Transgrid

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HumeLink

Noise and Vibration Impact Assessment Addendum
Technical Report 9

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Noise and Vibration Impact Assessment Addendum

Transgrid

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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 Transgrid (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.

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Executive Summary

Background

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 365 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink.

An Environmental Impact Statement (EIS) was prepared in accordance with the requirements of Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The EIS was placed on public exhibition by the NSW Department of Planning, Housing and Infrastructure (DPHI) (formerly the NSW Department of Planning and the Environment (DPE)) for a period of 42 days, between 30 August 2023 and 10 October 2023.

Transgrid has proposed amendments and refinements to the project as described in the EIS. The proposed amendments to the project include:

- changes to the transmission line corridor, including the realignment of the route through Green Hills State Forest to the west of Batlow
- change to the number and location of construction ancillary facilities, including worker accommodation facilities and construction compounds
- nomination of access tracks to support the construction and operation of the project
- additional telecommunications connections to existing substations.

The proposed refinements to the project include:

- transmission line and substation design refinements at Gregadoo
- identification of areas where controlled blasting may be required
- use of approved water sources
- use of helicopters and drones.

This report has been prepared to assess the potential noise and vibration impacts associated with these project amendments and refinements.

The project described and assessed in the EIS is referred to as the EIS project, and the project including the proposed amendments is referred to as the amended project.

The report references the methodology of *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and outlines any new or updated aspects of the methodology and assessment of impacts for the construction and operation of the amended project.

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. Construction noise levels are also compared to the highly noise affected criteria of 75 dBA, as per the ICNG. The construction noise assessment in this report presents the predicted noise impacts prior to the application of mitigation.

Operational noise has been assessed based on the Environment Protection Authority *Noise Policy for Industry* (NPfI) (EPA, 2017) methodology.

This report includes new and revised mitigation measures for the amended project.

Construction

Compared to the EIS project, construction of the amended project would include changes to the transmission line corridor, additional telecommunications connections to existing substations, changes to ancillary facilities, