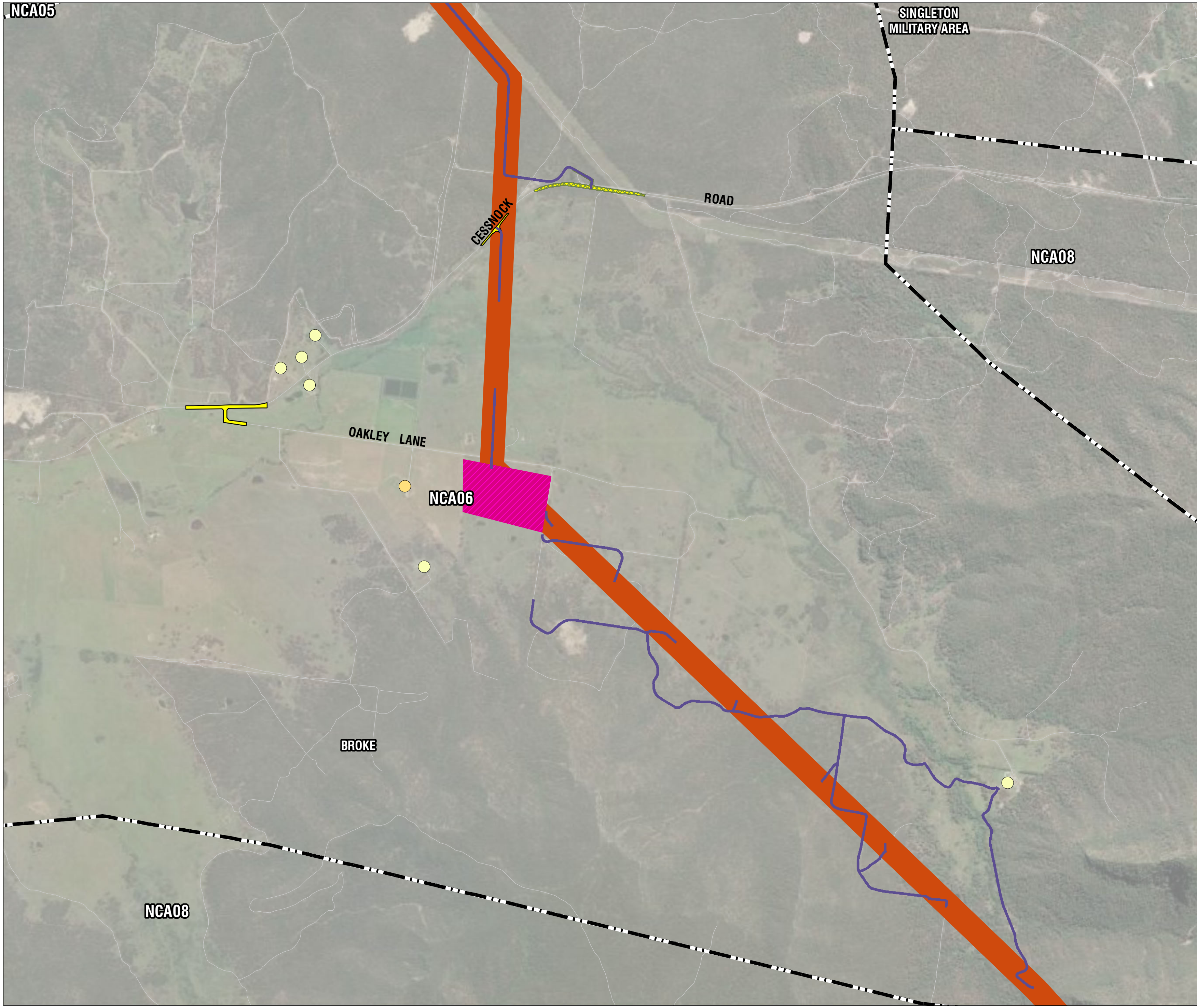
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

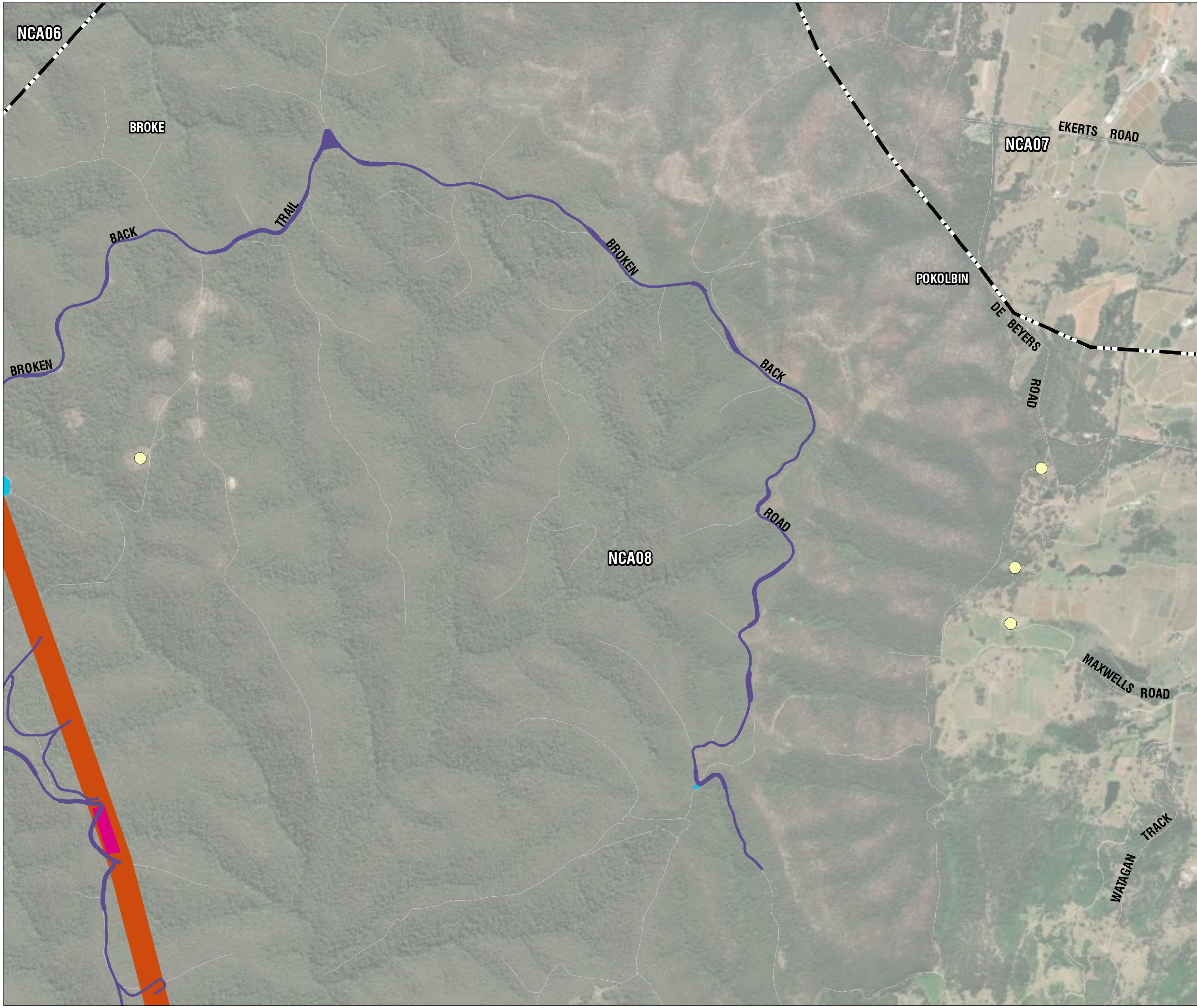
LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Laydown area
- Stringing station

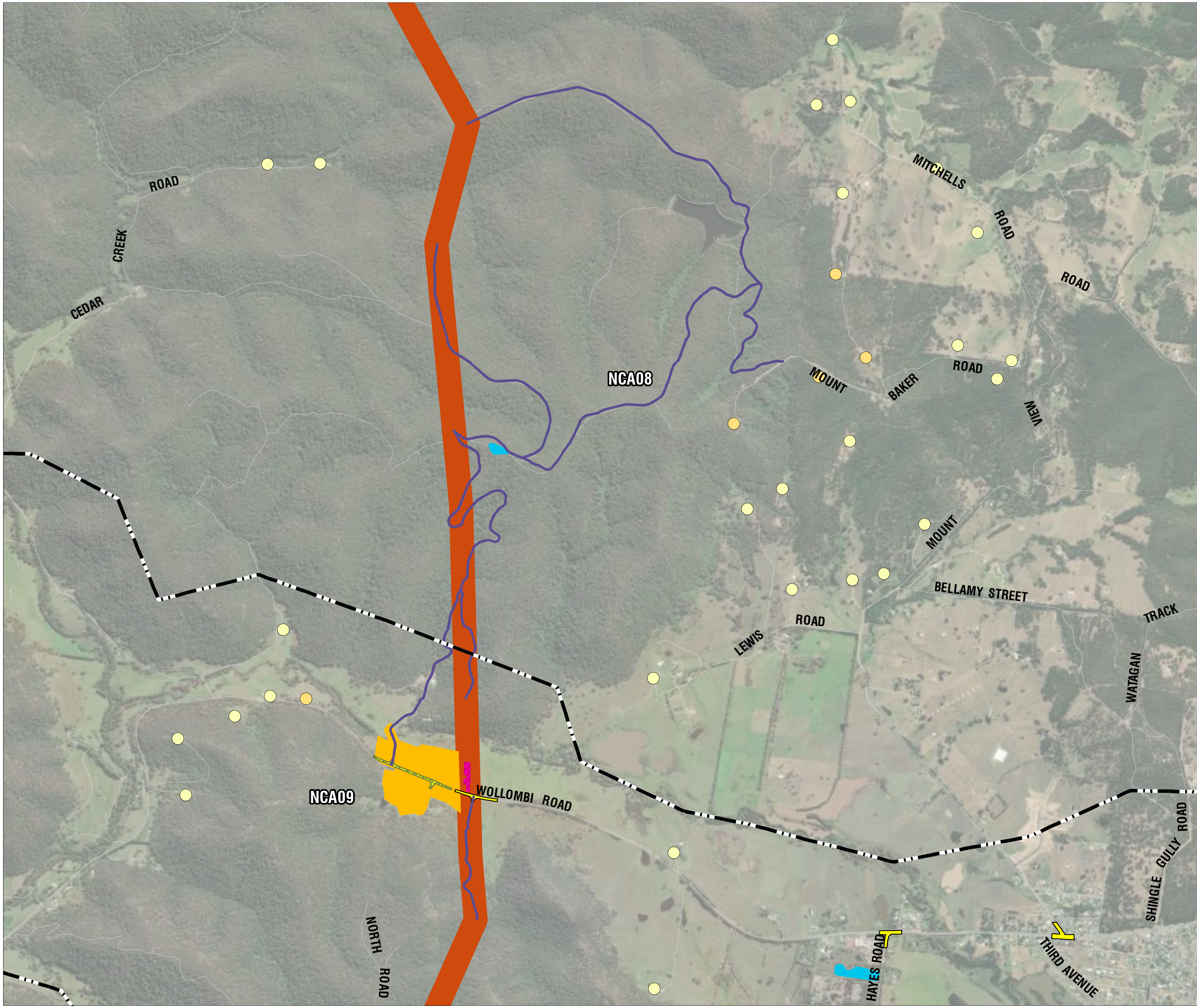
Noise Impacts

- 1 - 10 dB (Clearly Audible)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

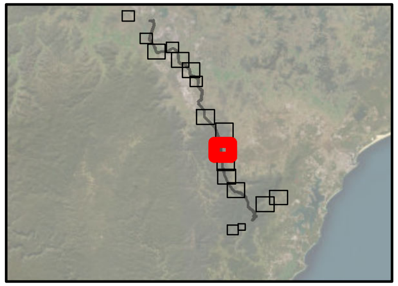
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Laydown area
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

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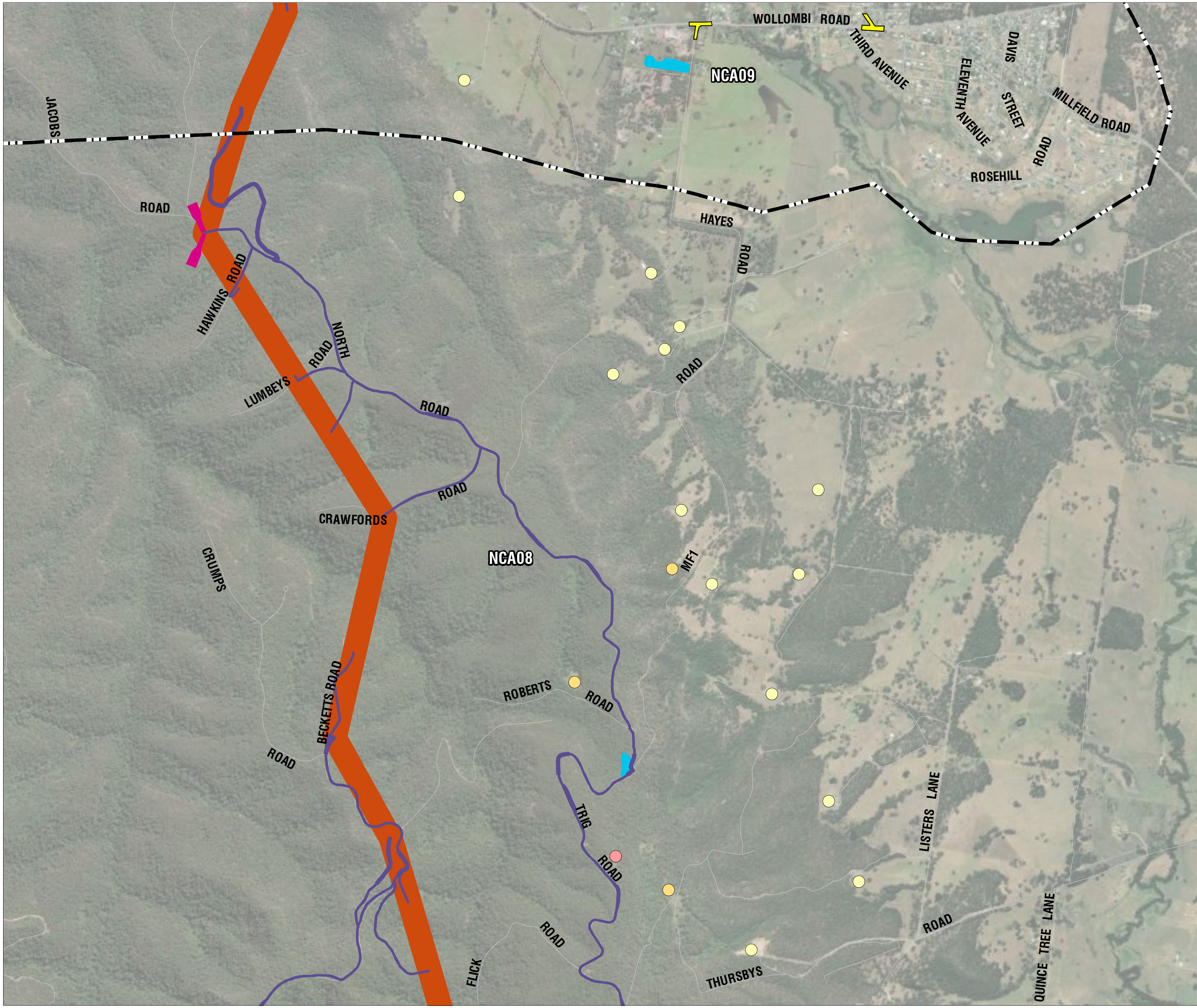


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

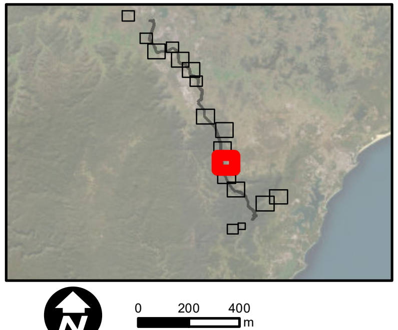
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Laydown area
- Intersection (typical)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)



Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

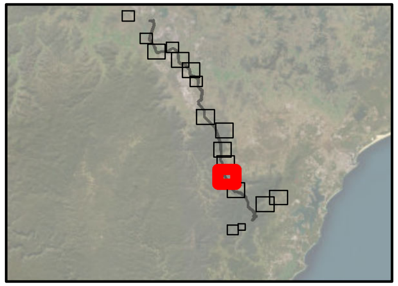
ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Laydown area
- Stringing station

Noise Impacts

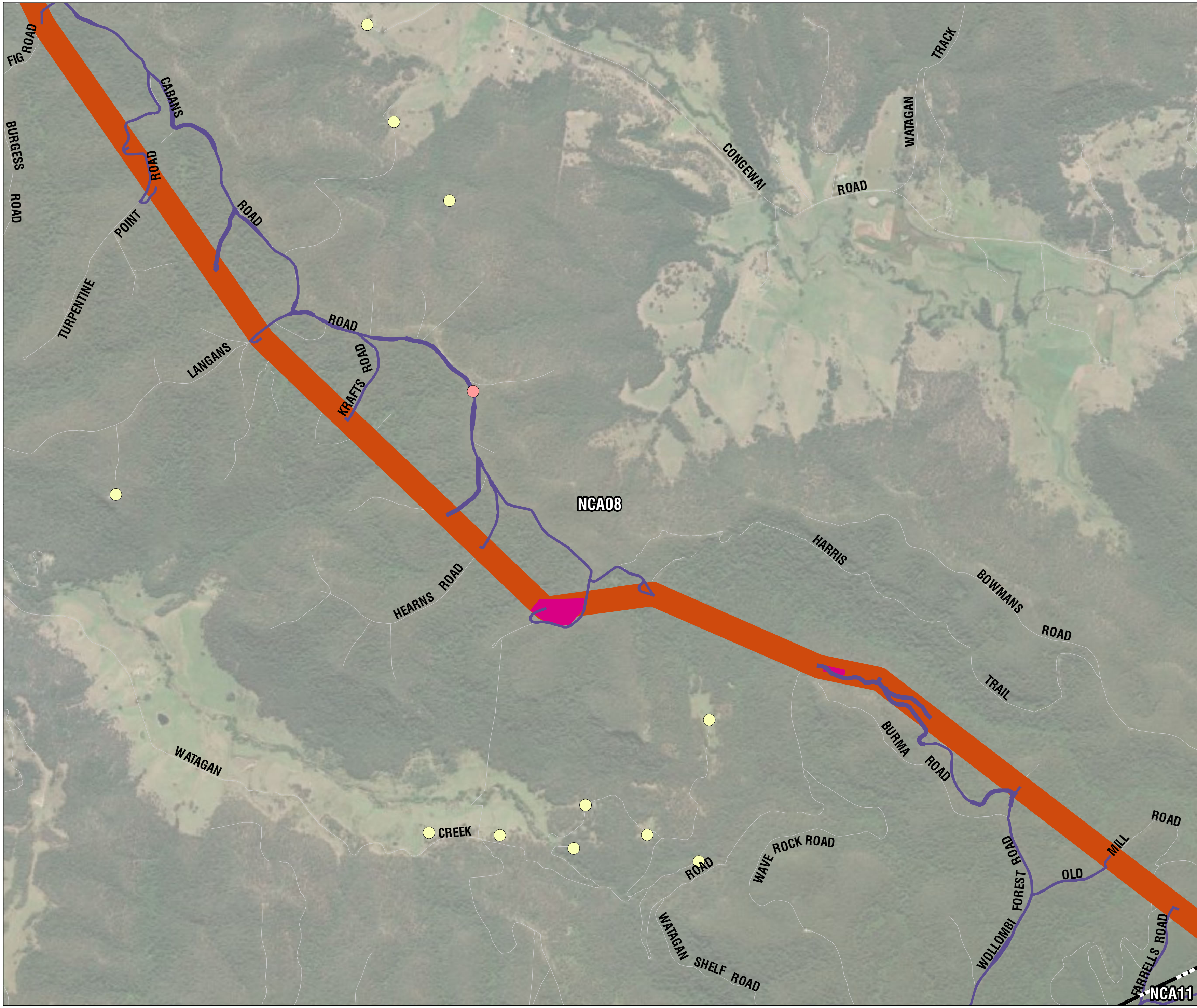
- 1 - 10 dB (Clearly Audible)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



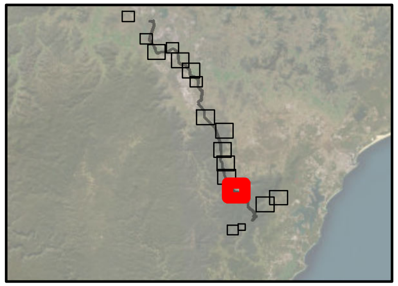
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access Tracks (major)
- Stringing station

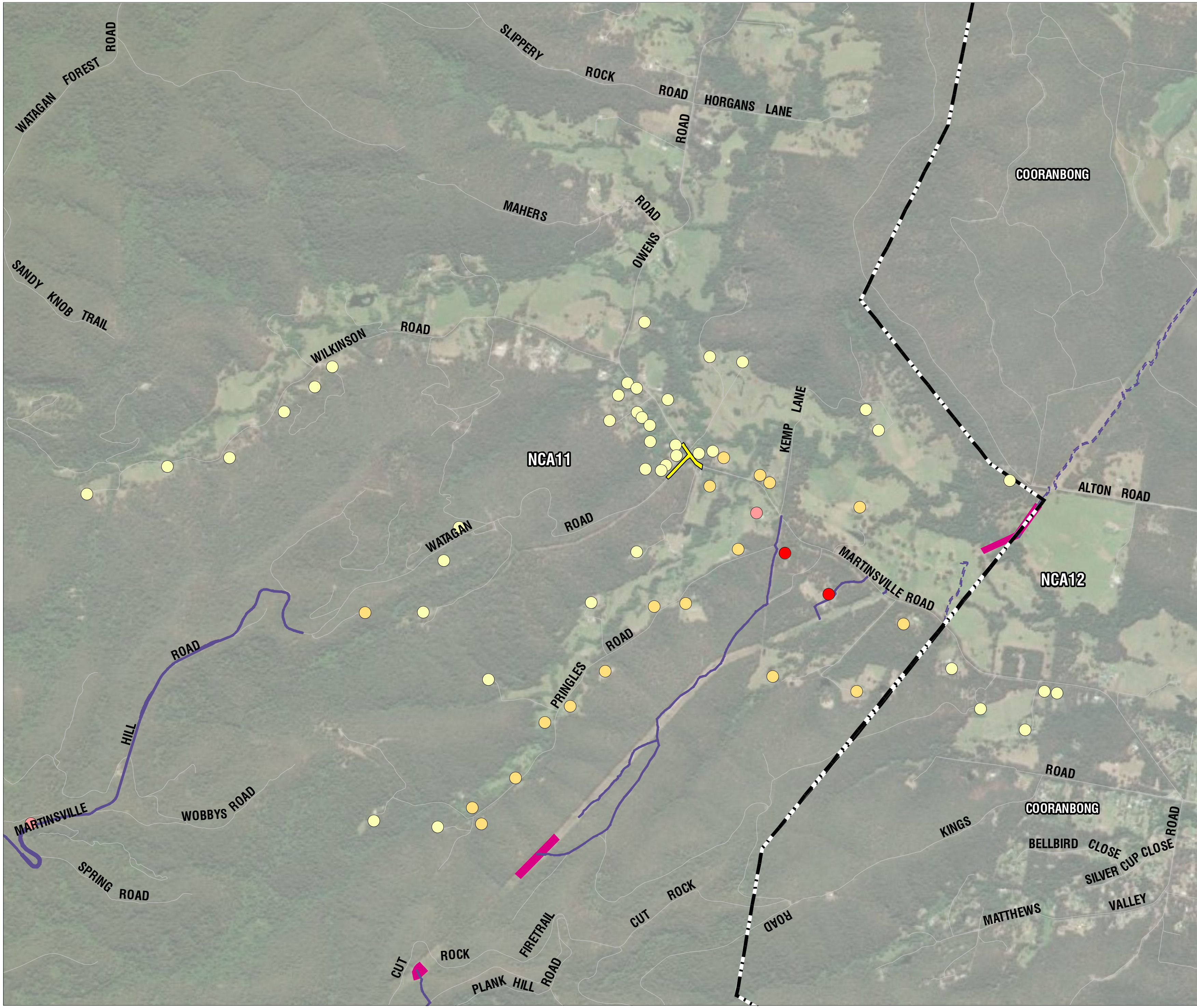
Noise Impacts
- 1 - 10 dB (Clearly Audible)
- > 20 dB (Highly Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

LEGEND

- Study area
- NCA boundary
- Access Tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station

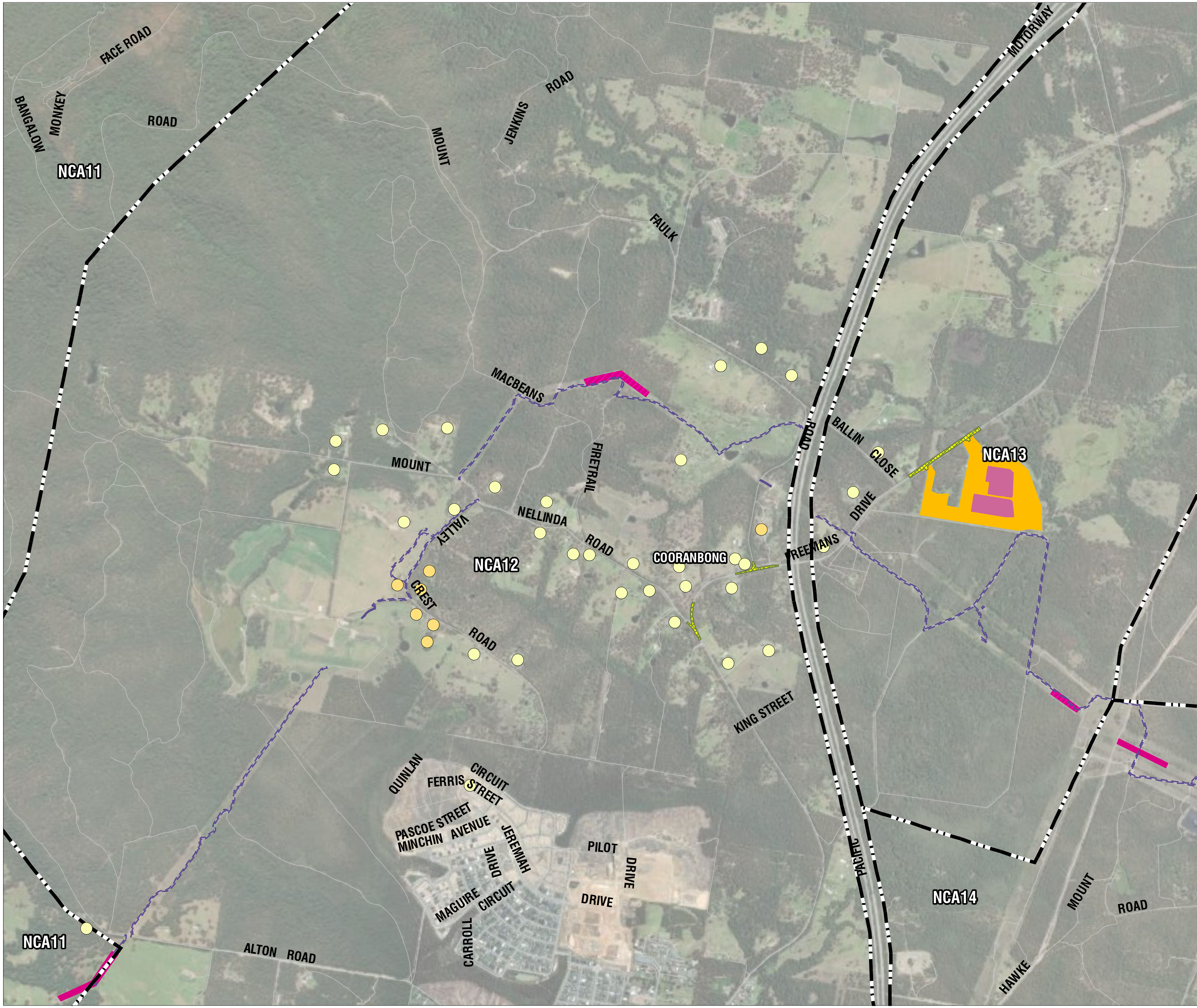
Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)

0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



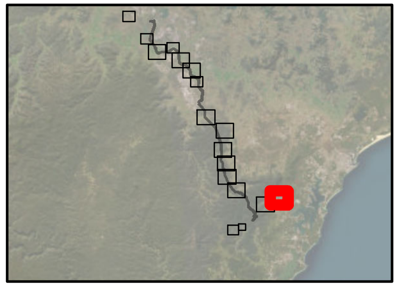
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

LEGEND
- Study area
- NCA boundary
- Access Tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

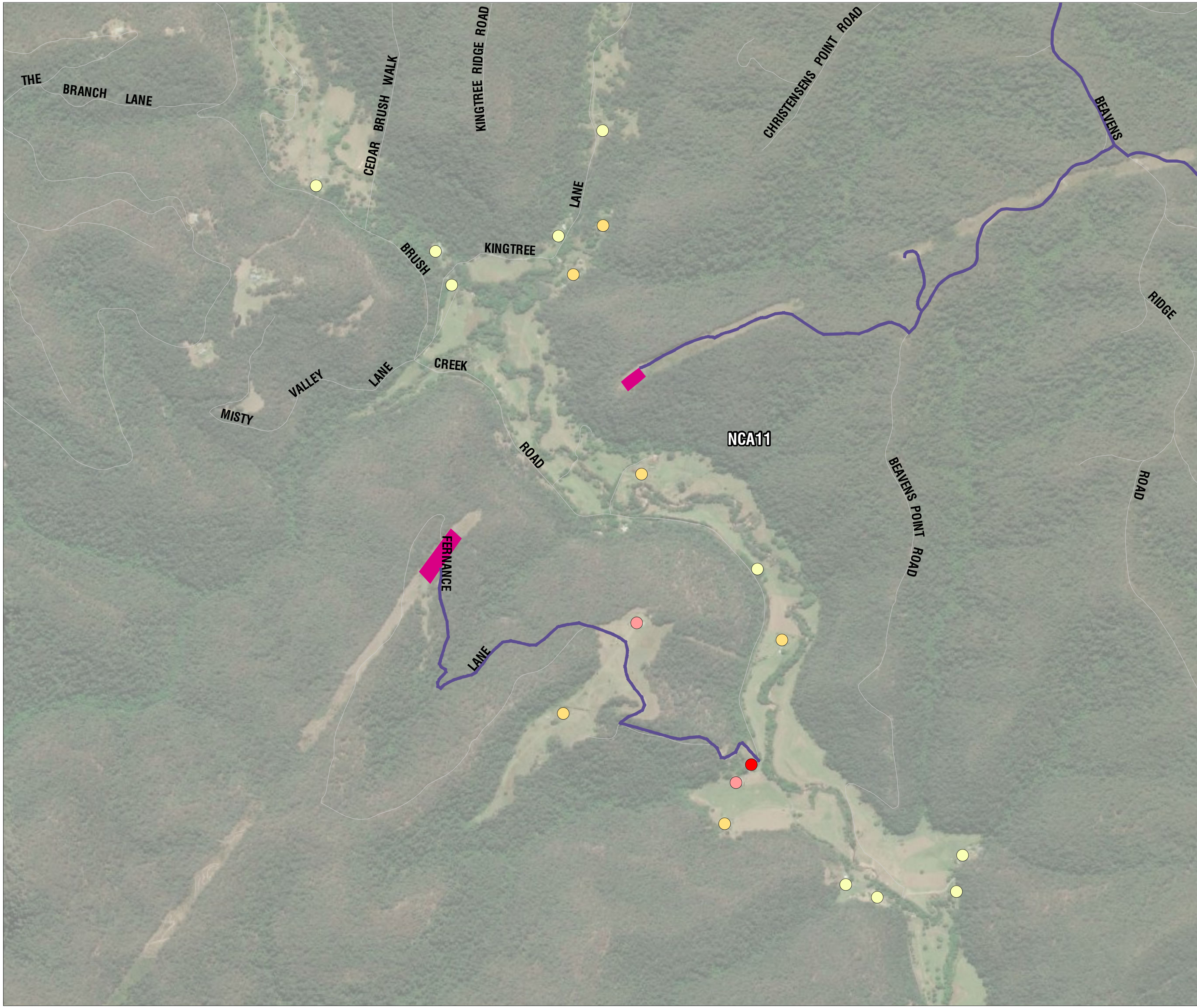
Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

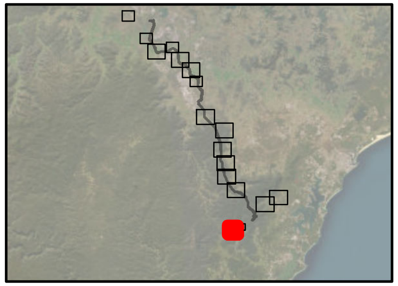
ATTACHMENT G.6

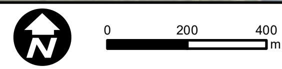
LEGEND

- Study area
- NCA boundary
- Access Tracks (major)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)





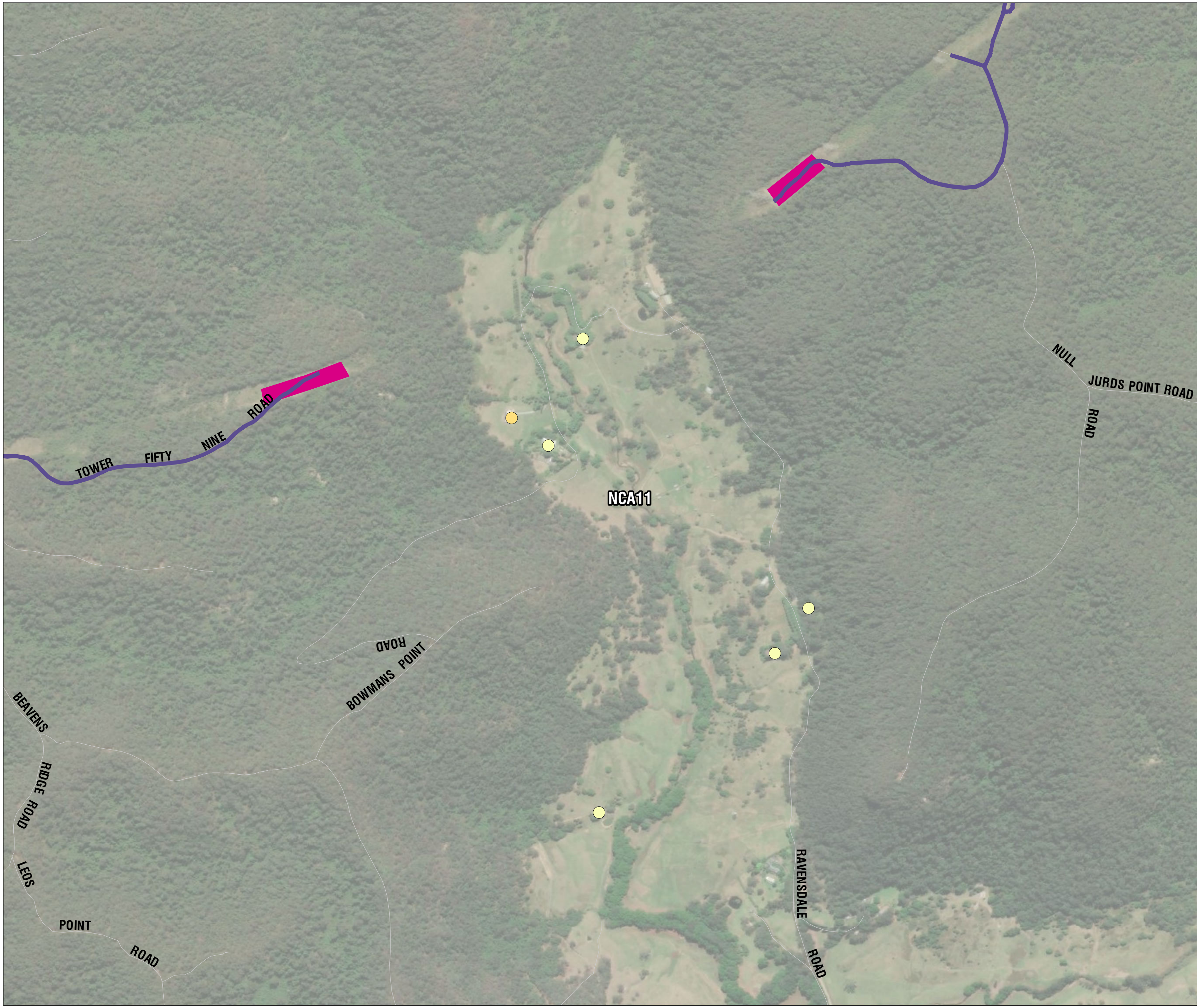
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:19,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, ACCESS TRACKS (MAJOR), CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.6

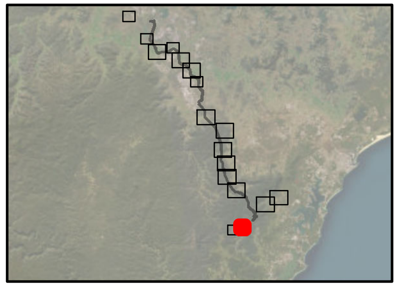


LEGEND

- Study area
- NCA boundary
- Access Tracks (major)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 200 400 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:13,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

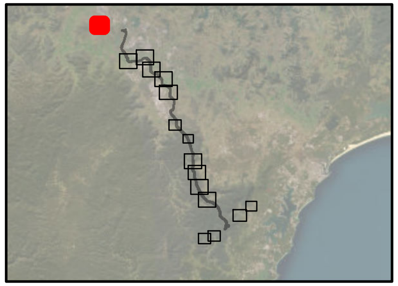
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND
- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Noise Impacts
- 11 - 20 dB (Moderately Intrusive)



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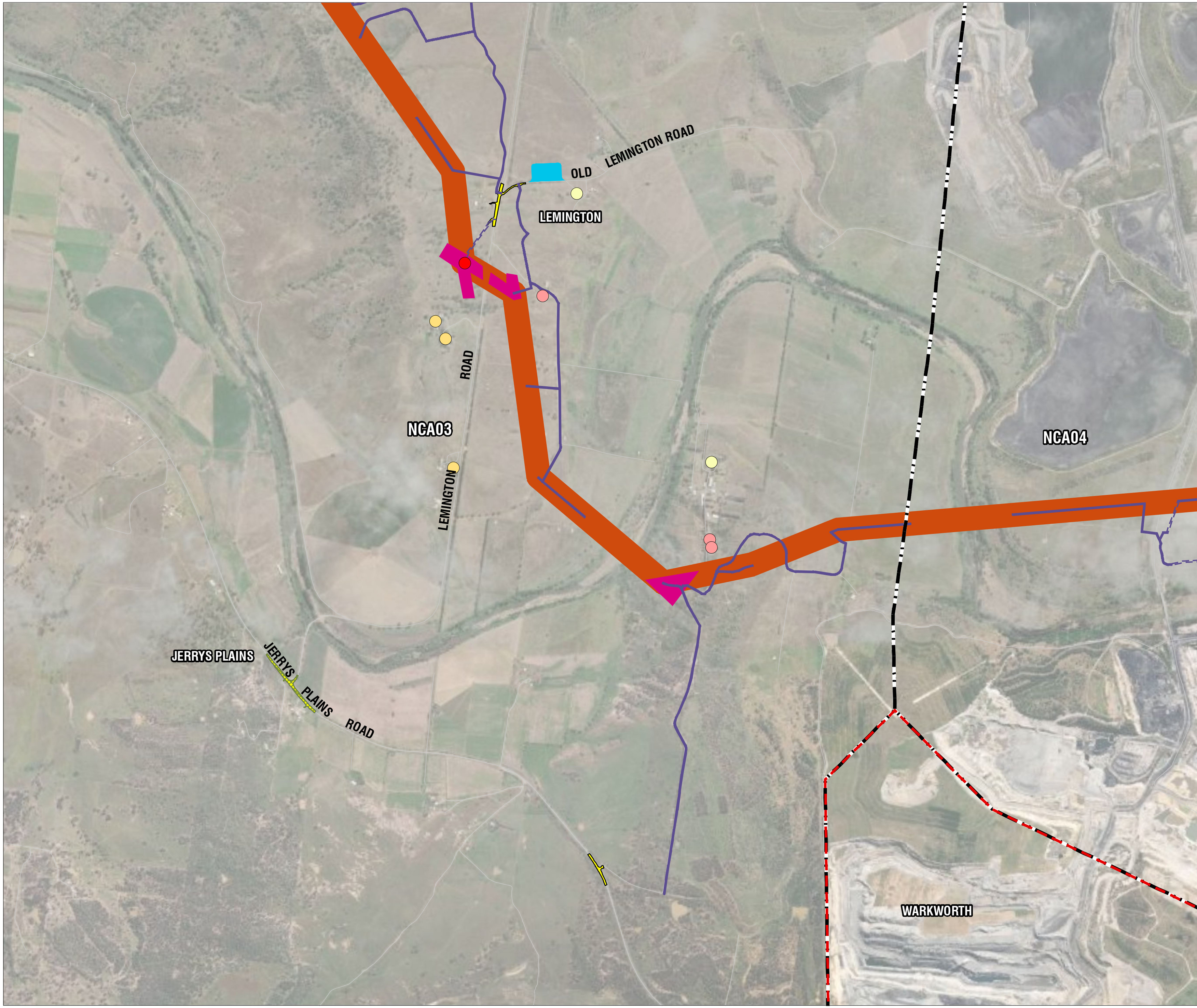
Scale:	1:17,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

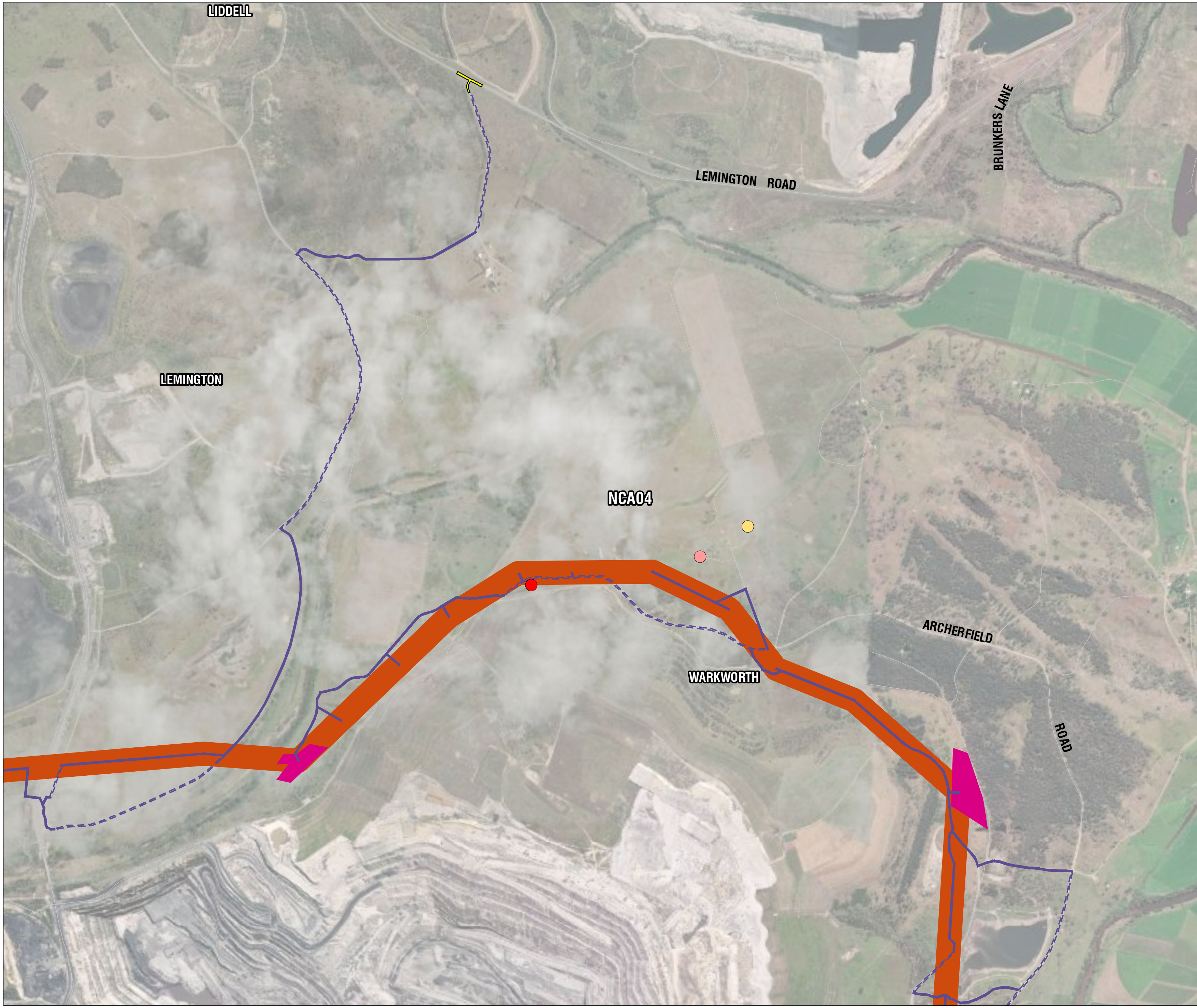
LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Intersection (intensive)
- Stringing station

Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



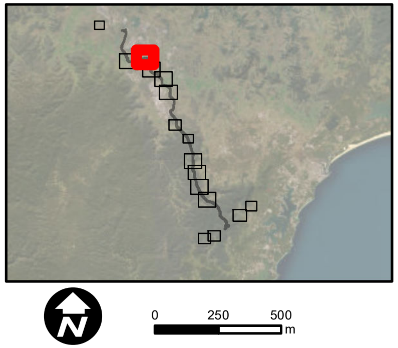
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
HTP CORRIDOR,
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station

Noise Impacts
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)
- > 75 dBA (Highly Noise Affected)



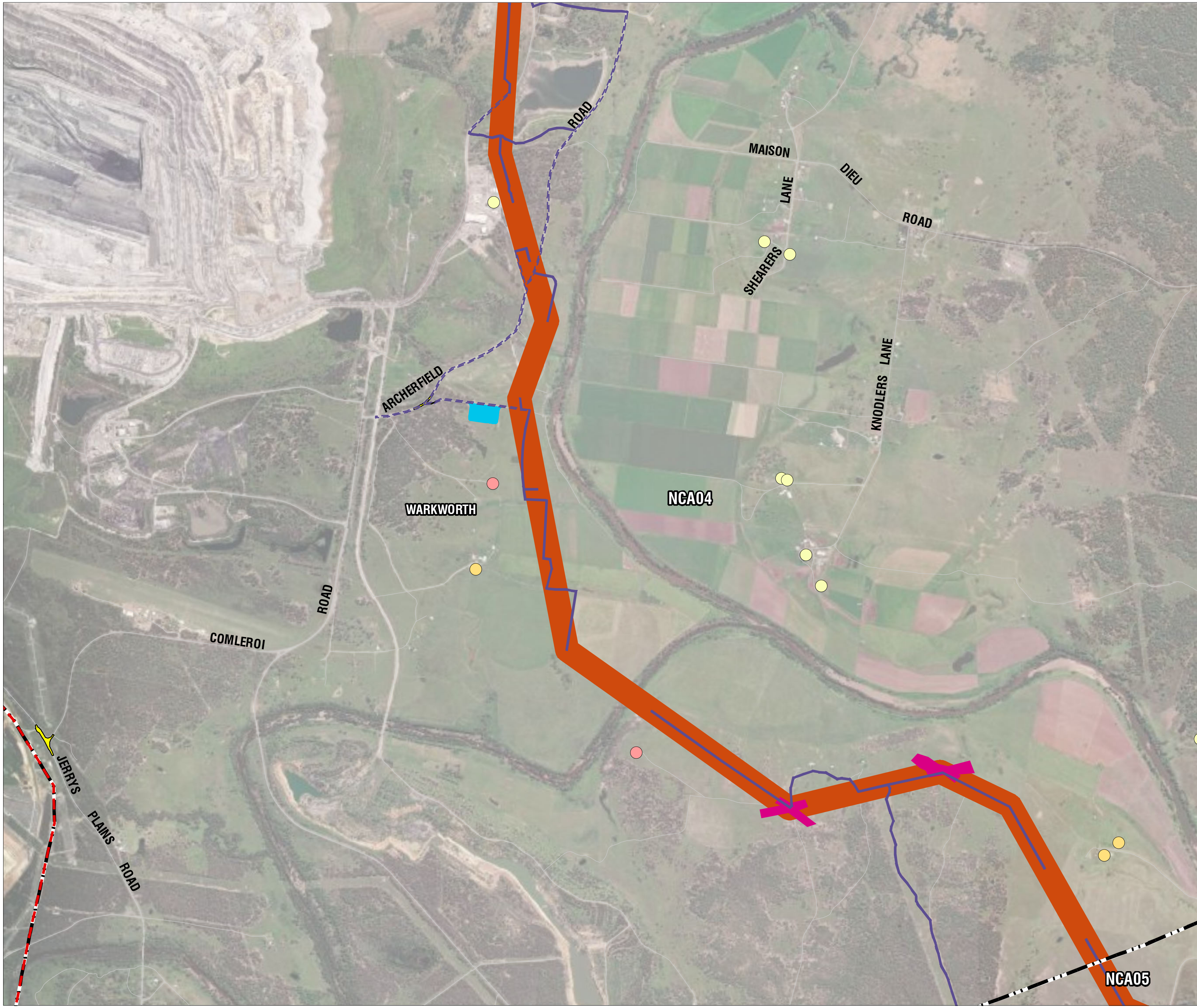
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

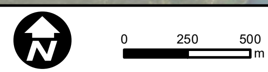
WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7



LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

Noise Impacts
- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)
- > 20 dB (Highly Intrusive)



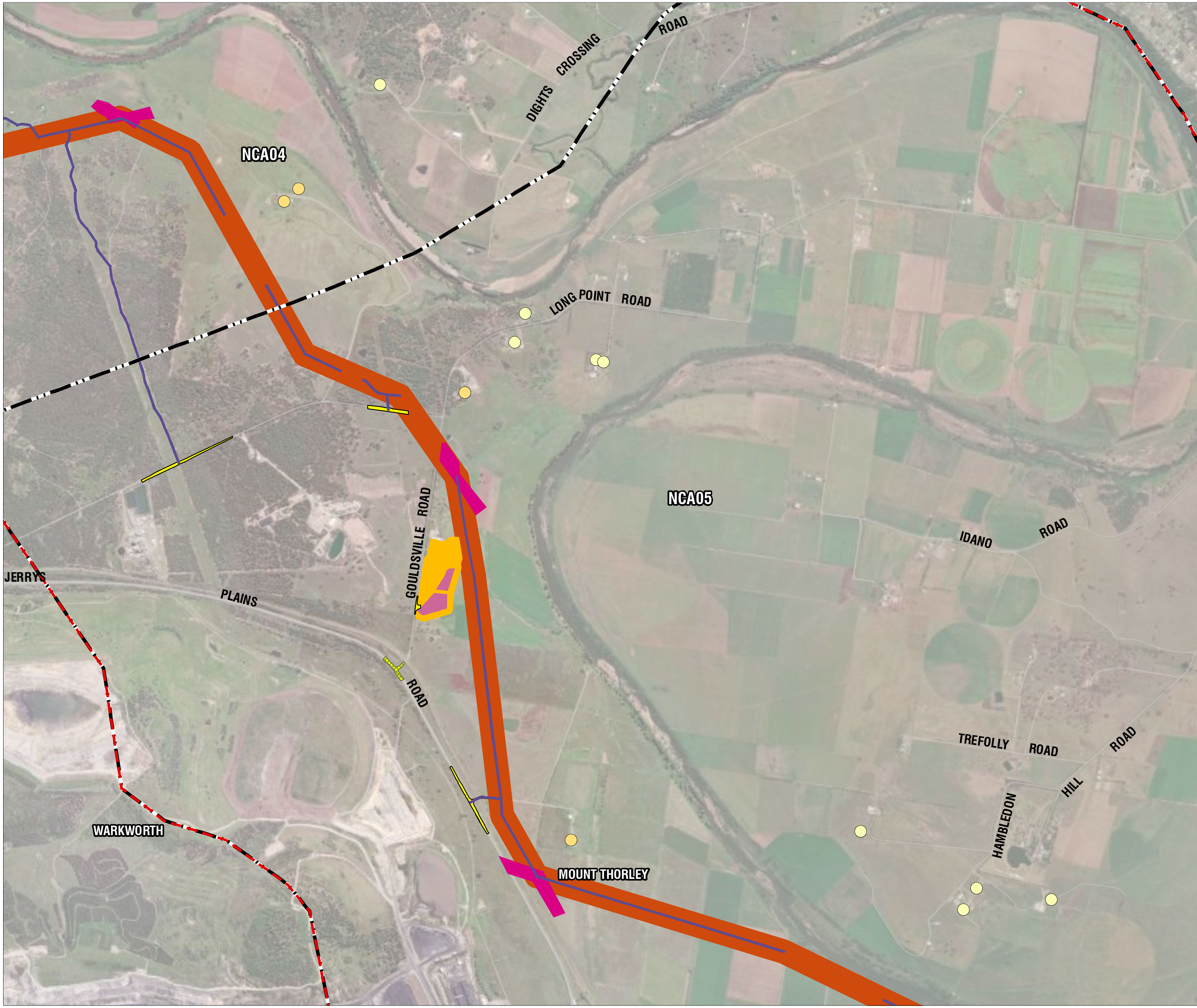
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

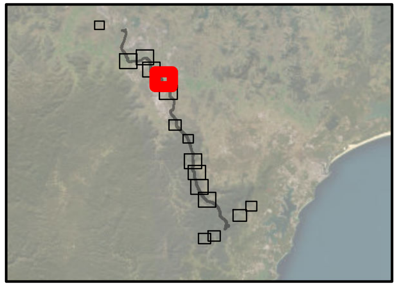


LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Accommodation site

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
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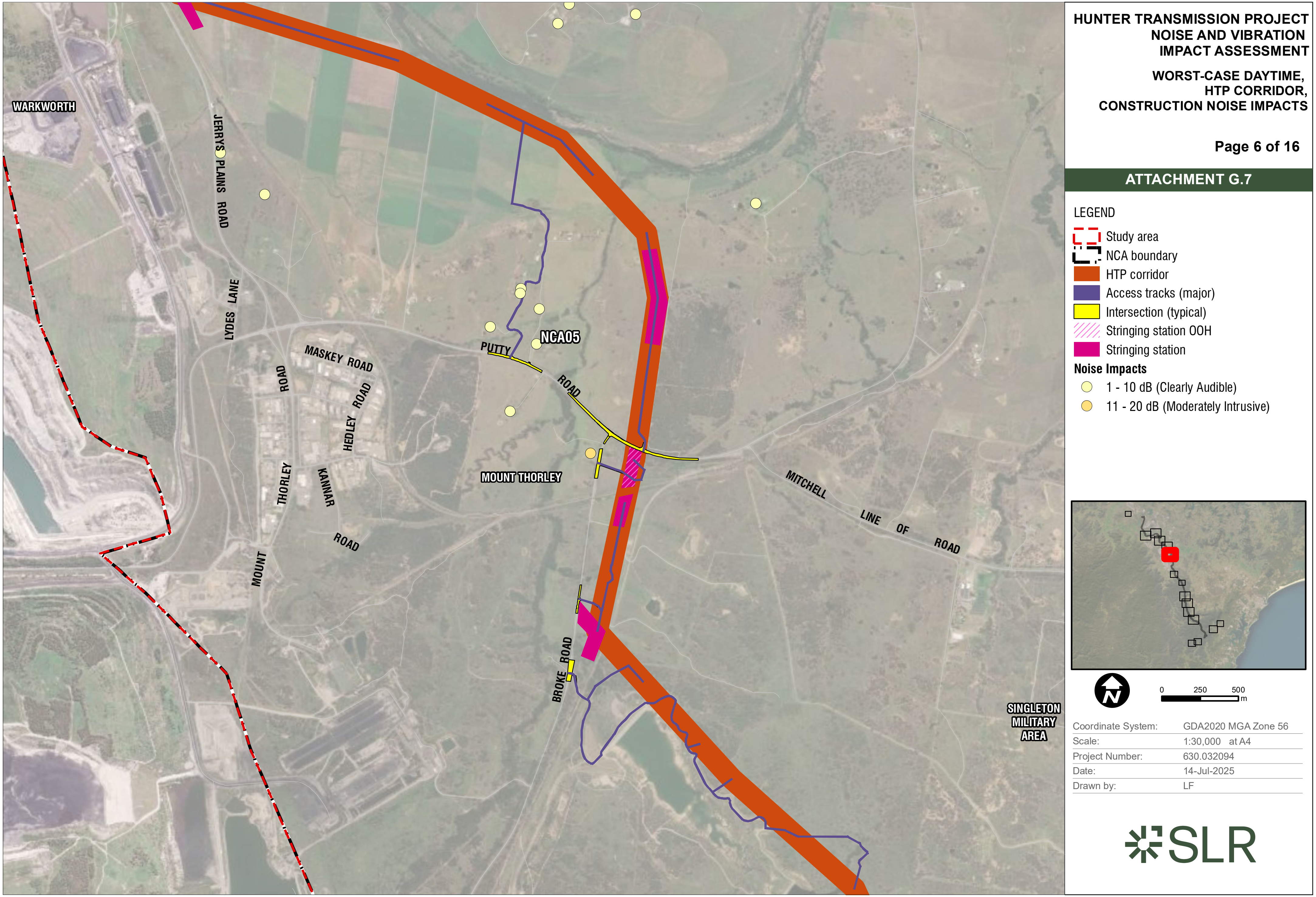
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7



Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
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Drawn by:	LF

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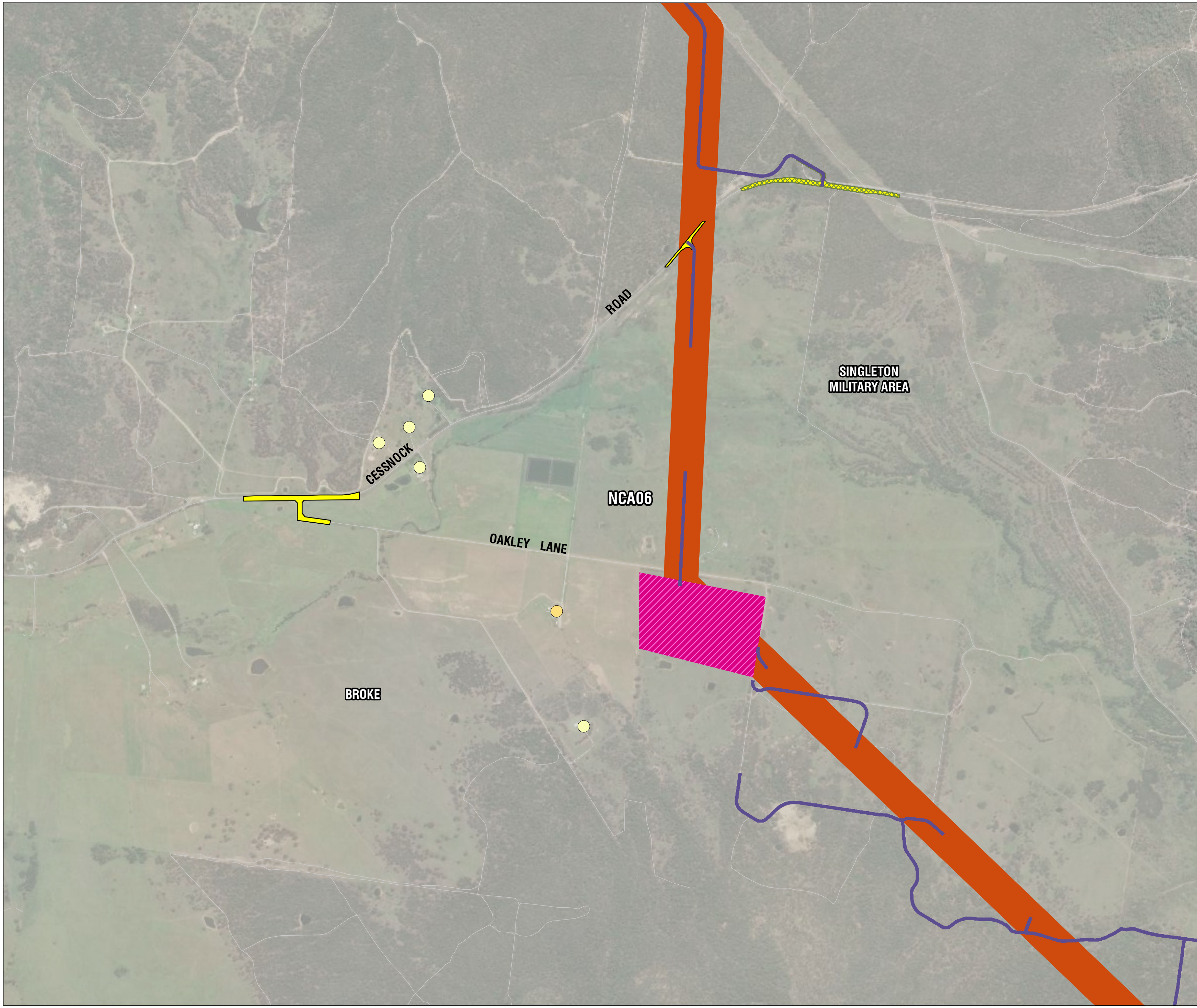


HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE DAYTIME,
HTP CORRIDOR,
CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND
Study area
NCA boundary
HTP corridor
Access tracks (major)
Intersection (typical)
Intersection (intensive)
Stringing station OOH
Stringing station
Noise Impacts
1 - 10 dB (Clearly Audible)
11 - 20 dB (Moderately Intrusive)

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

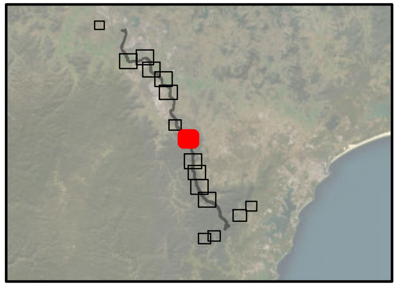
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

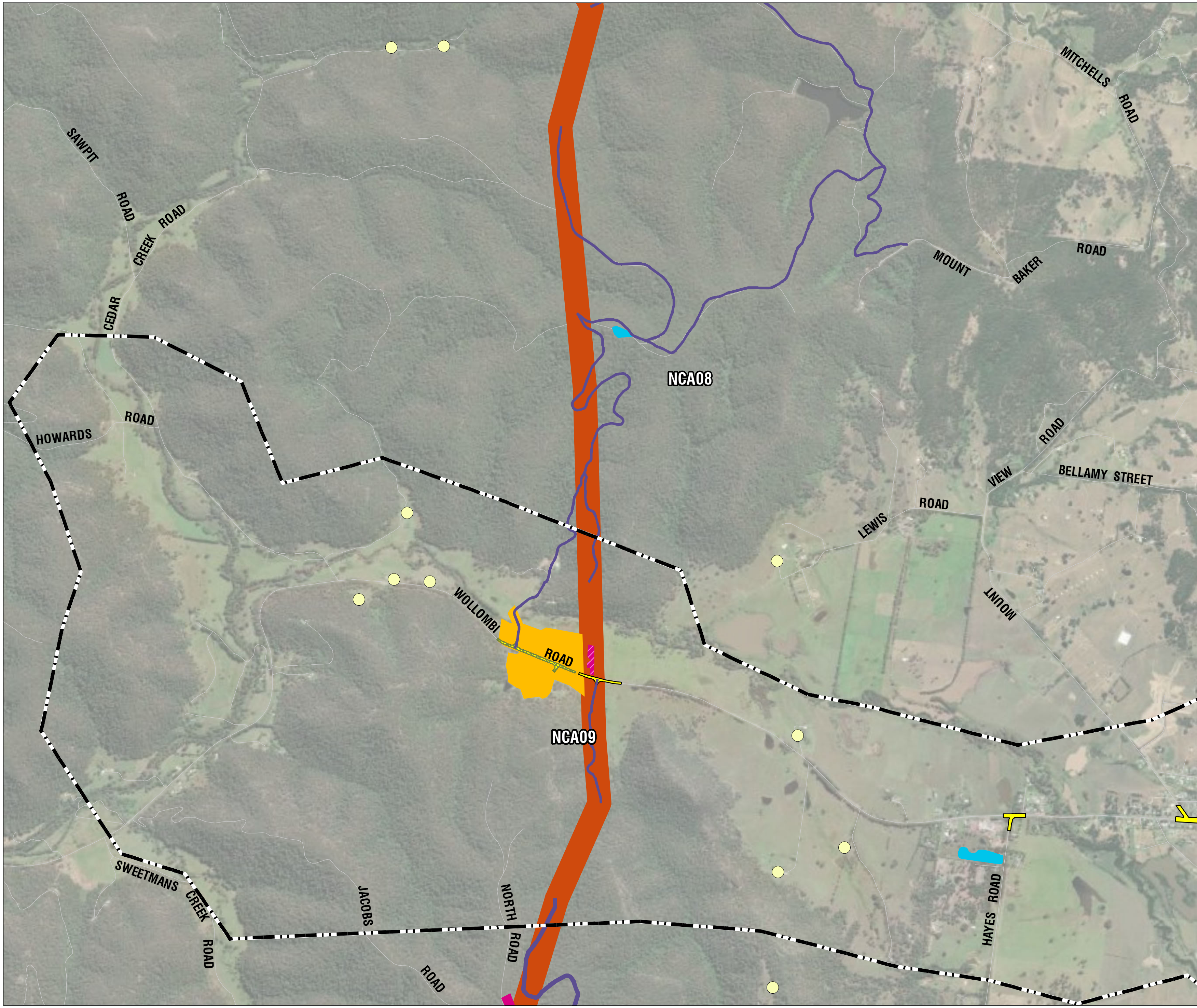
LEGEND
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area

Noise Impacts
- 1 - 10 dB (Clearly Audible)



Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND

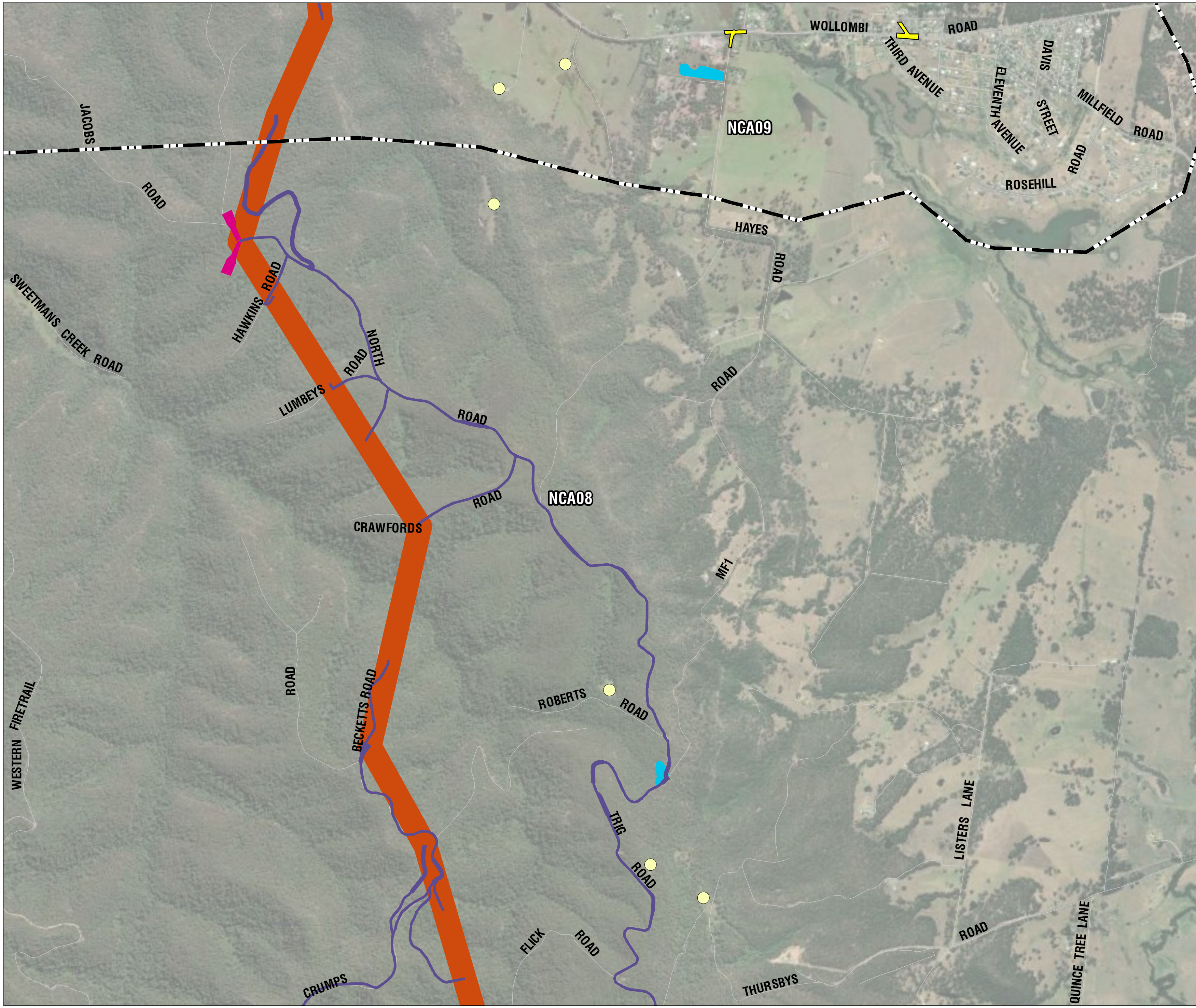
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station OOH
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

Page 10 of 16

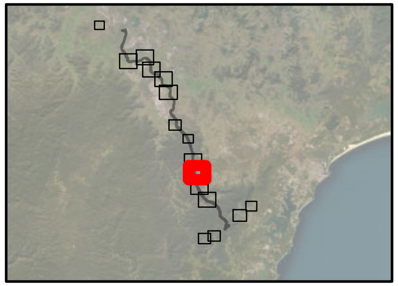
ATTACHMENT G.7

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Intersection (typical)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

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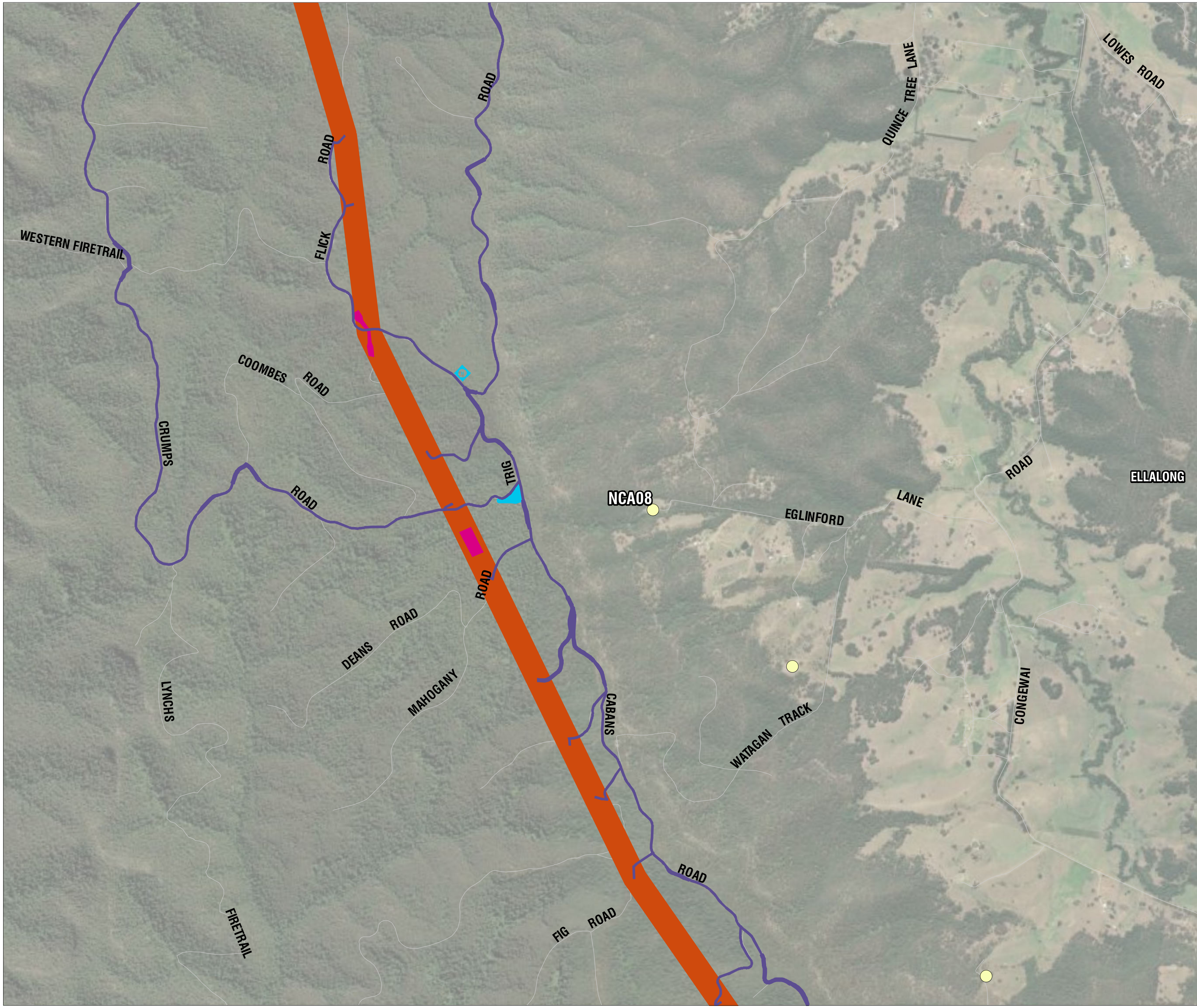


HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

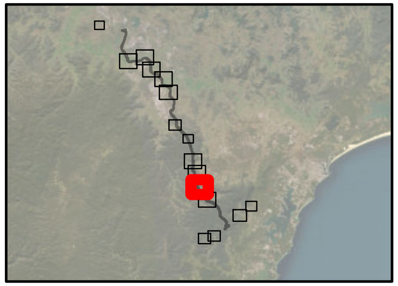
ATTACHMENT G.7

LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Laydown area
- Stringing station

Noise Impacts

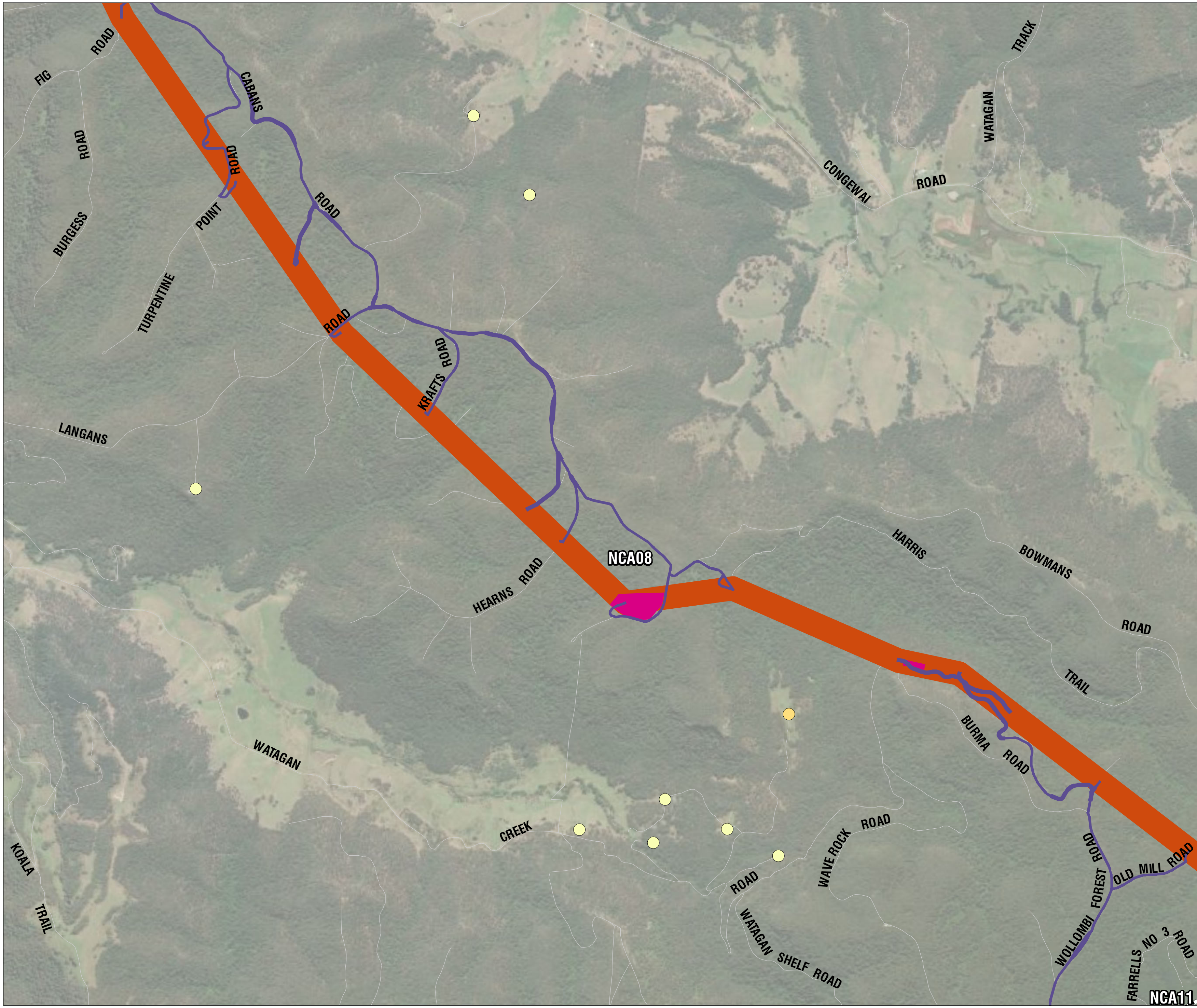
- 1 - 10 dB (Clearly Audible)



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

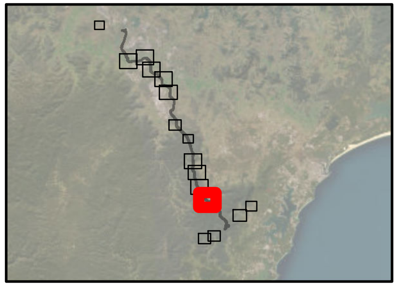
ATTACHMENT G.7

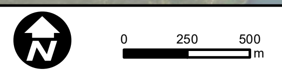
LEGEND

- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)





Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR

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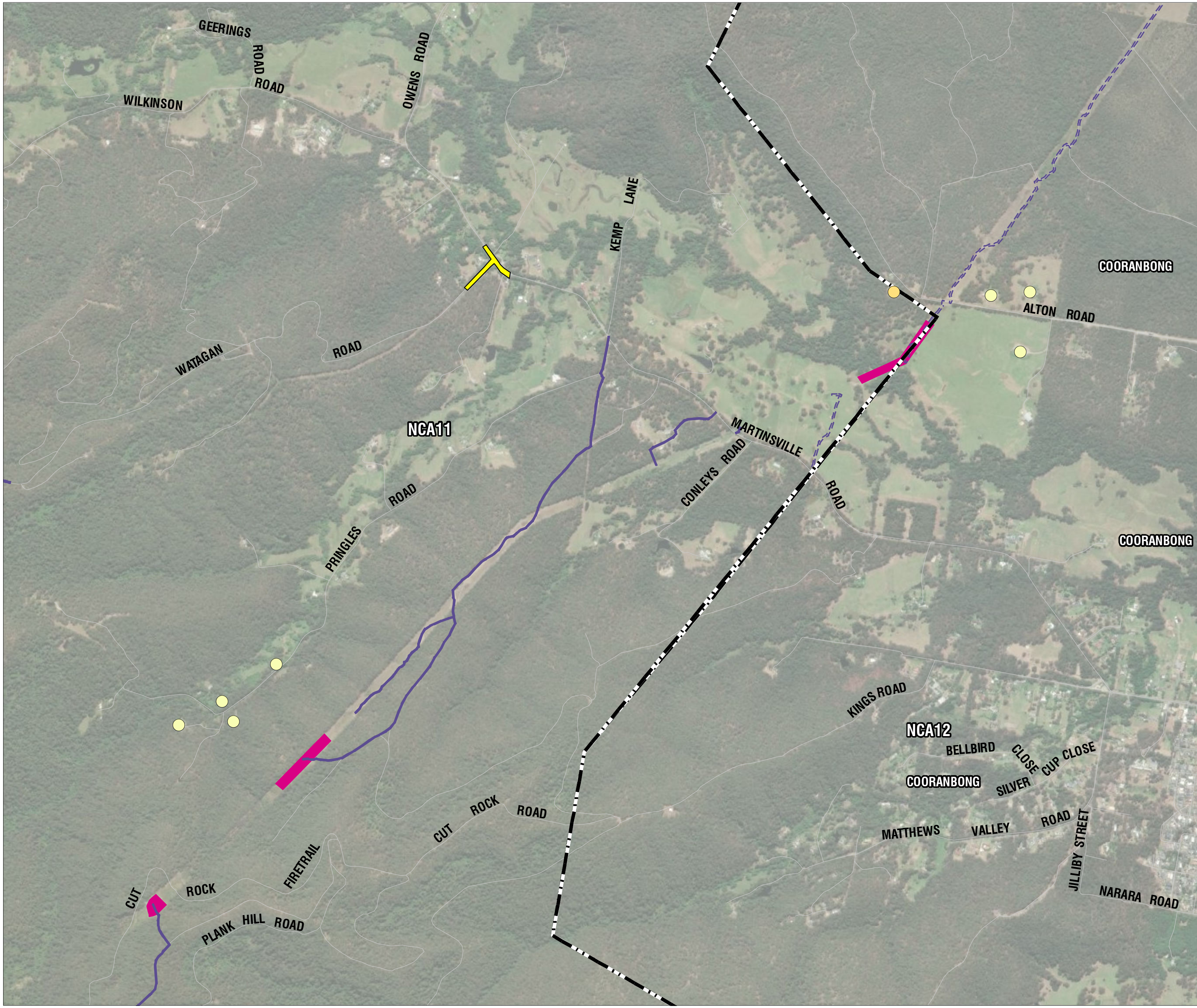


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND

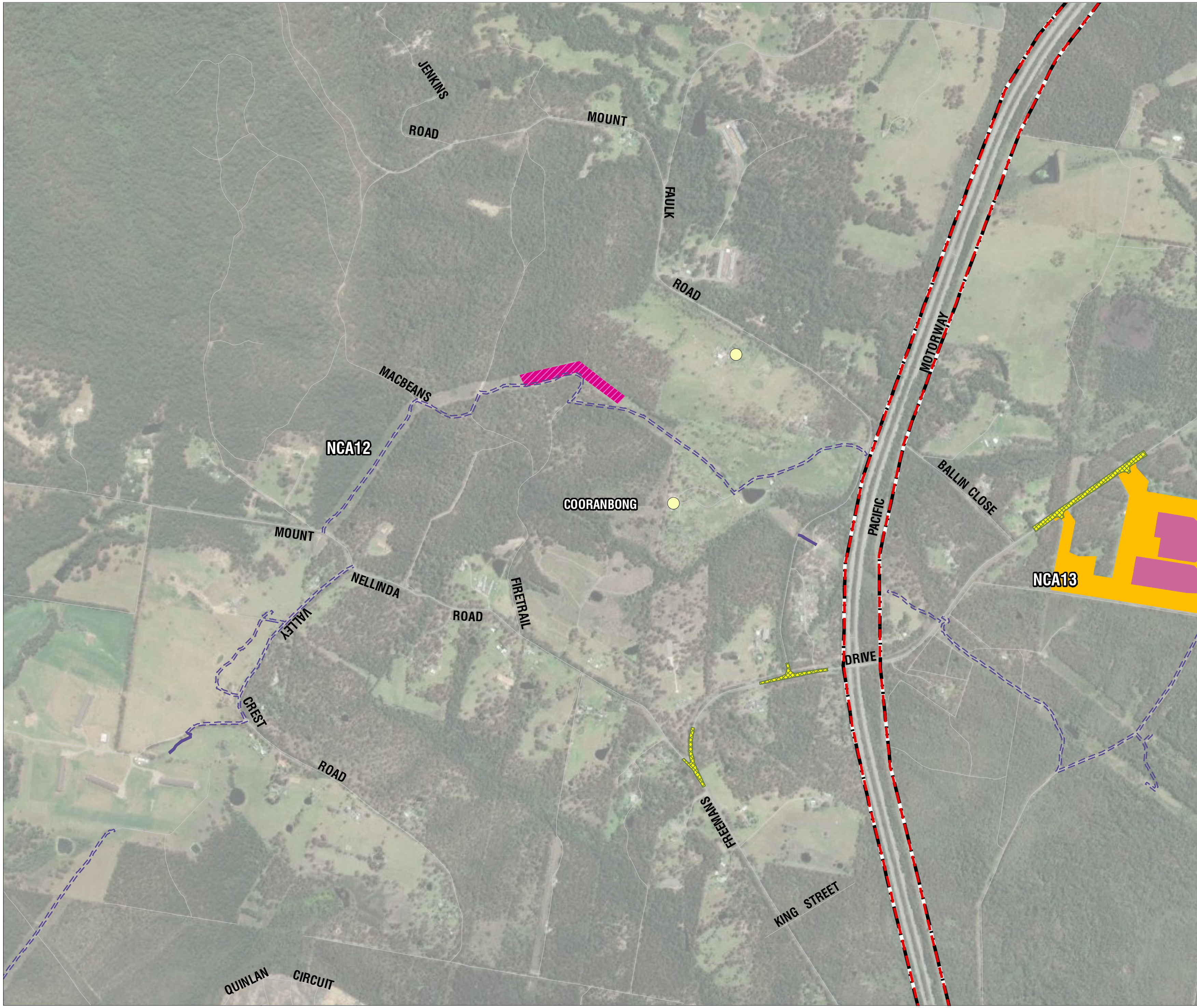
- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station

Noise Impacts

- 1 - 10 dB (Clearly Audible)
- 11 - 20 dB (Moderately Intrusive)

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



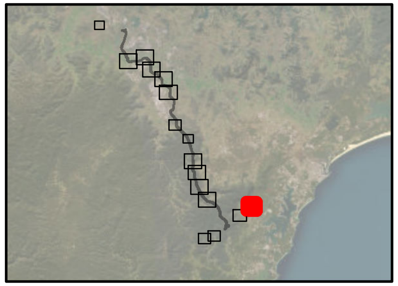
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND
- Study area
- NCA boundary
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station OOH
- Stringing station
- Accommodation site

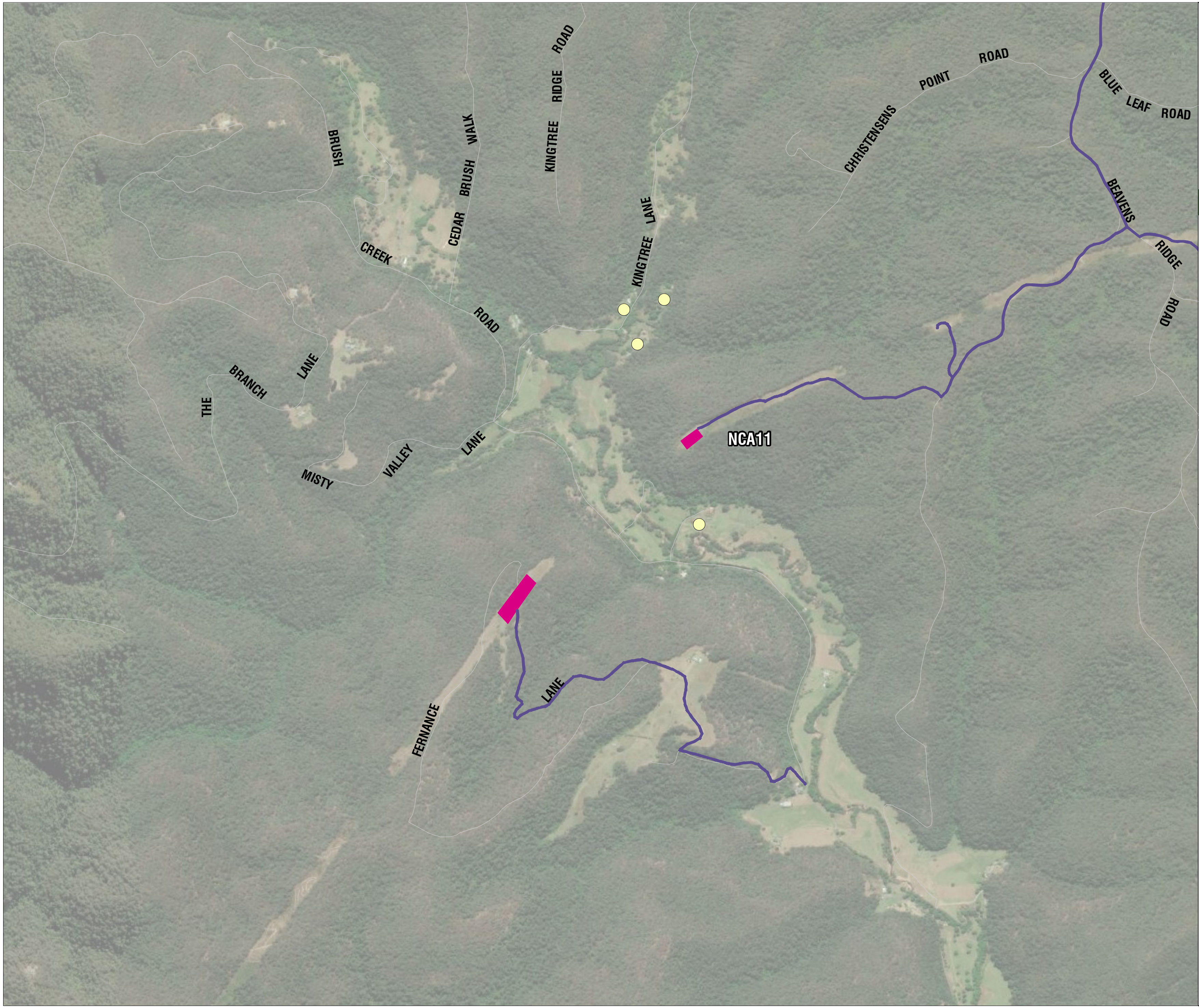
Noise Impacts
- 1 - 10 dB (Clearly Audible)



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:19,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

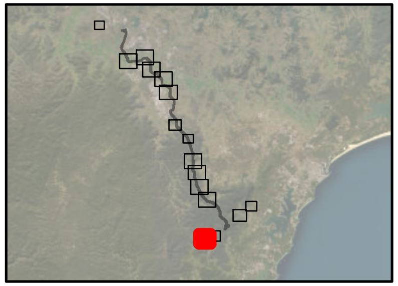
ATTACHMENT G.7

LEGEND

- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Noise Impacts

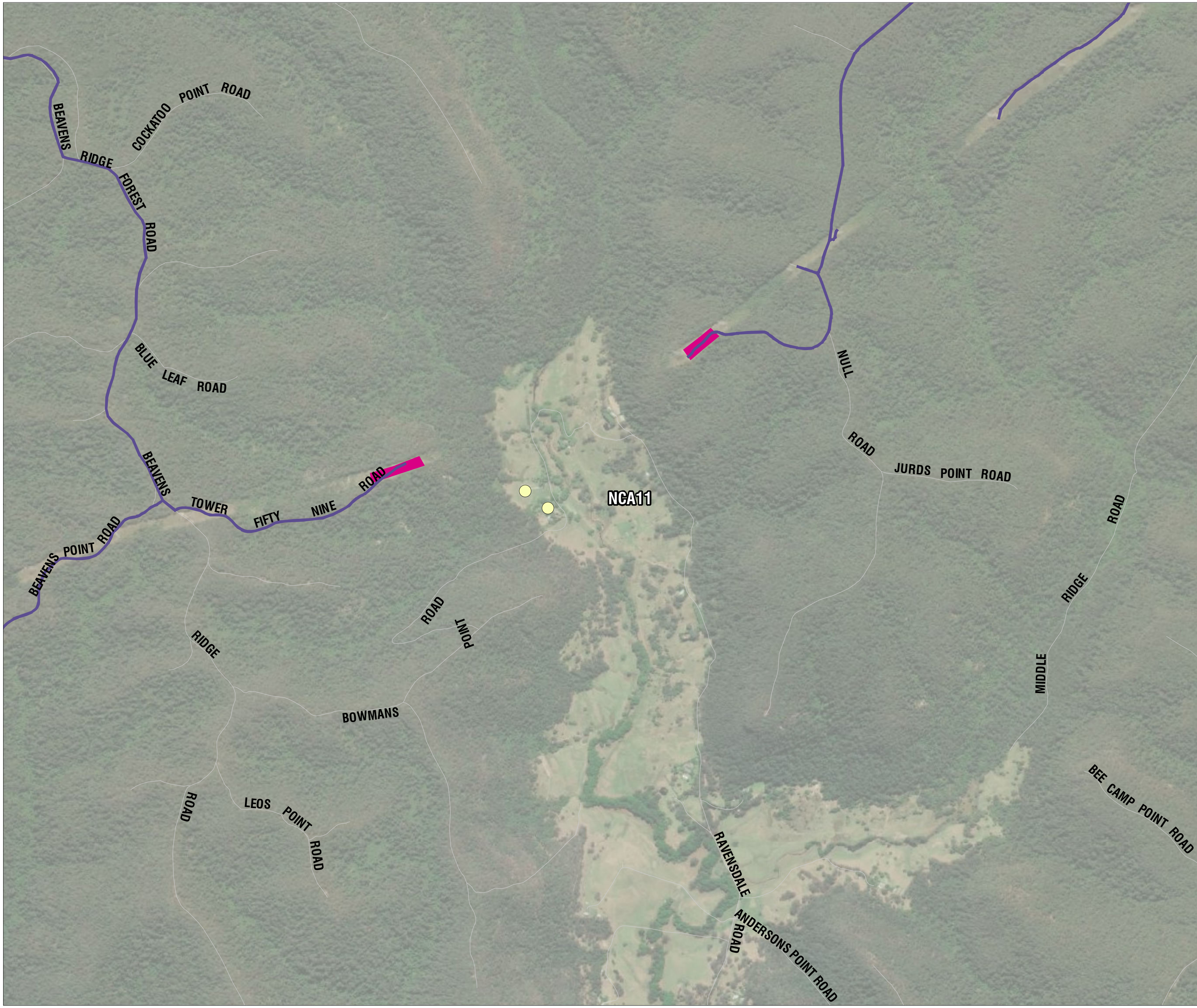
- 1 - 10 dB (Clearly Audible)



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME, HTP CORRIDOR, CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.7

LEGEND
- Study area
- NCA boundary
- Access tracks (major)
- Stringing station

Noise Impacts
- 1 - 10 dB (Clearly Audible)

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	14-Jul-2025
Drawn by:	LF

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Attachment H Construction vibration impacts

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

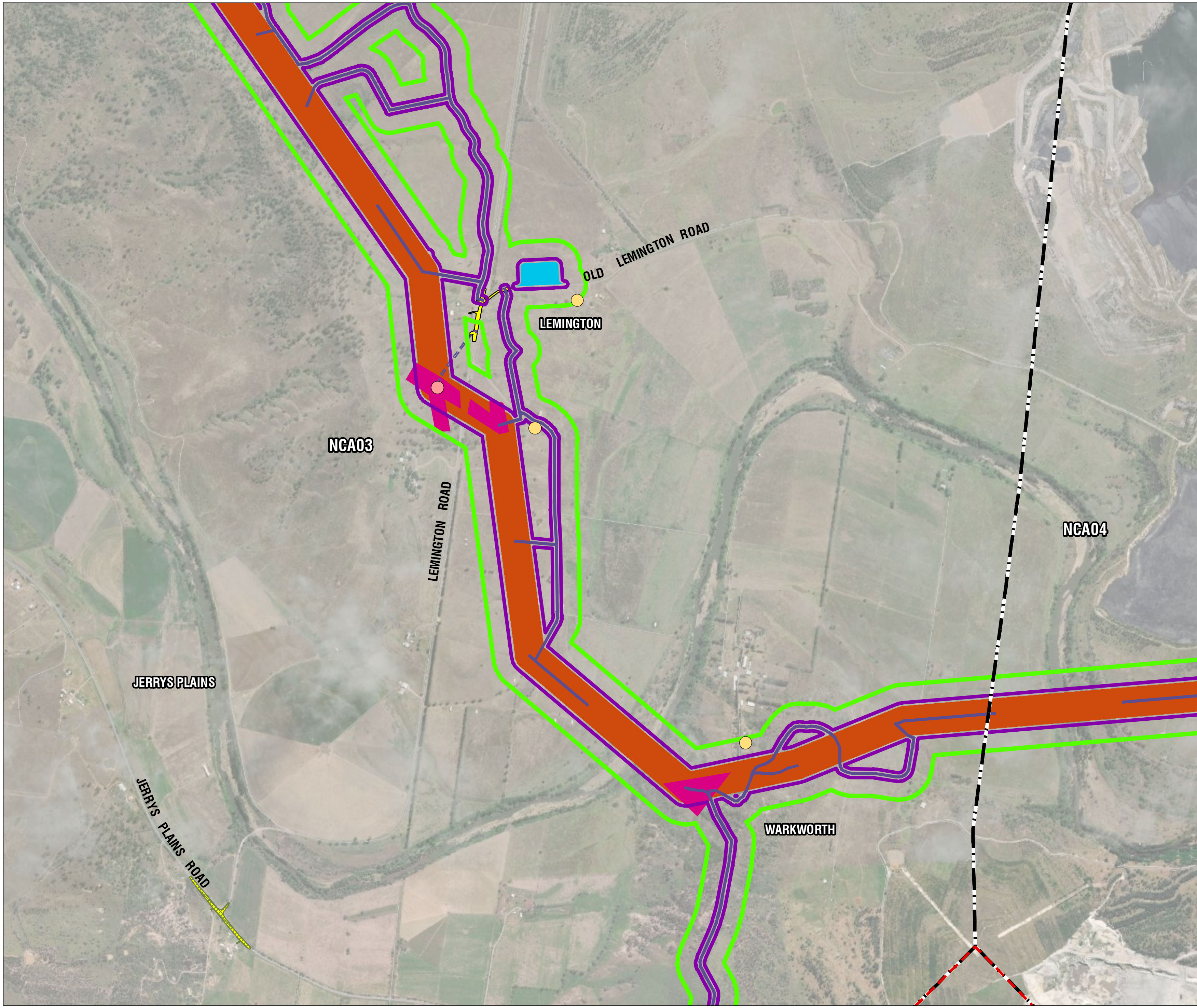
SLR Project No.: 630.032094.00001

14 July 2025

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

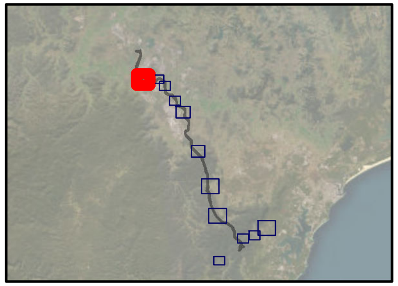
WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1



LEGEND
- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Intersection (intensive)
- Stringing station

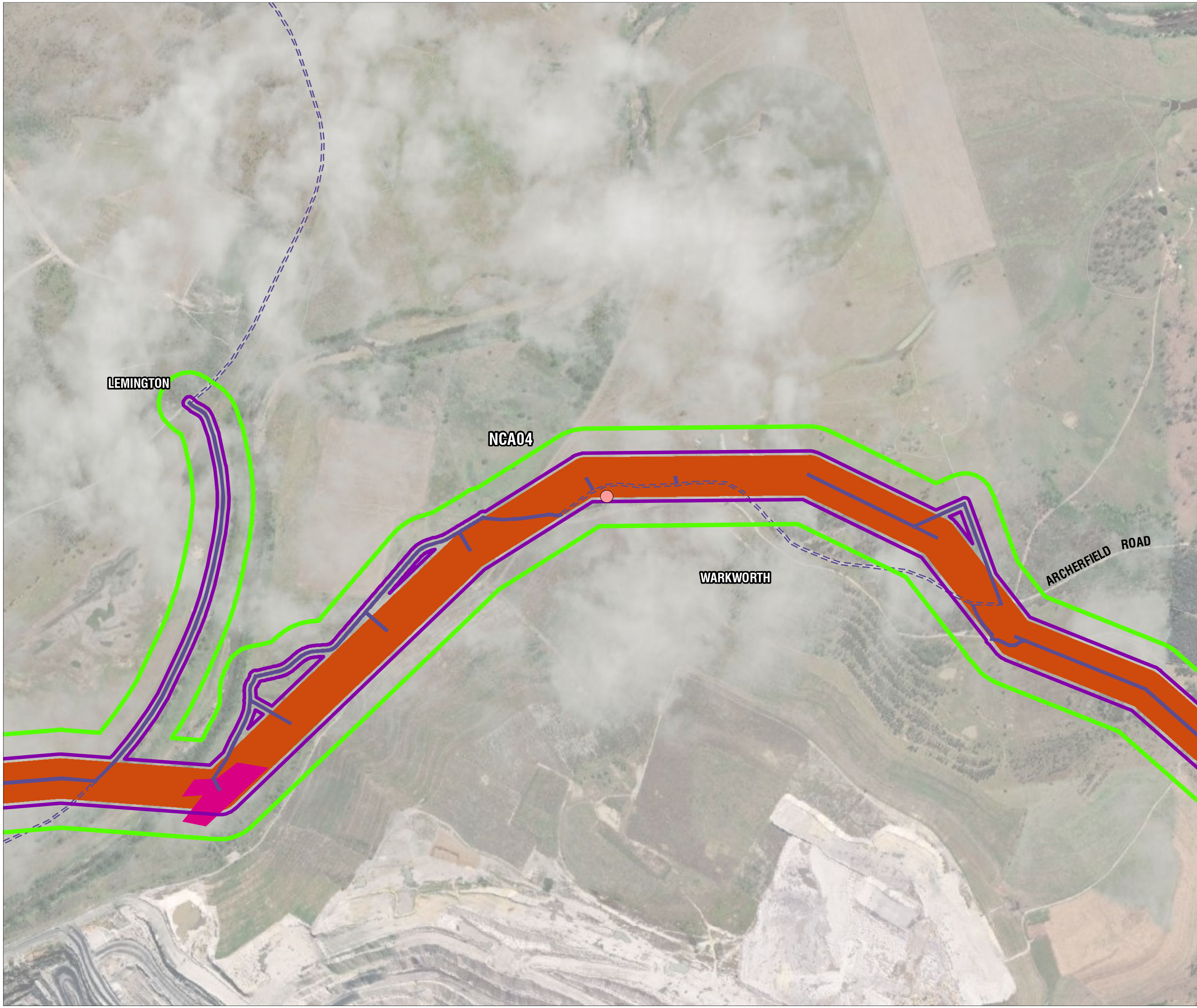
Vibration Impacts
- Cosmetic Damage
- Human Comfort



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

LEGEND
- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Stringing station

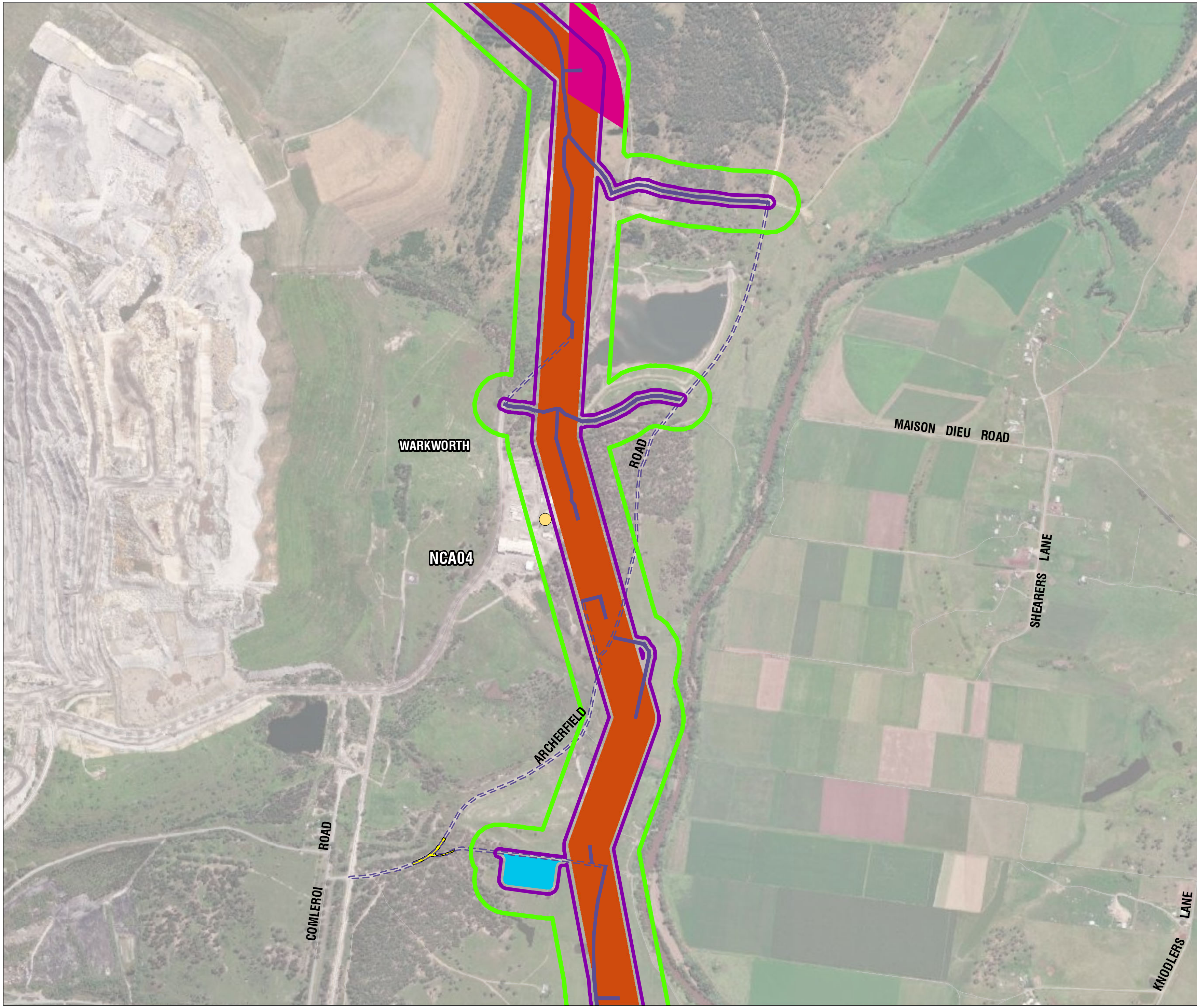
Vibration Impacts
- Cosmetic Damage

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

H:\Projects-SLR\630-SrvNTL\630-NTL\630.032094.00001 Hunter Transmission Project -\06 SLR Data\01 GIS\GIS\AV\FINAL FIGURES\SLR630032094 ATTH1 AV_VIB_INTENSIVE_07_DDP.mxd



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

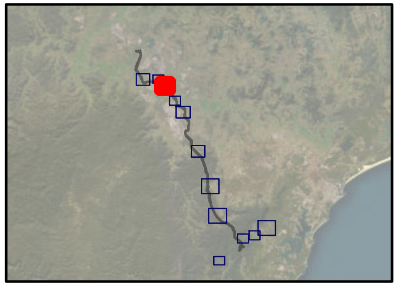
ATTACHMENT H.1

LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

Vibration Impacts

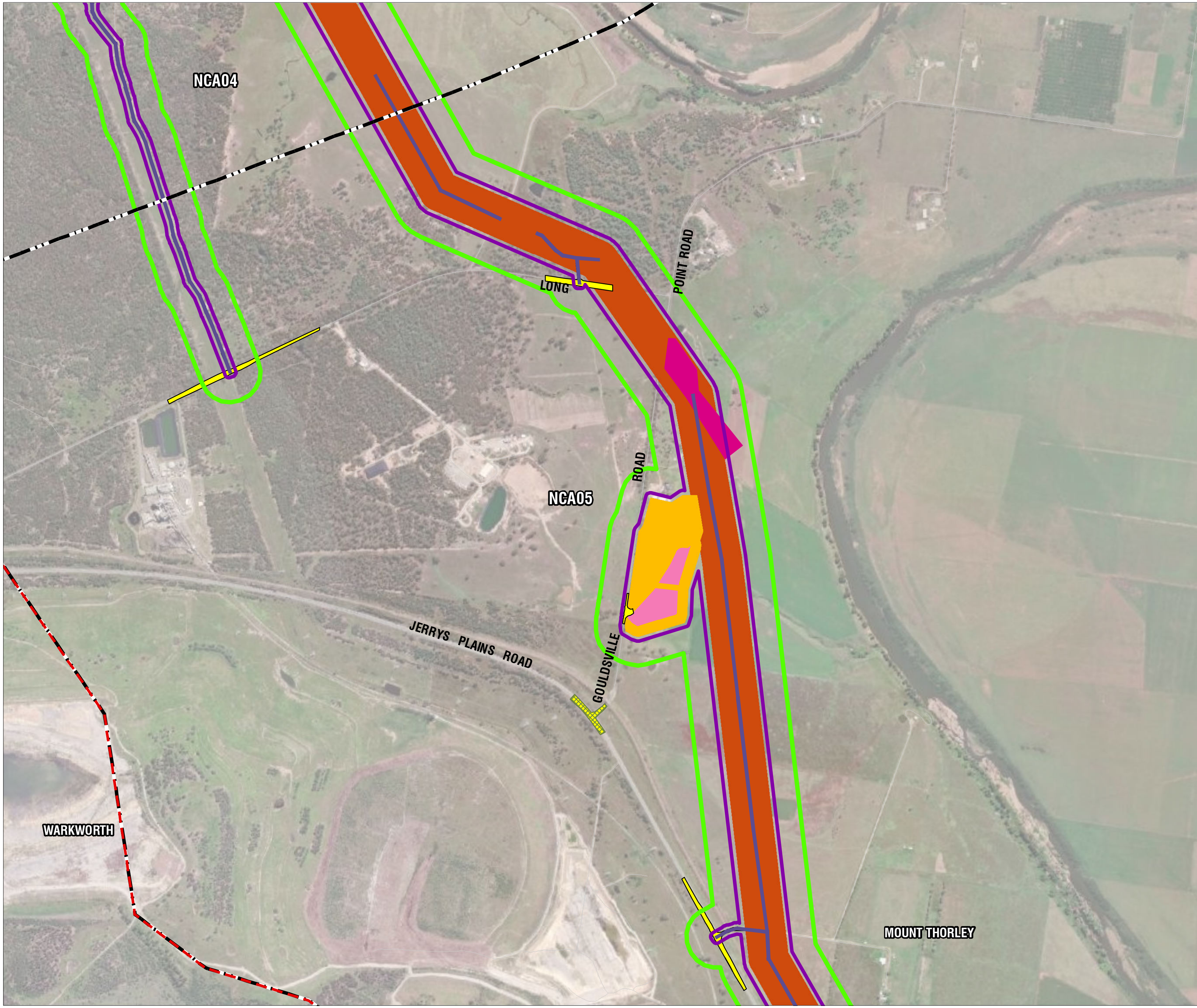
- Human Comfort



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

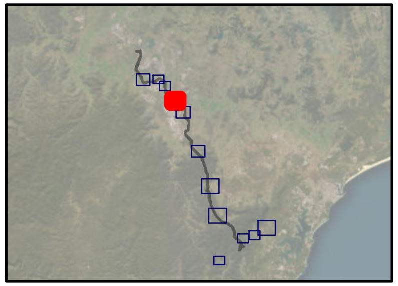


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

LEGEND
- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Accommodation site



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Intersection (typical)
- Stringing station
- Stringing station OOH

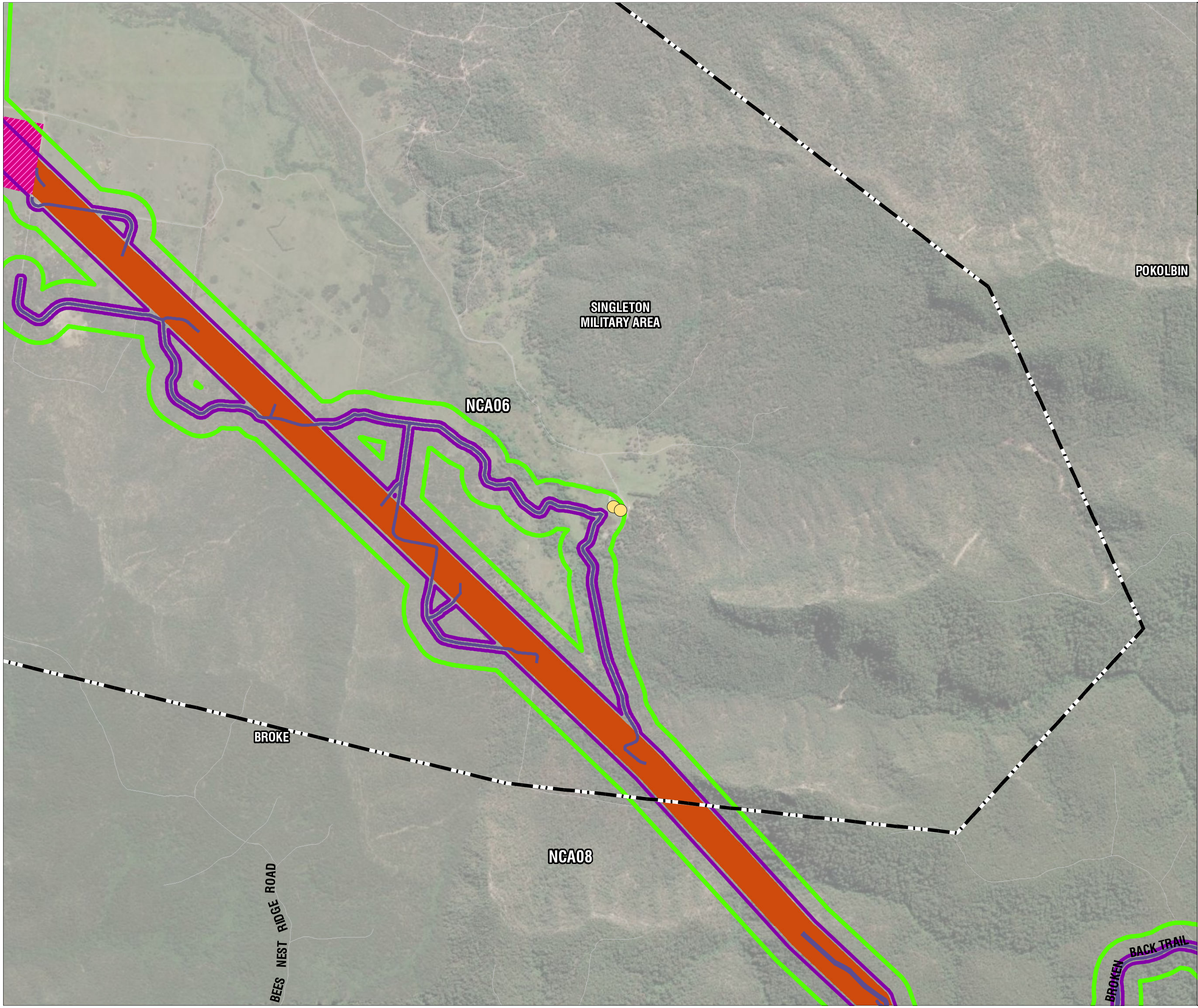
Vibration Impacts

- Human Comfort

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



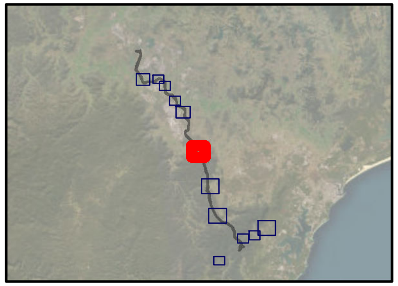
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND
OTHER CONSTRUCTION VIBRATION
IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

LEGEND
- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Stringing station
- Stringing station OOH

Vibration Impacts
- Human Comfort



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Scale:	1:24,000 at A4
Project Number:	630.032094
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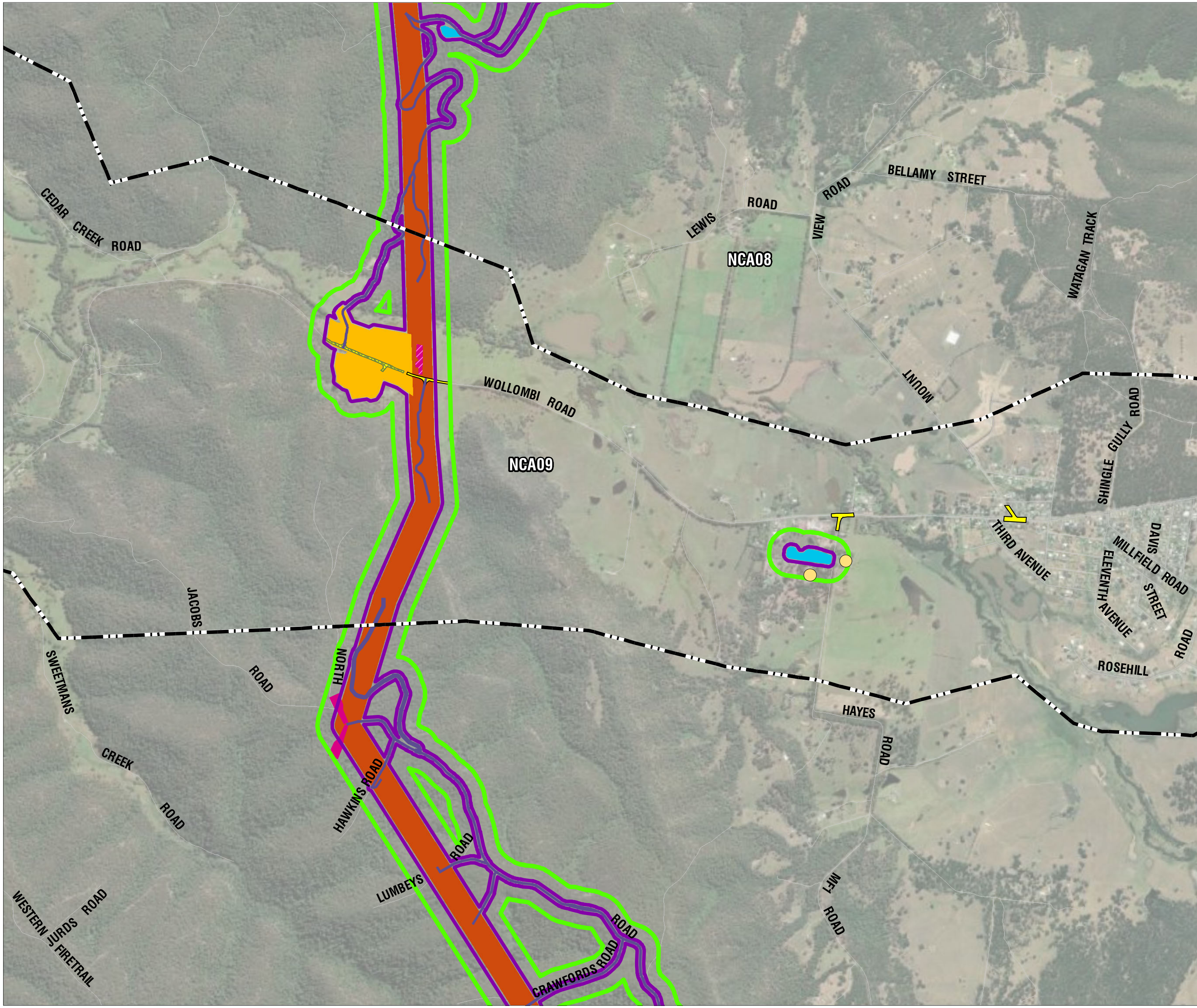
SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1



LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Laydown area
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Vibration Impacts

- Human Comfort

0 250 500 m

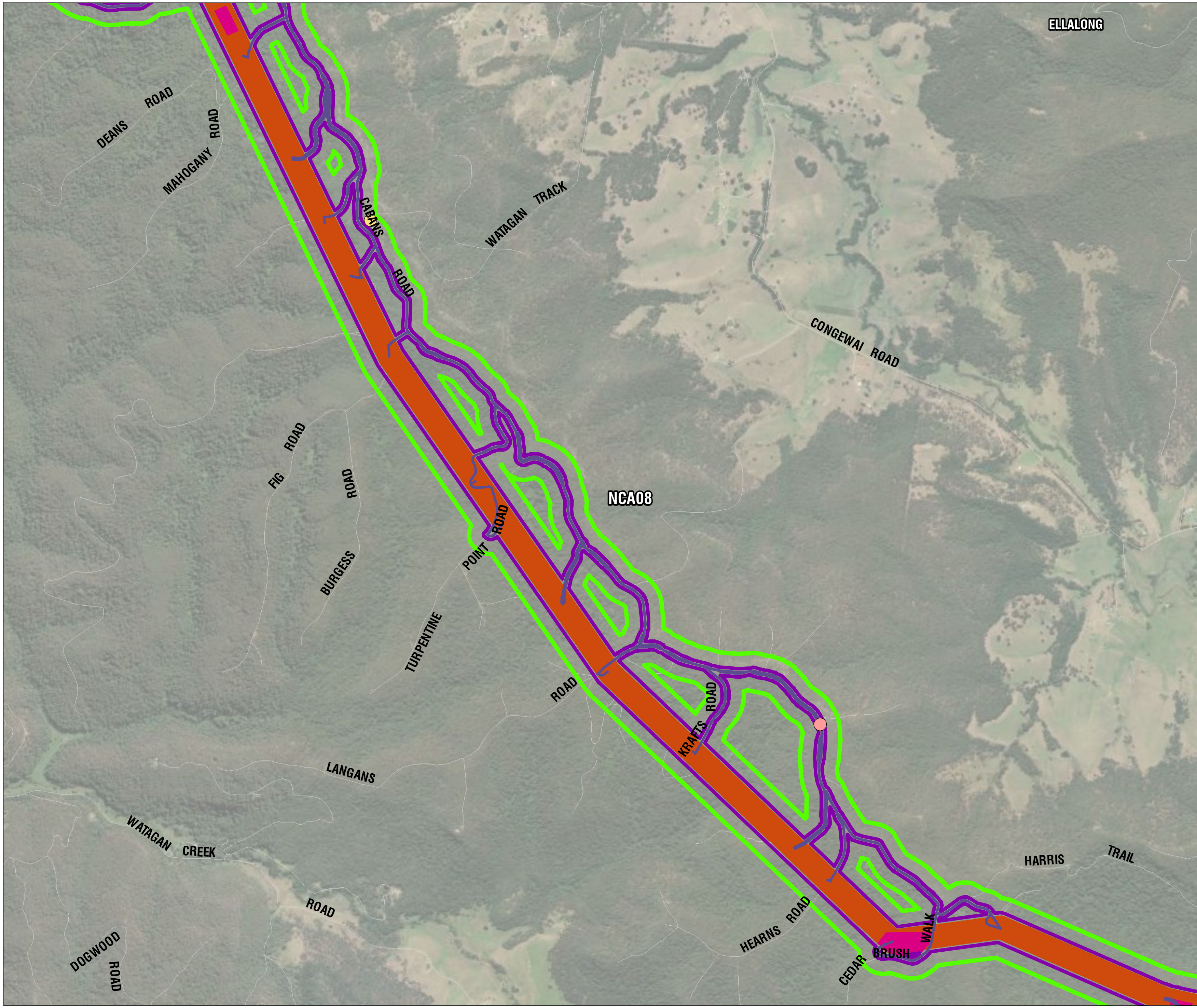
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

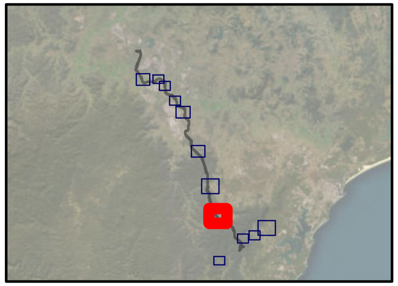


LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Stringing station

Vibration Impacts

- Cosmetic Damage
- Human Comfort



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

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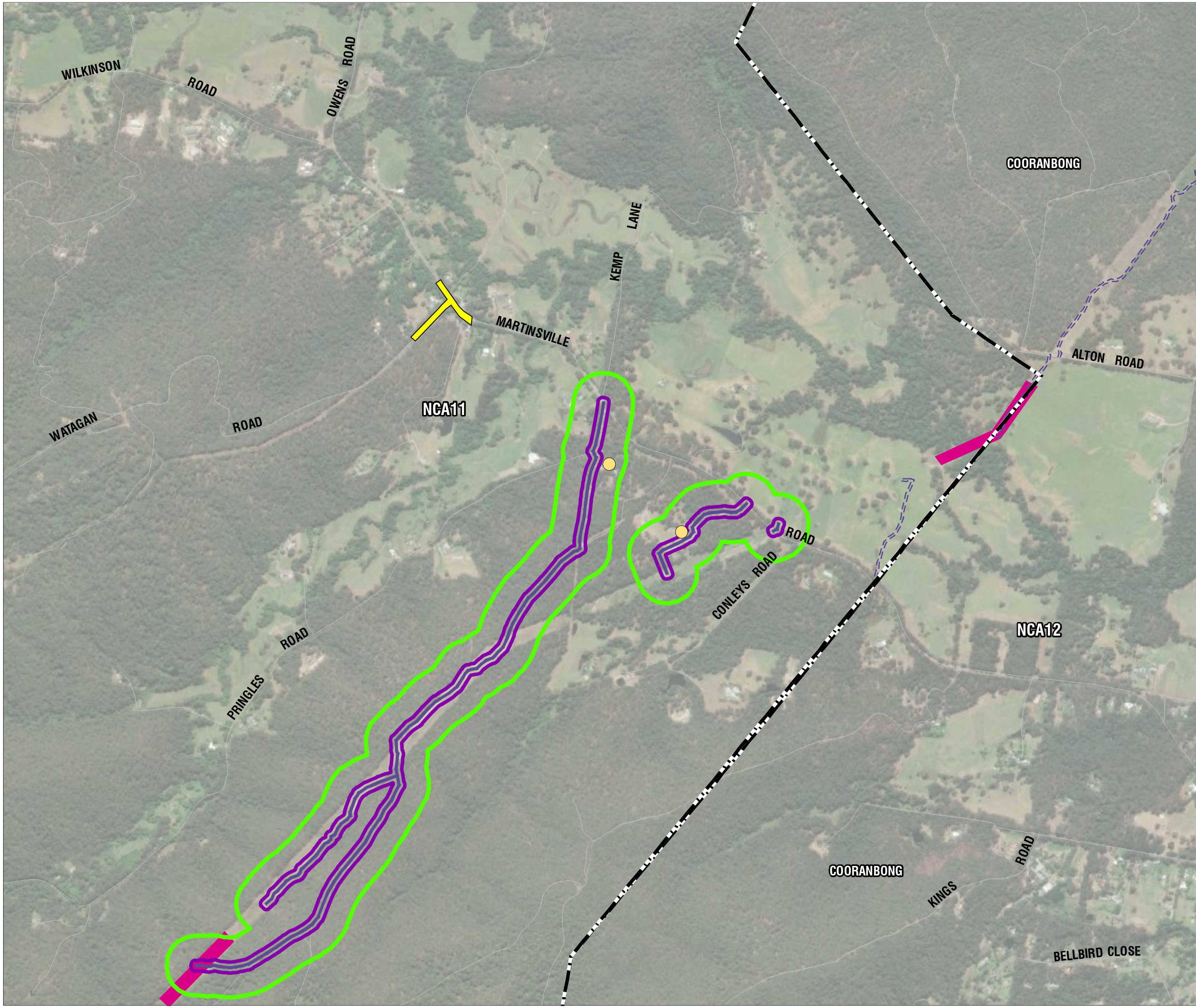
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

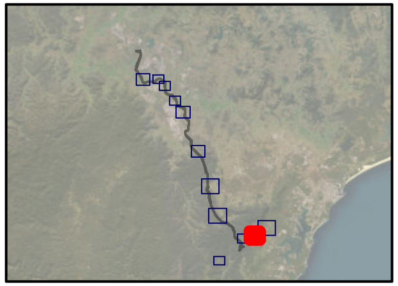


LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station

Vibration Impacts

- Human Comfort



0 250 500 m

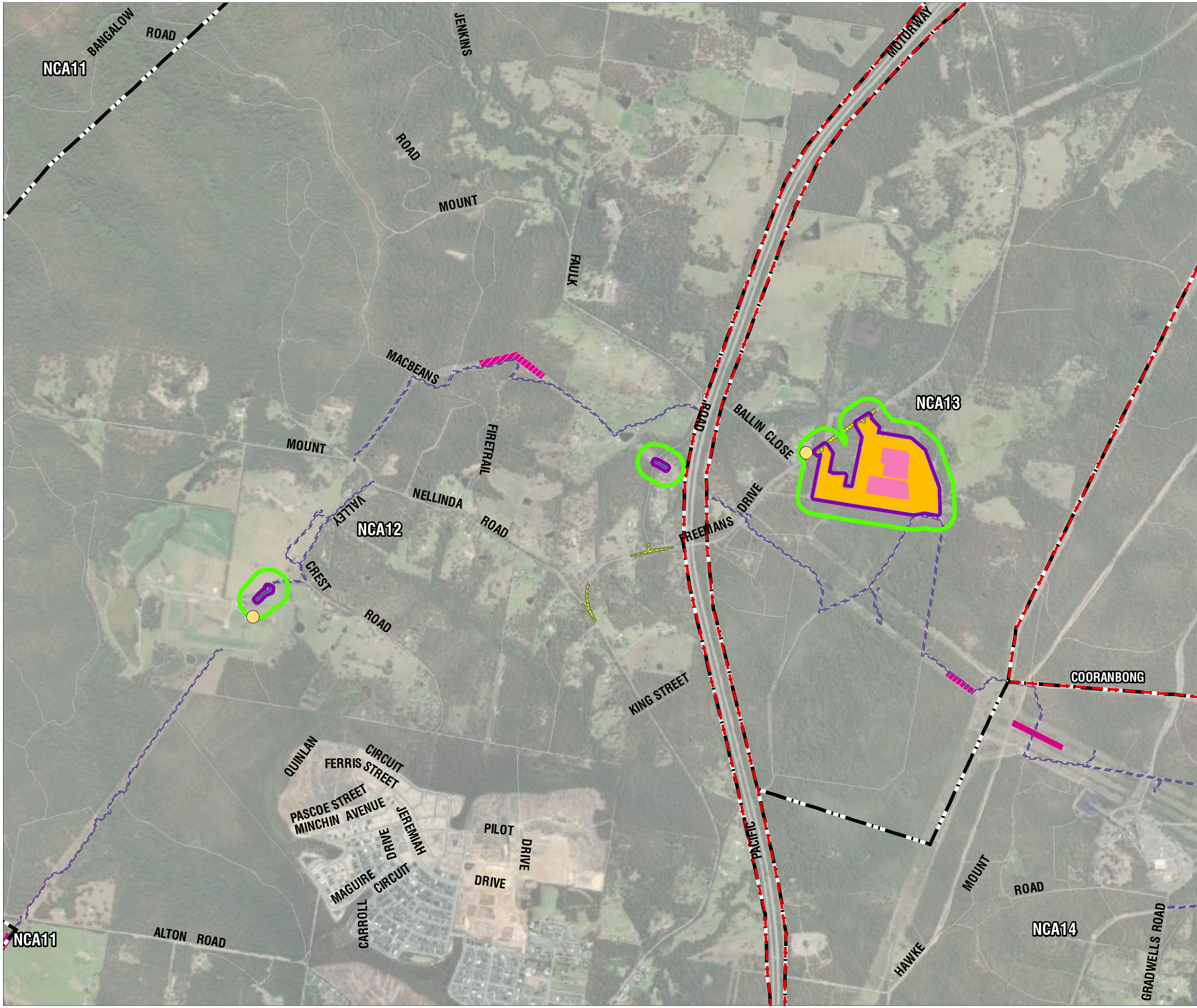
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

ATTACHMENT H.1

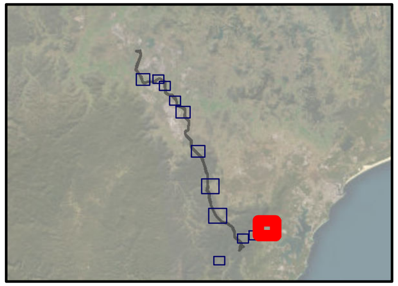


LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

Vibration Impacts

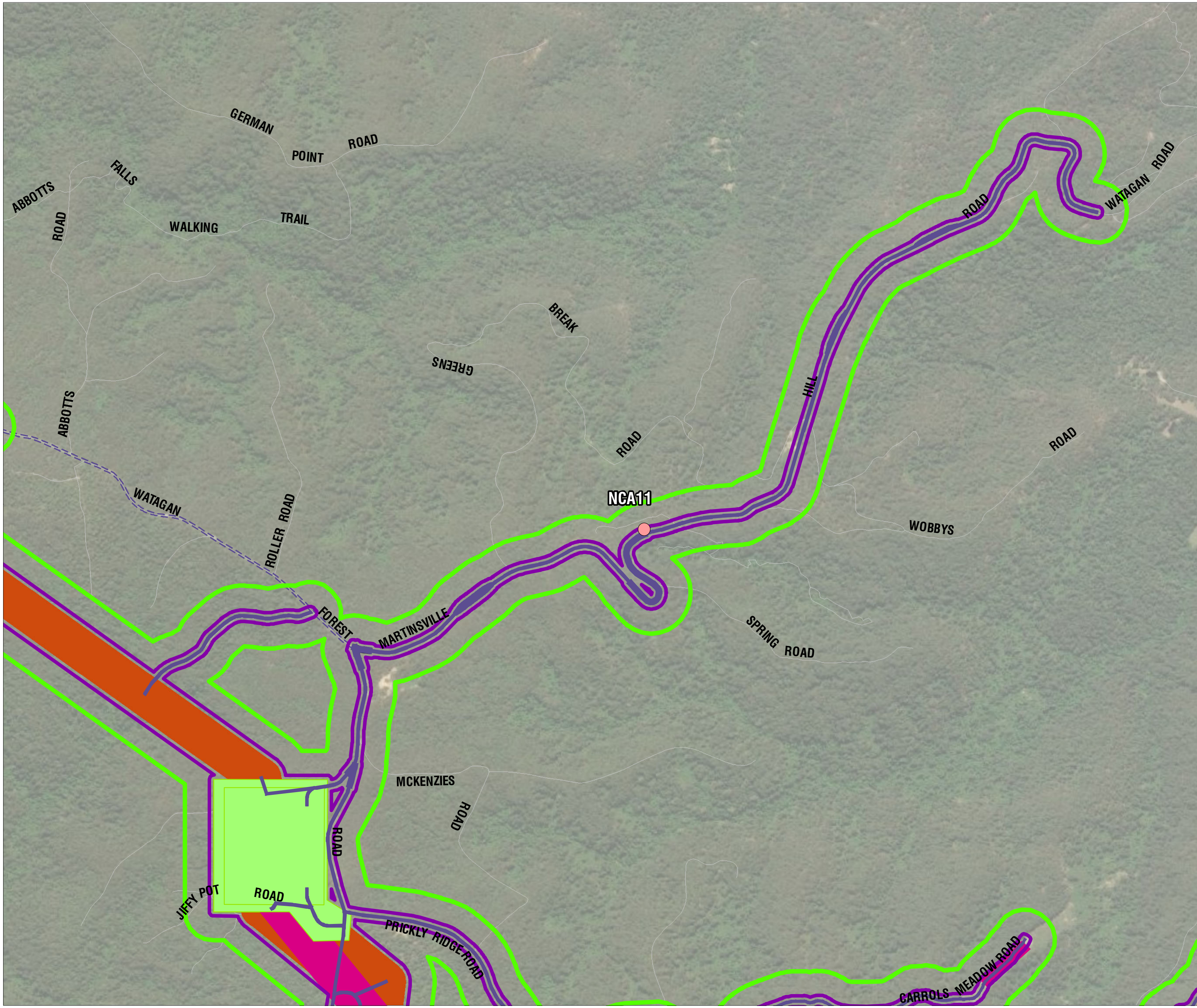
- Human Comfort



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

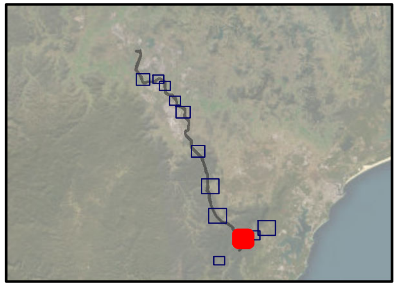
ATTACHMENT H.1

LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station
- Switching station

Vibration Impacts

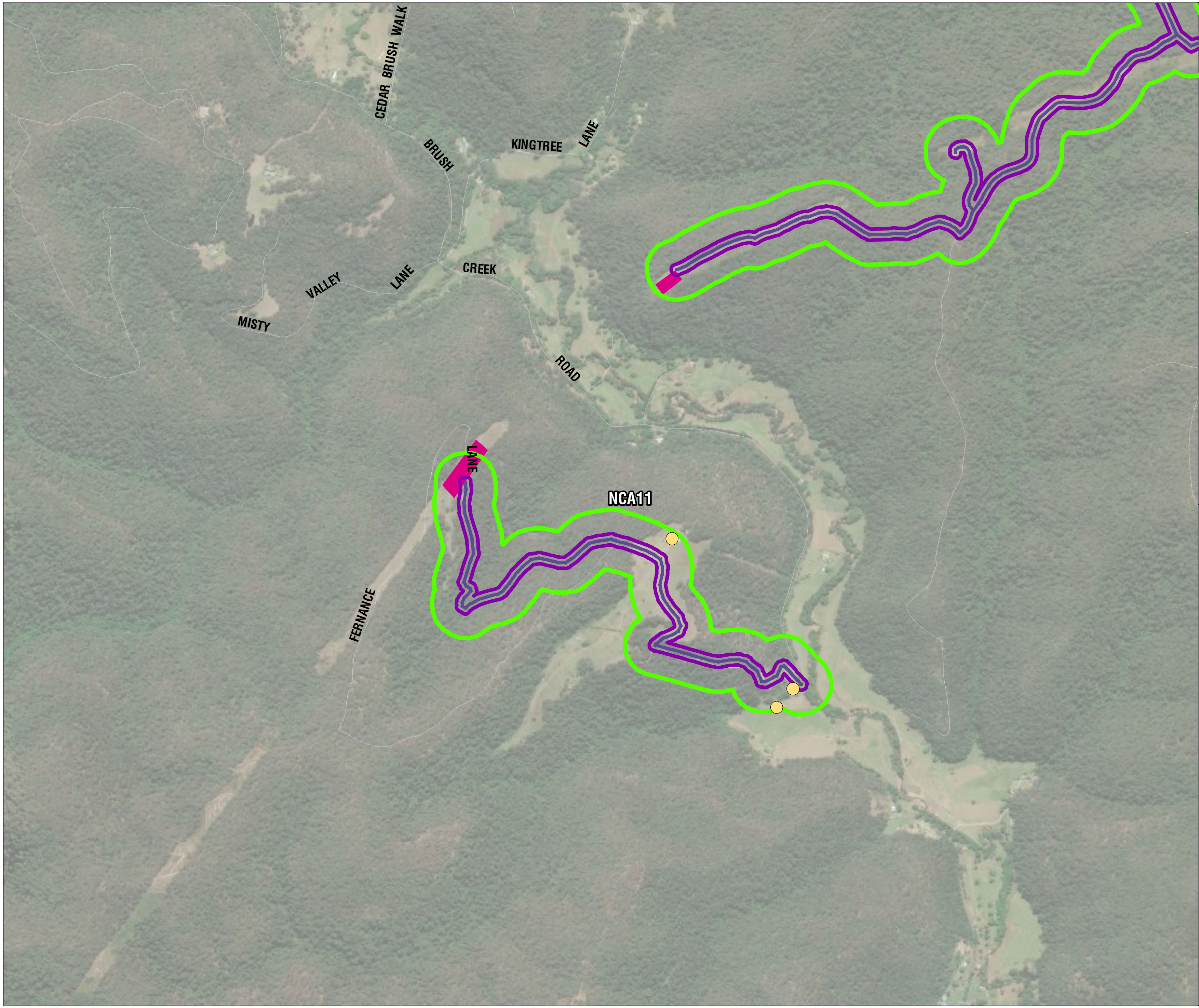
- Cosmetic Damage



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE EARTHWORKS AND OTHER CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

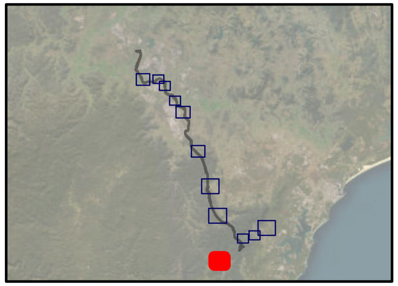
ATTACHMENT H.1

LEGEND

- Study area
- NCA boundary
- Cosmetic Damage 15 m buffer
- Human Comfort 100 m buffer
- Access tracks (major)
- Stringing station

Vibration Impacts

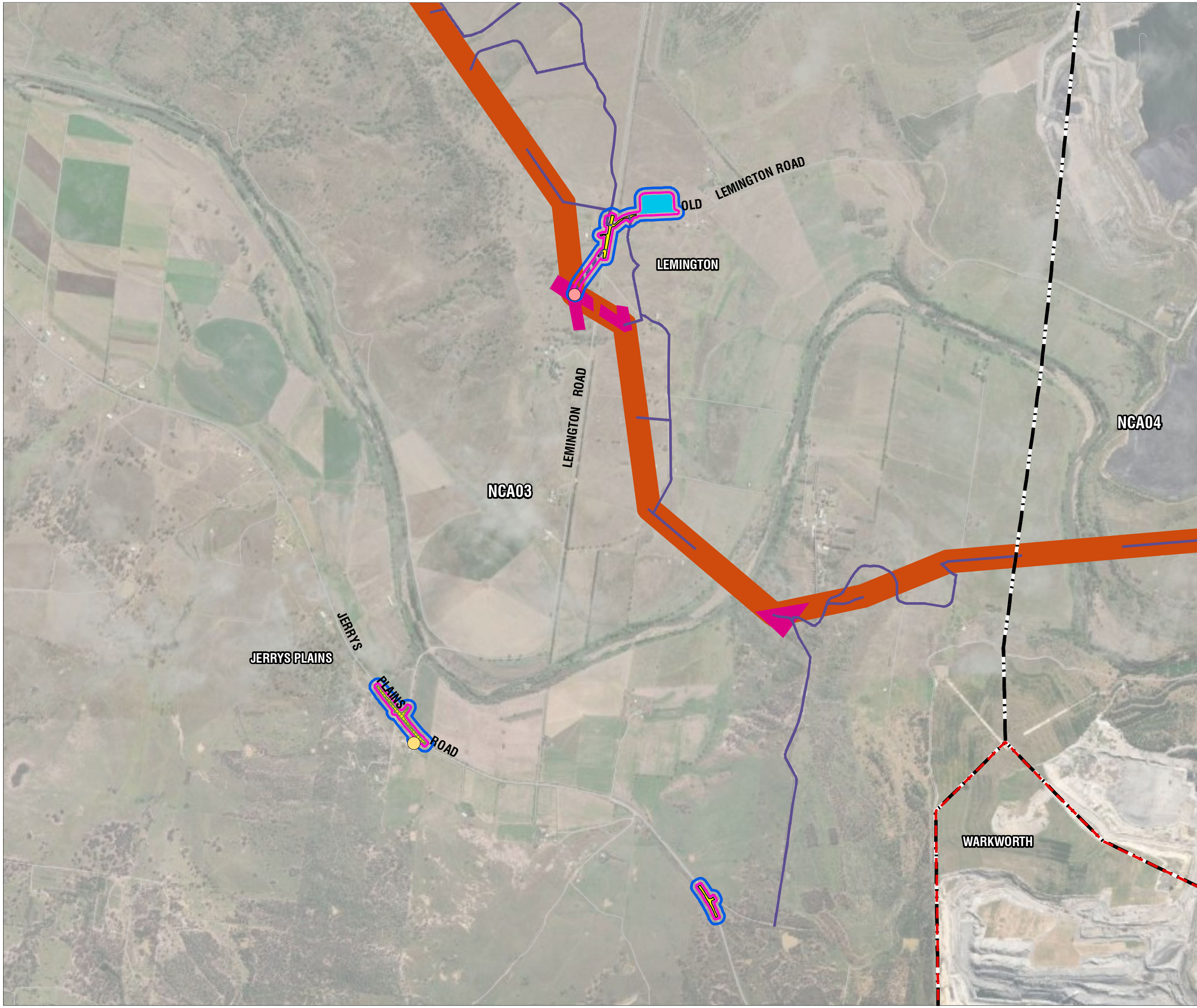
- Human Comfort



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



**HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT**

**ACCESS TRACKS (MINOR WORKS)
AND INTERSECTION CONSTRUCTION
VIBRATION IMPACTS ON
SENSITIVE RECEIVERS**

Page 1 of 7

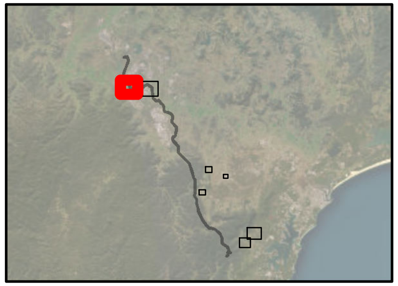
ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Intersection (intensive)
- Stringing station

Vibration Impacts

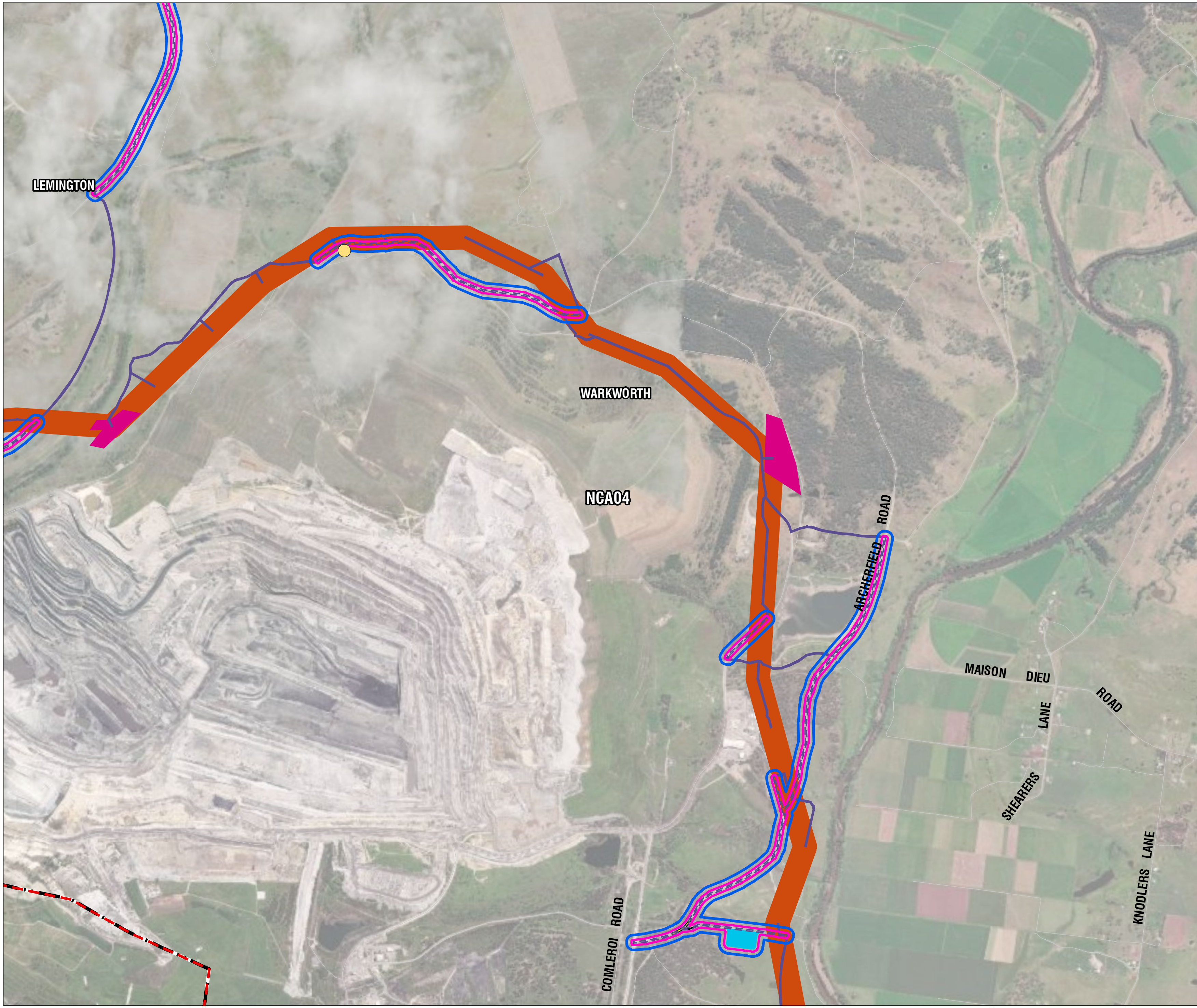
- Cosmetic Damage
- Human Comfort



0 410 820 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

ACCESS TRACKS (MINOR WORKS) AND INTERSECTION CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

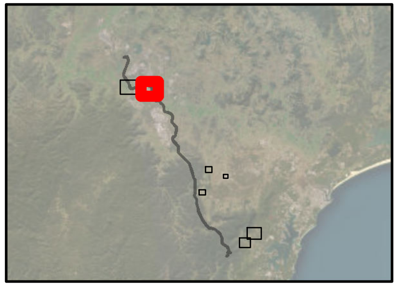
ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

Vibration Impacts

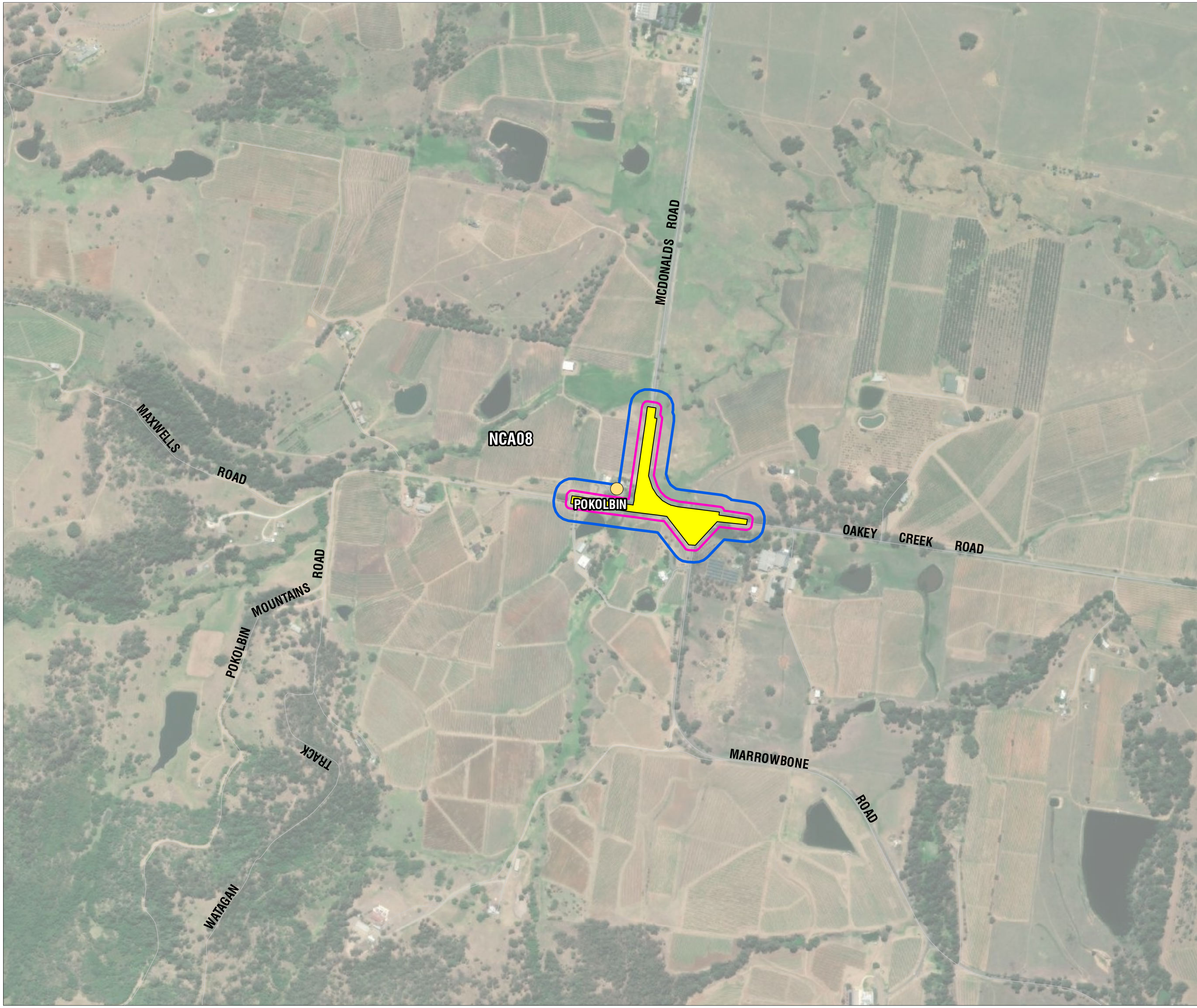
- Human Comfort



0 410 820 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

ACCESS TRACKS (MINOR WORKS) AND INTERSECTION CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

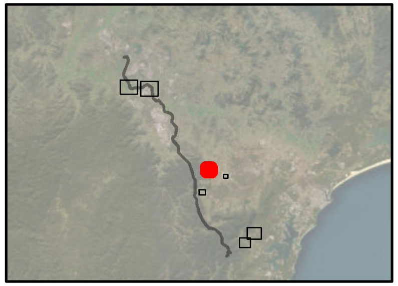
ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- Intersection (typical)

Vibration Impacts

- Human Comfort



0 165 330 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:12,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

ACCESS TRACKS (MINOR WORKS) AND INTERSECTION CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

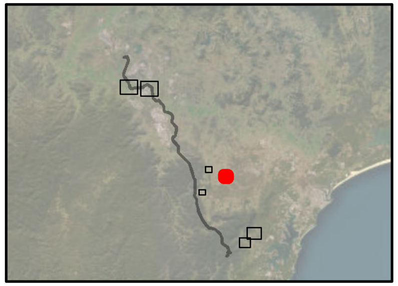
ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- Intersection (typical)

Vibration Impacts

- Cosmetic Damage
- Human Comfort



0 95 190 m

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Scale:	1:7,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

ACCESS TRACKS (MINOR WORKS) AND INTERSECTION CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

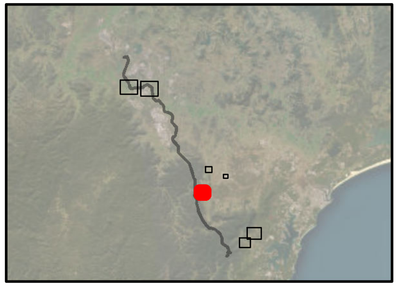
ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- Laydown area
- Intersection (typical)

Vibration Impacts

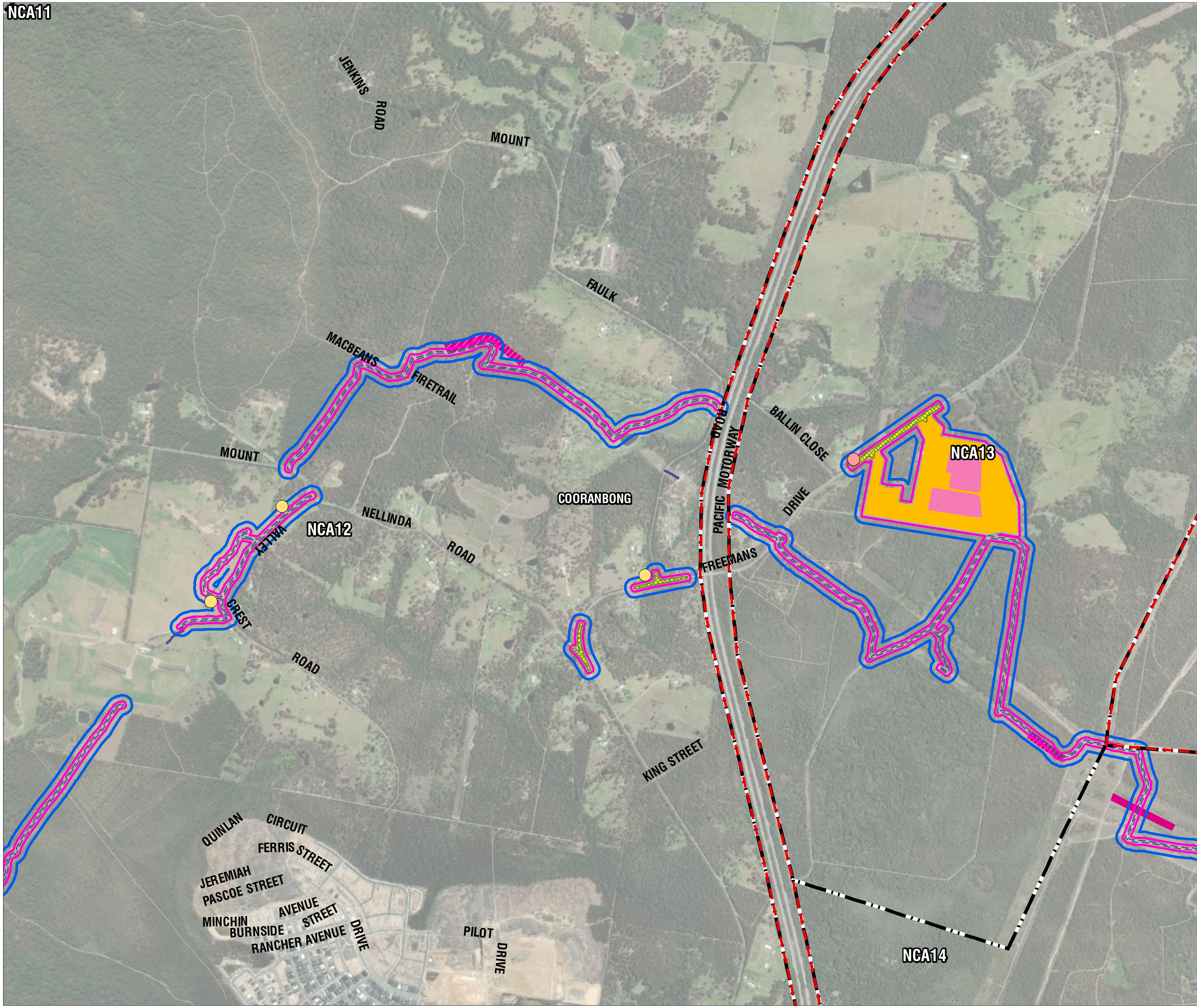
- Cosmetic Damage
- Human Comfort



0 150 300 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:11,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

ACCESS TRACKS (MINOR WORKS) AND INTERSECTION CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

Page 6 of 7

ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- Access tracks (major)
- Access tracks (minor)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH
- Accommodation site

Vibration Impacts

- Cosmetic Damage
- Human Comfort

0 330 660 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR

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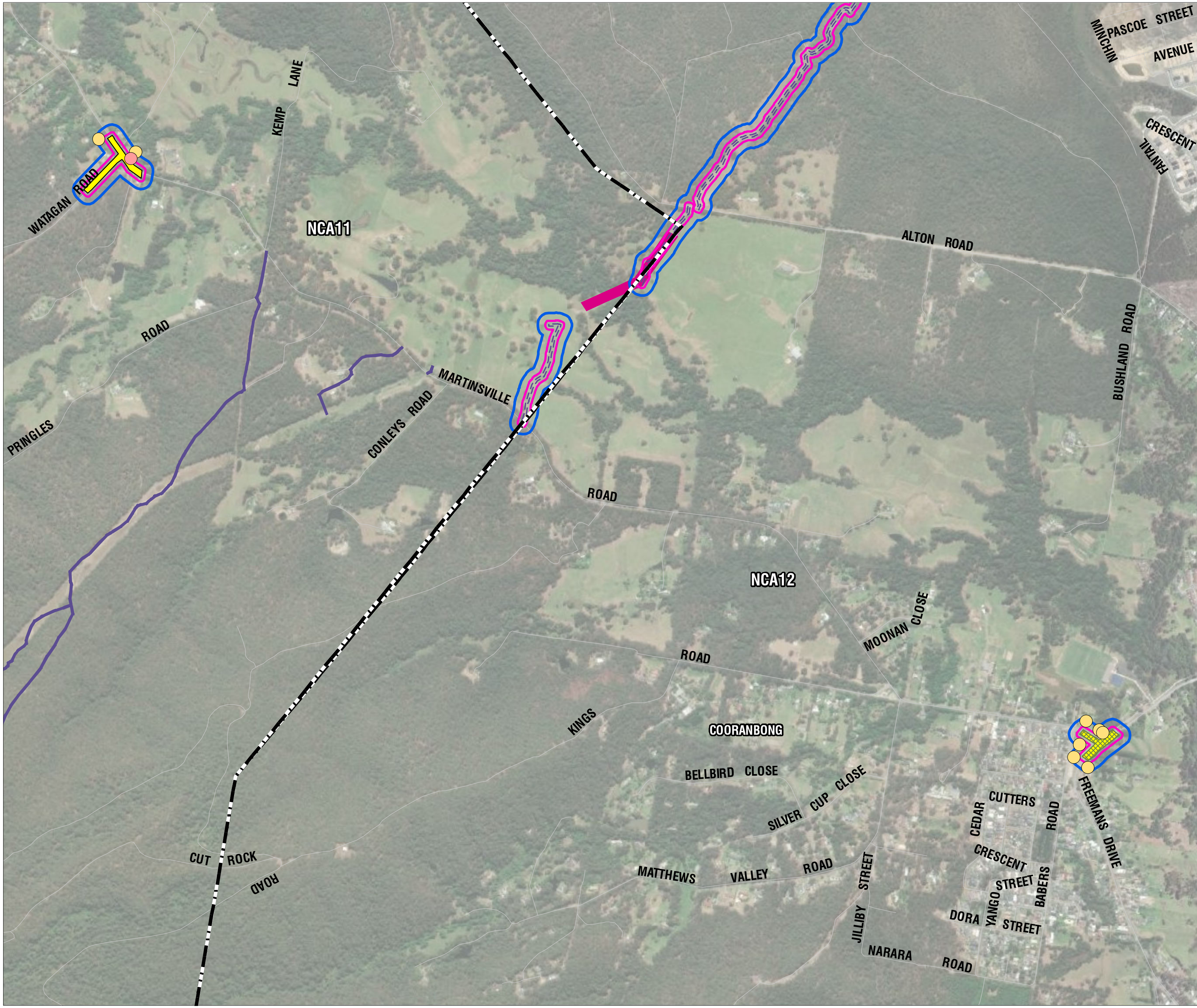


HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

ACCESS TRACKS (MINOR WORKS) AND INTERSECTION CONSTRUCTION VIBRATION IMPACTS ON SENSITIVE RECEIVERS

Page 7 of 7

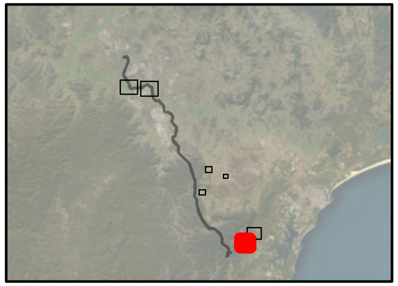
ATTACHMENT H.2

LEGEND

- Study area
- NCA boundary
- Moderate works 12 m buffer
- Moderate works 40 m buffer
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Intersection (intensive)
- Stringing station

Vibration Impacts

- Cosmetic Damage
- Human Comfort

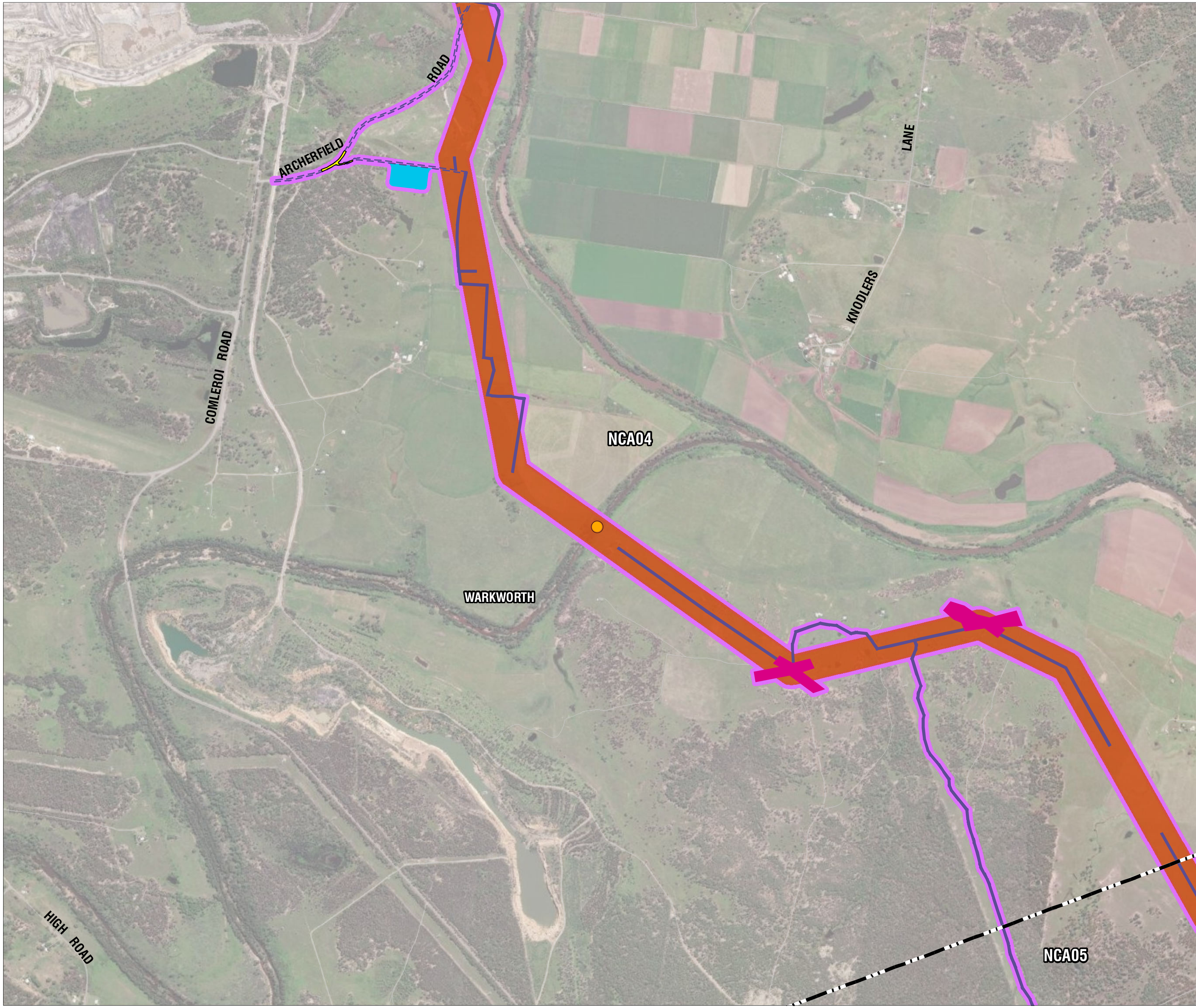


N

0 260 520 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:19,000 at A4
Project Number:	630.032094
Date:	10-Jul-2025
Drawn by:	LF

SLR



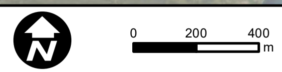
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION
IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION
VIBRATION IMPACTS ON
ABORIGINAL HERITAGE SITES

ATTACHMENT H.3

LEGEND
- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

Vibration Impacts
- Potentially impacted sites



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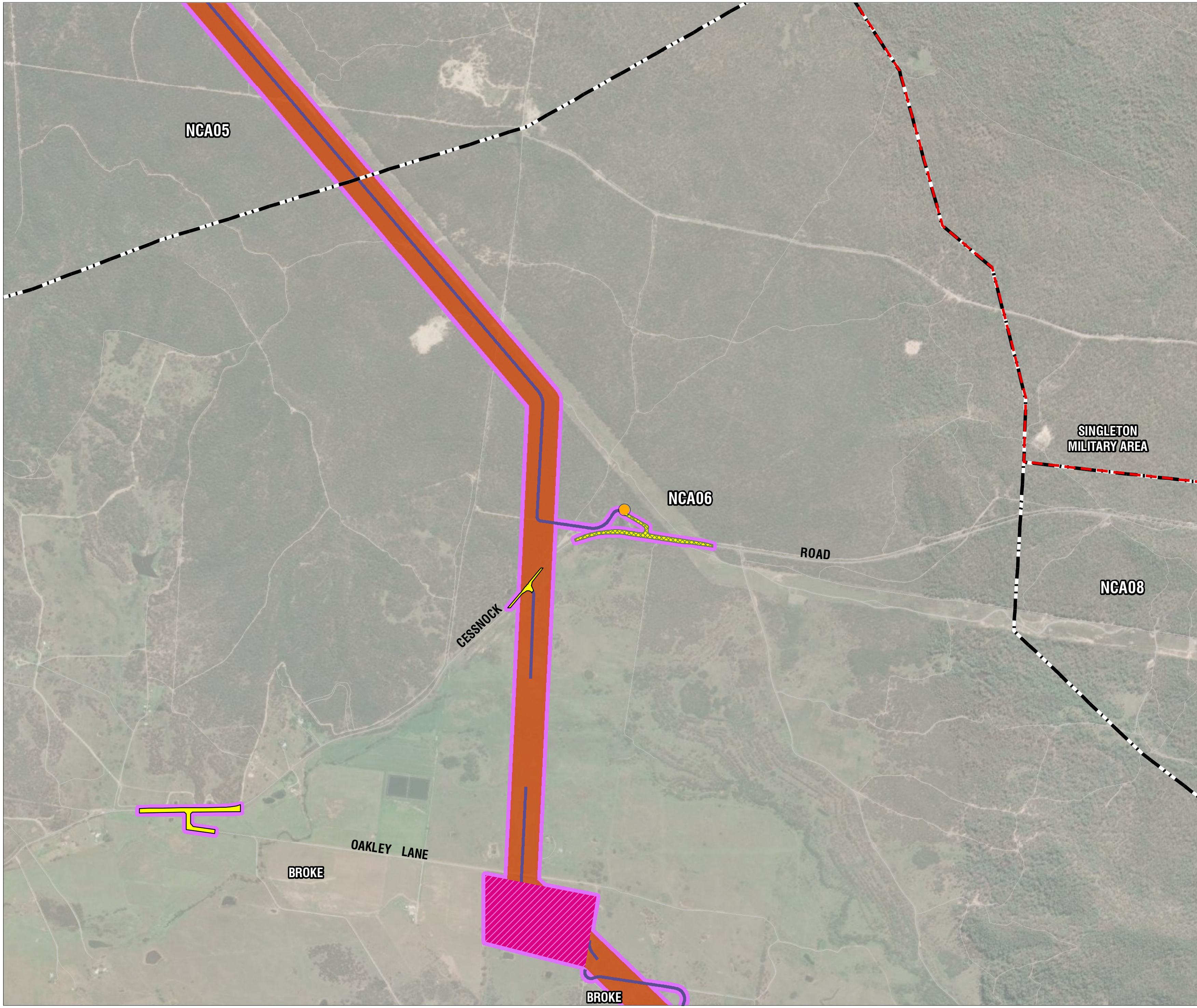
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

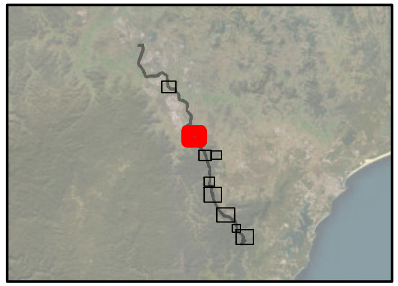
ATTACHMENT H.3

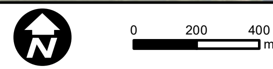
LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Vibration Impacts

- Potentially impacted sites





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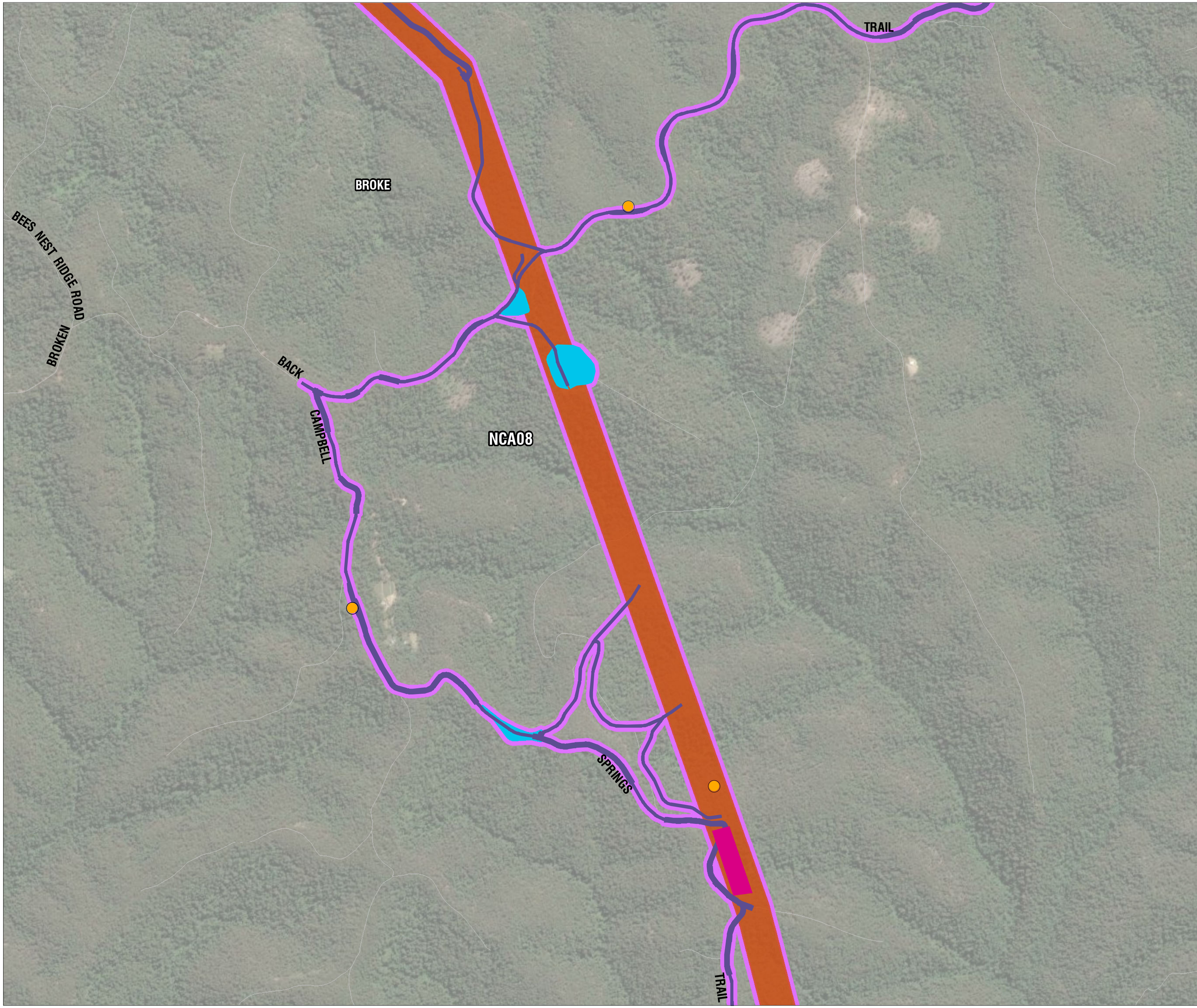
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

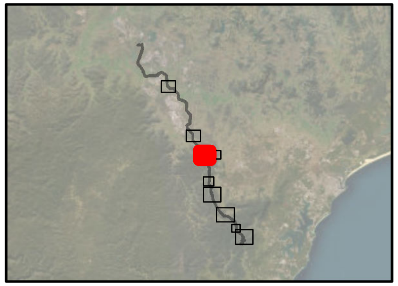
ATTACHMENT H.3

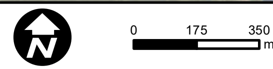
LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Laydown area
- Stringing station

Vibration Impacts

- Potentially impacted sites





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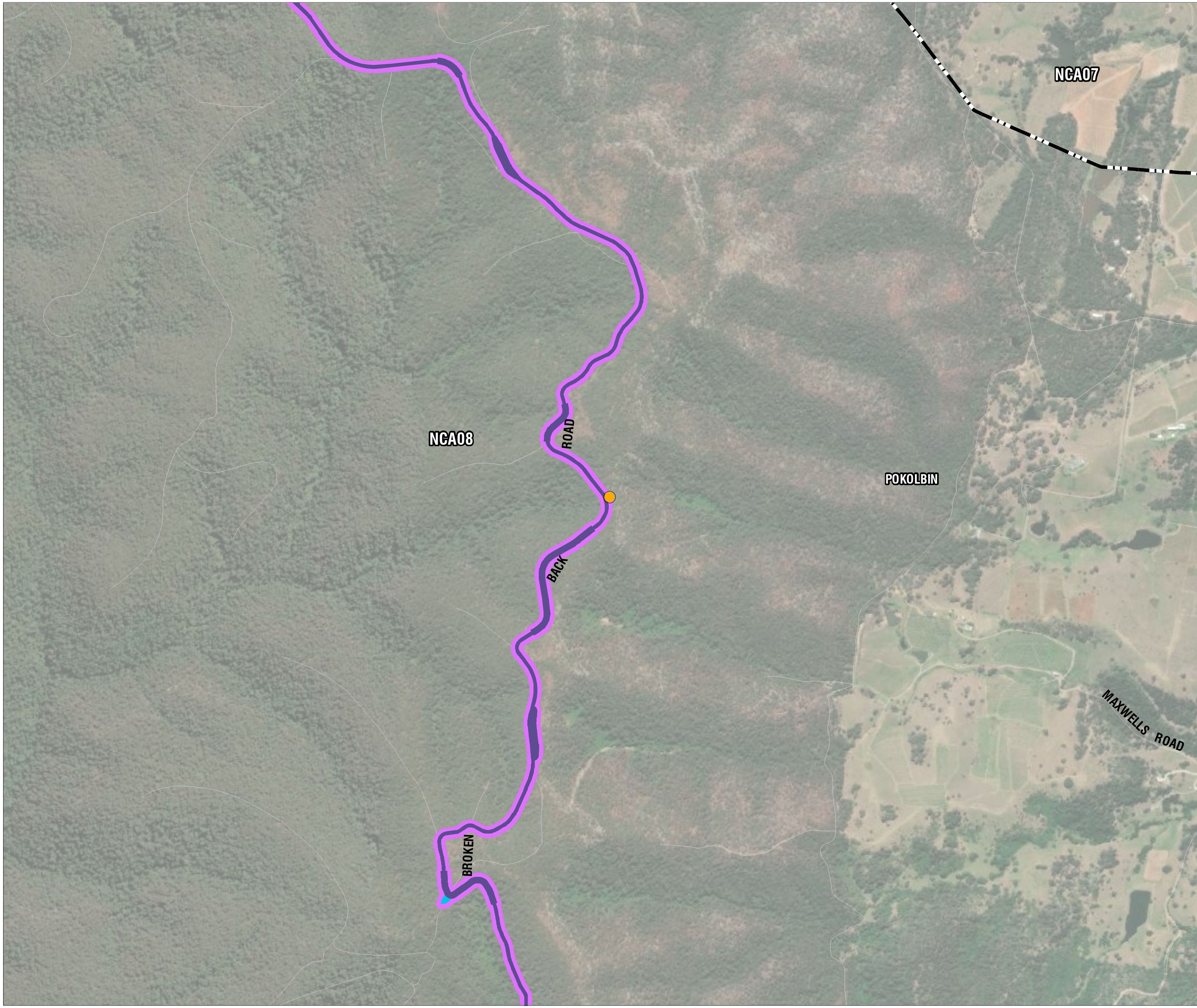
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

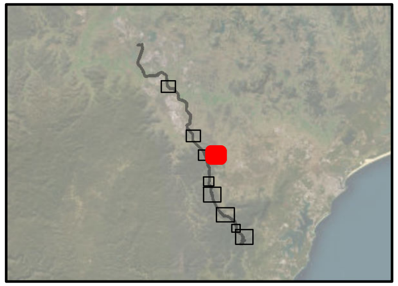
ATTACHMENT H.3

LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- Access tracks (major)
- Laydown area

Vibration Impacts

- Potentially impacted sites



0 150 300 m

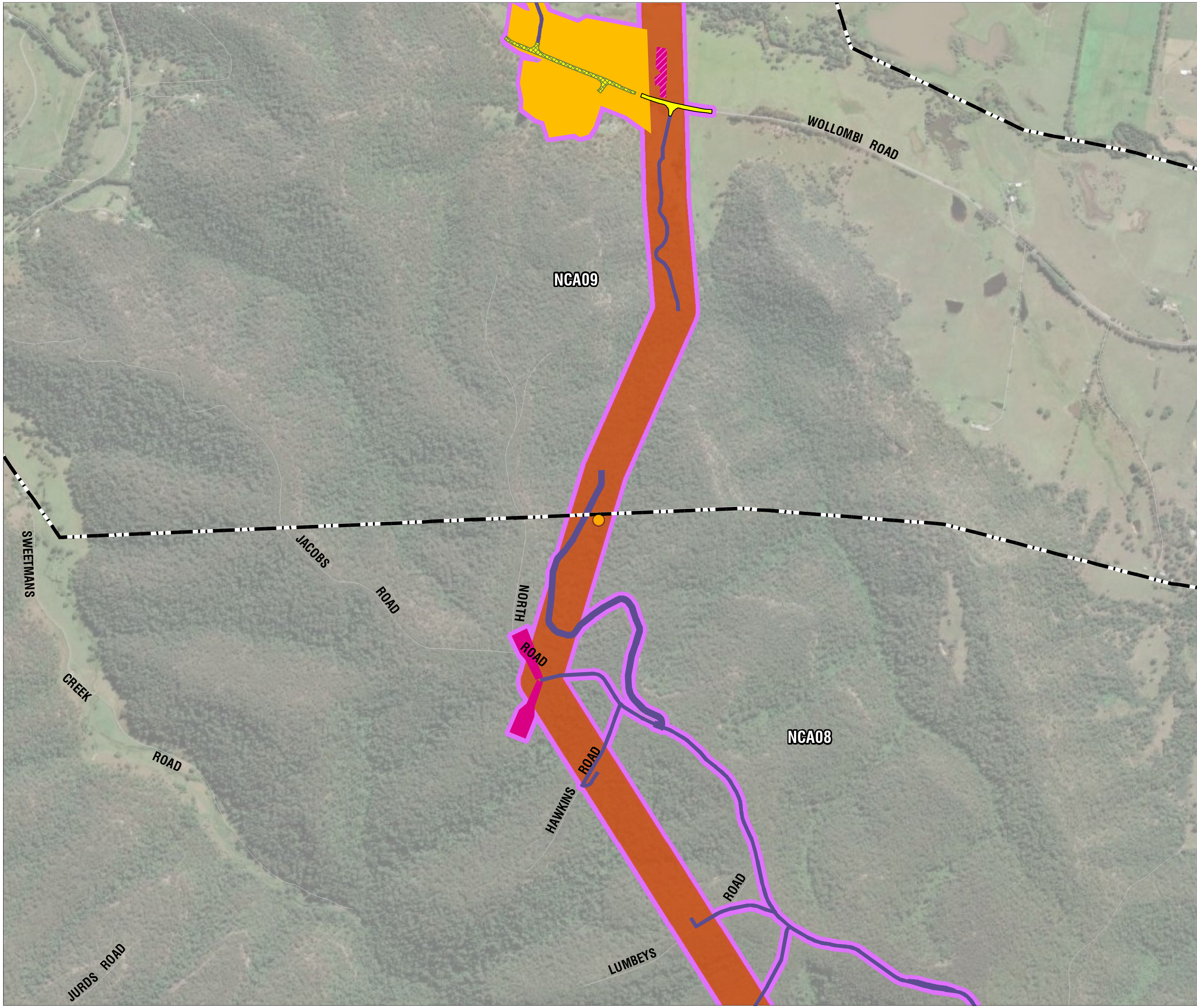
Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

SLR

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

ATTACHMENT H.3



LEGEND
- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Stringing station OOH

Vibration Impacts
- Potentially impacted sites

0 150 300 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:18,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

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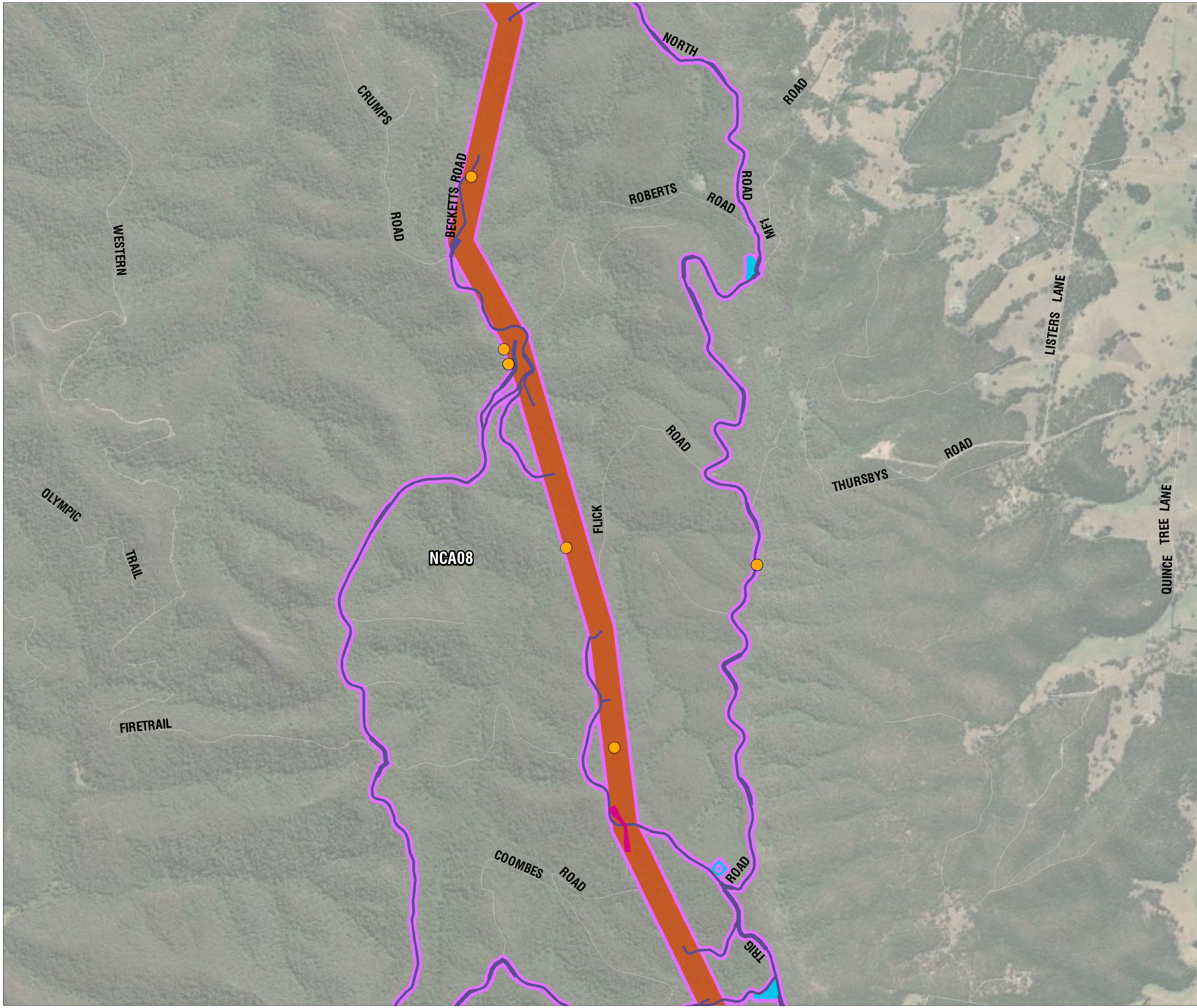


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

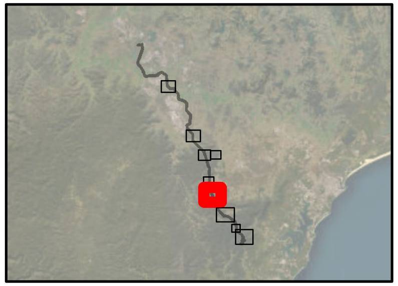
ATTACHMENT H.3

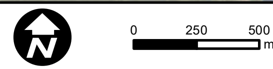
LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Laydown area
- Stringing station

Vibration Impacts

- Potentially impacted sites





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Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

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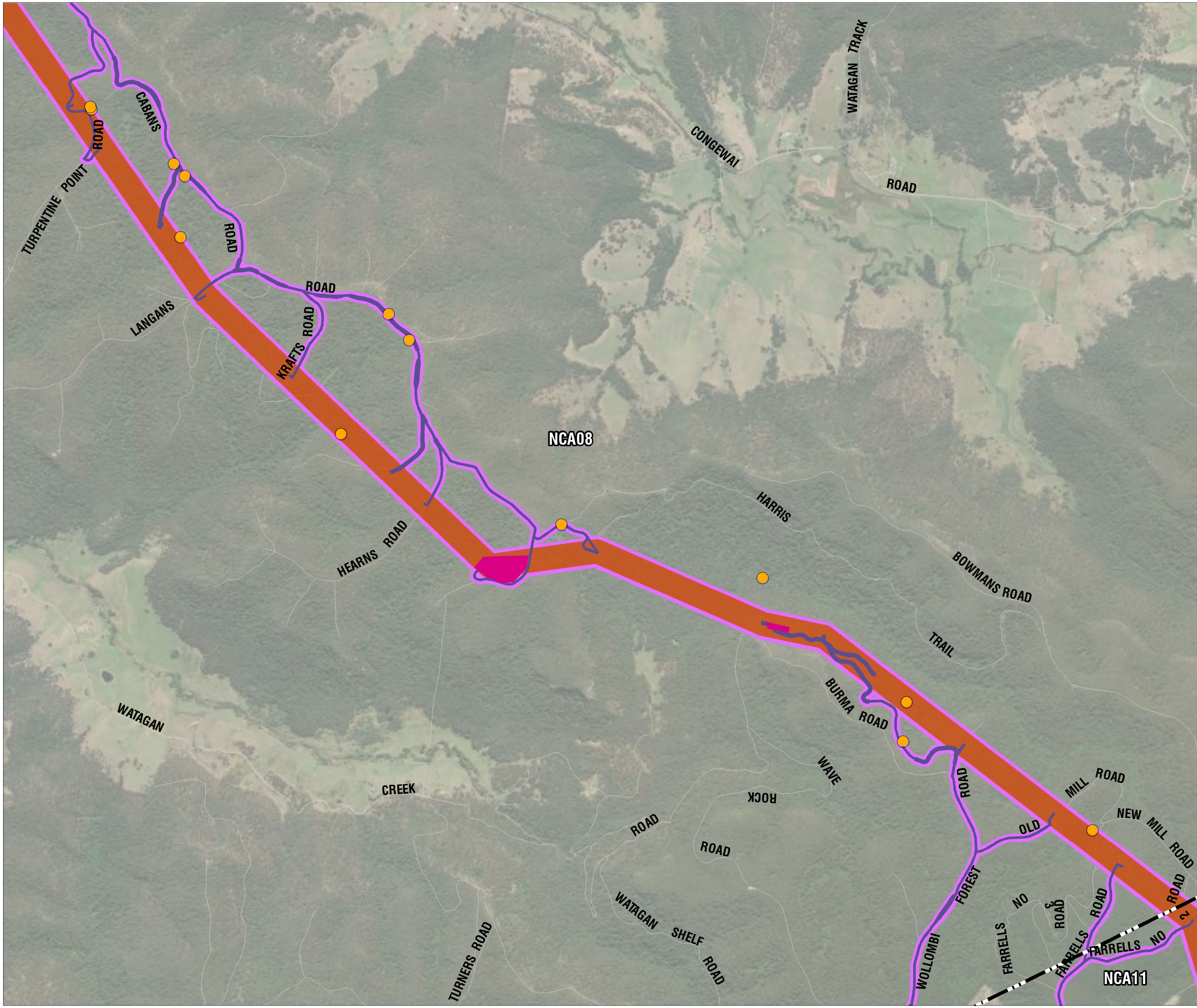
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

ATTACHMENT H.3



LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Stringing station

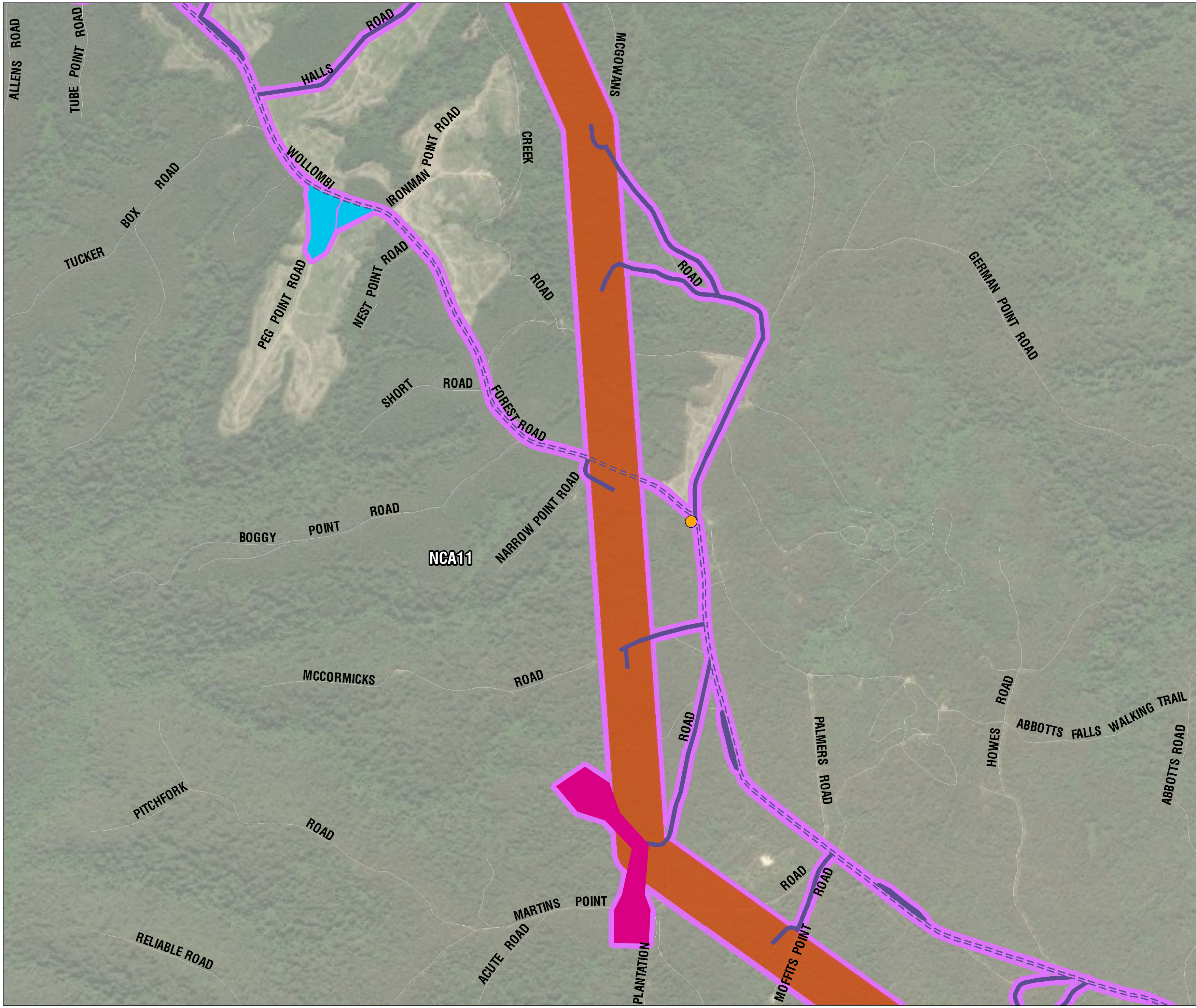
Vibration Impacts

- Potentially impacted sites

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

SLR



HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

Page 8 of 9

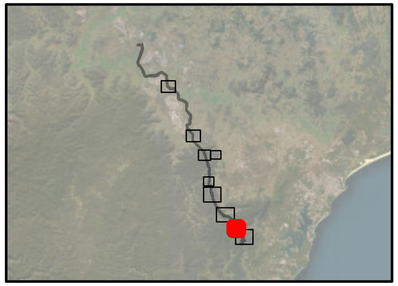
ATTACHMENT H.3

LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Stringing station

Vibration Impacts

- Potentially impacted sites



0 125 250 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:15,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

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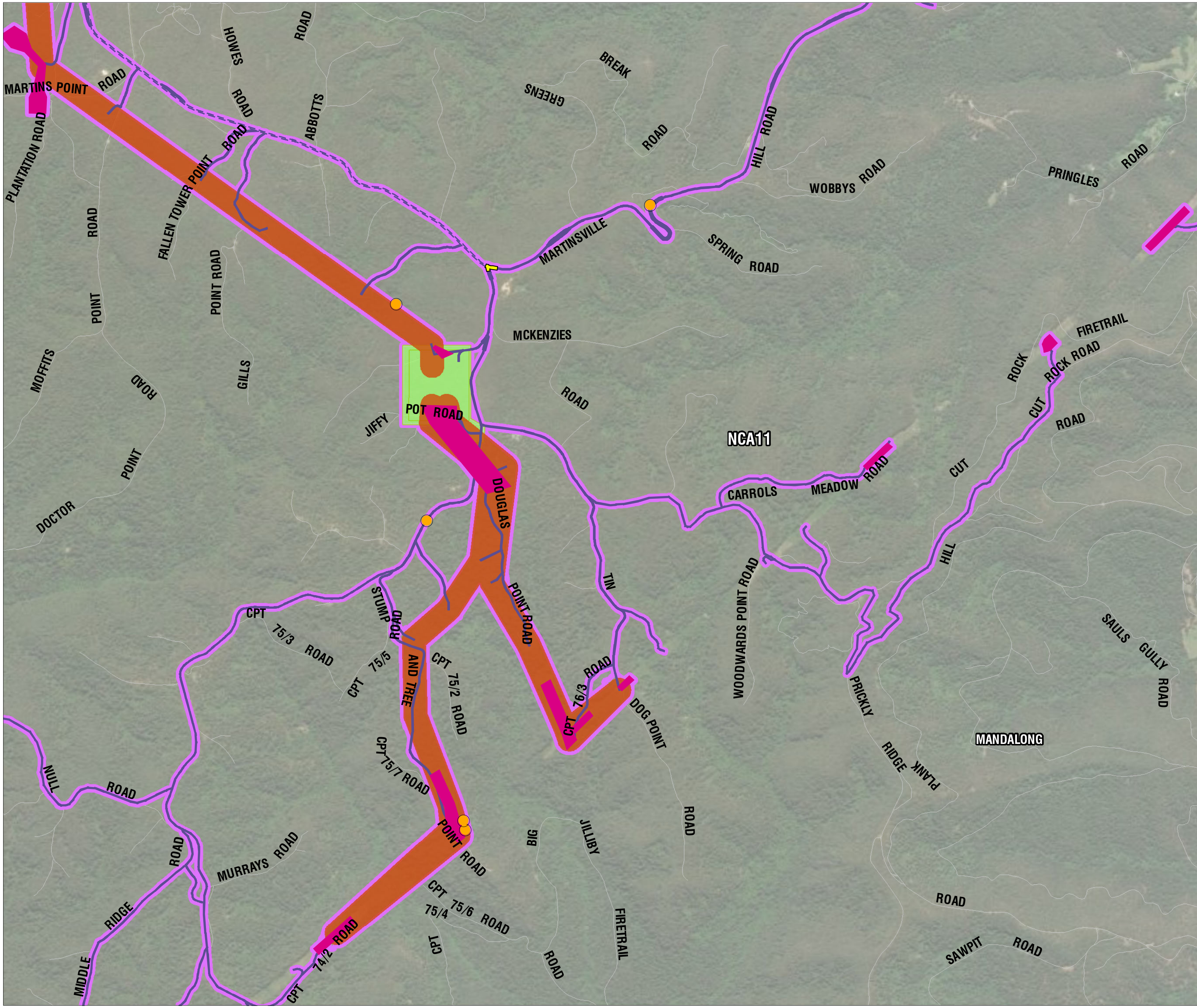
HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS ON ABORIGINAL HERITAGE SITES

ATTACHMENT H.3

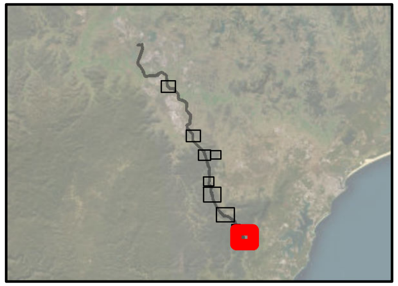


LEGEND

- Study area
- NCA boundary
- Safe working distance 10 m buffer
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Intersection (typical)
- Stringing station
- Switching station

Vibration Impacts

- Potentially impacted sites



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	08-Jul-2025
Drawn by:	LF

Attachment I Operational noise impacts

Noise and Vibration Impact Assessment

Hunter Transmission Project

EnergyCo

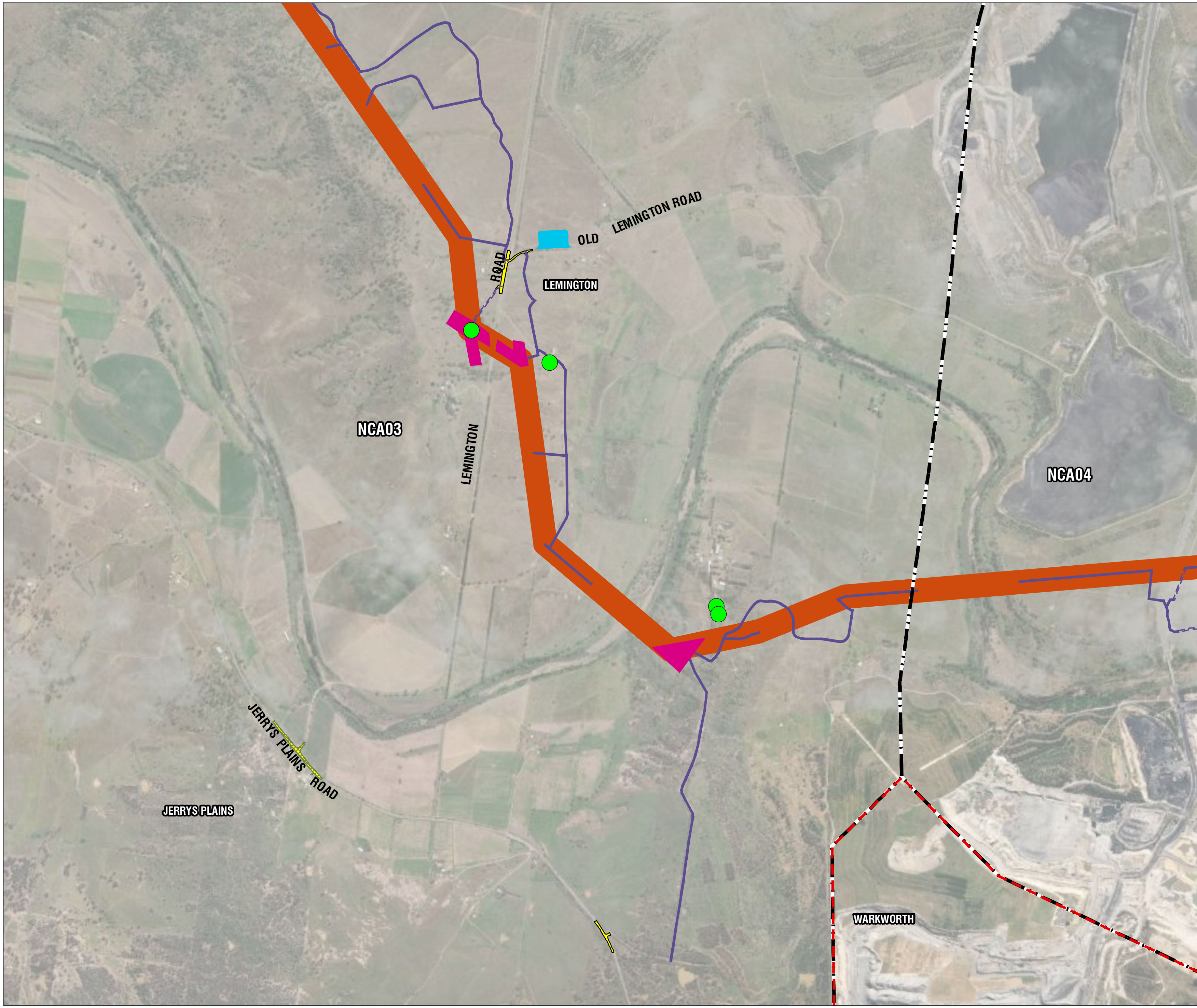
SLR Project No.: 630.032094.00001

14 July 2025

HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

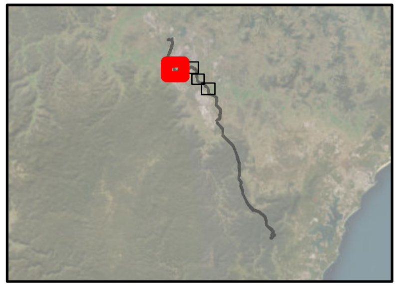
OPERATIONAL NOISE IMPACTS

ATTACHMENT I



LEGEND

- Potentially impacted receivers
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Intersection (intensive)
- Stringing station



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:30,000 at A4
Project Number:	630.032094
Date:	11-Jul-2025
Drawn by:	LF

SLR

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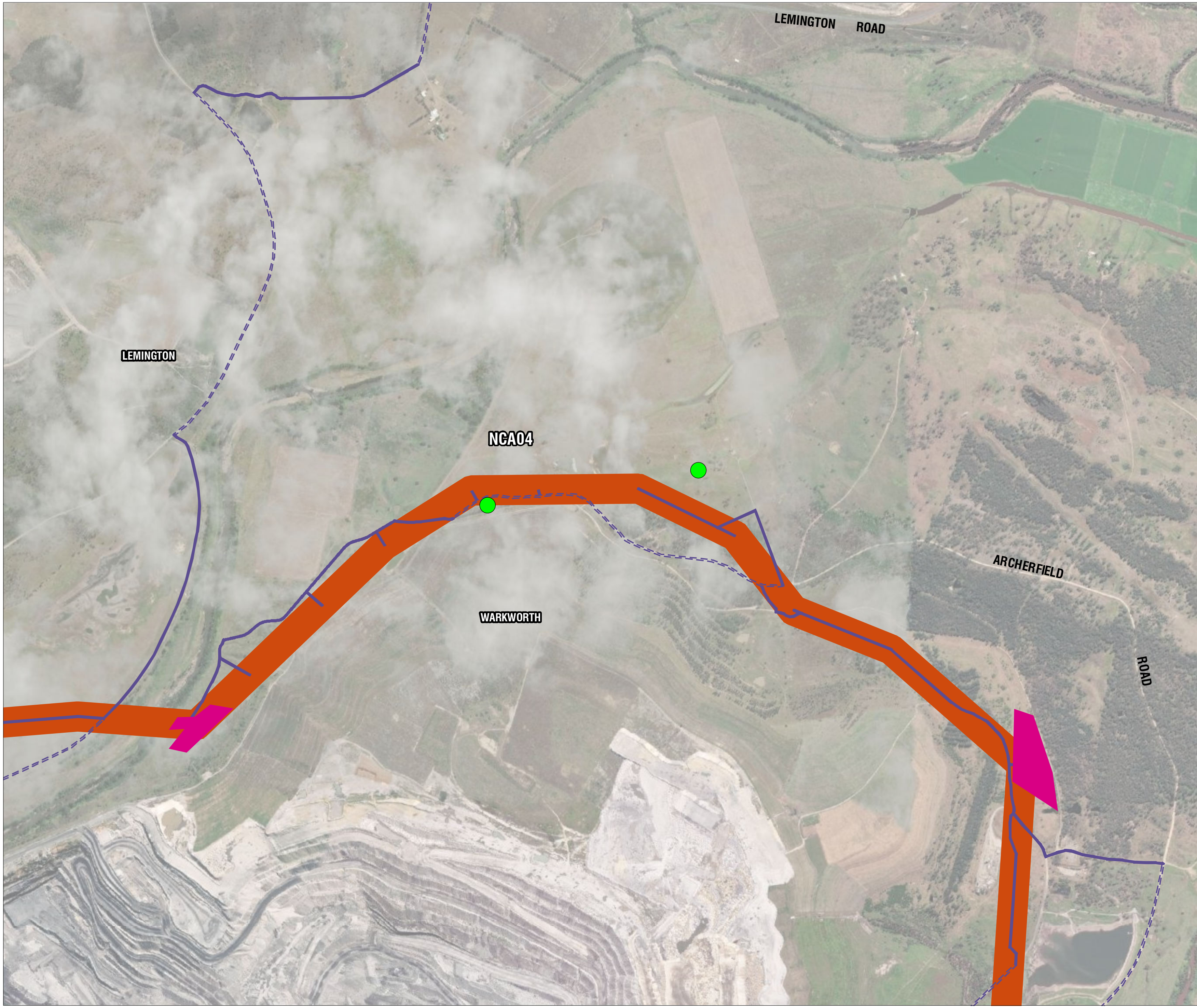


HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

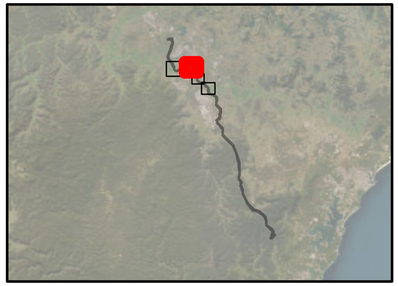
OPERATIONAL NOISE IMPACTS

Page 2 of 4

ATTACHMENT I

LEGEND

- Potentially impacted receivers
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Stringing station



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:24,000 at A4
Project Number:	630.032094
Date:	11-Jul-2025
Drawn by:	LF

SLR

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HUNTER TRANSMISSION PROJECT NOISE AND VIBRATION IMPACT ASSESSMENT

OPERATIONAL NOISE IMPACTS

Page 3 of 4

ATTACHMENT I

LEGEND

- Potentially impacted receivers
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Access tracks (minor)
- Laydown area
- Intersection (typical)
- Stringing station

0 250 500 m

Coordinate System:	GDA2020 MGA Zone 56
Scale:	1:21,000 at A4
Project Number:	630.032094
Date:	11-Jul-2025
Drawn by:	LF

SLR

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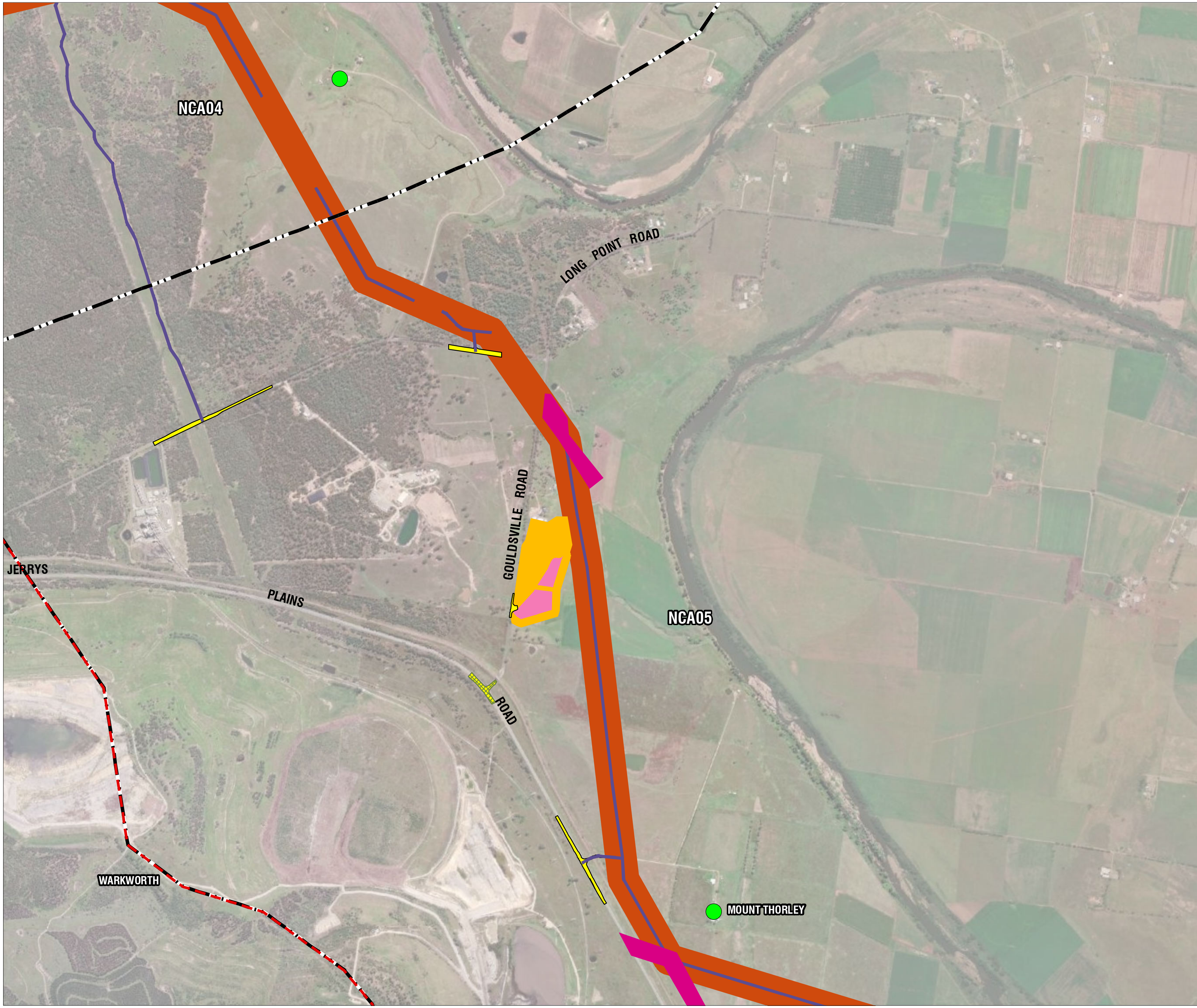


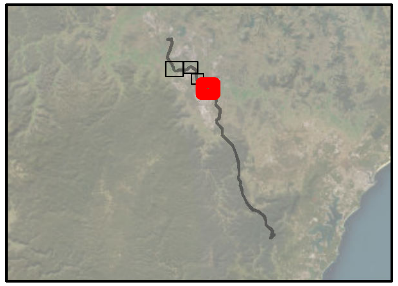
HUNTER TRANSMISSION PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

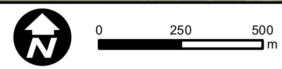
OPERATIONAL NOISE IMPACTS
Page 4 of 4

ATTACHMENT I

LEGEND

- Potentially impacted receivers
- Study area
- NCA boundary
- HTP corridor
- Access tracks (major)
- Construction support site
- Intersection (typical)
- Intersection (intensive)
- Stringing station
- Accommodation site





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Project Number:	630.032094
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Drawn by:	LF

SLR

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Making Sustainability Happen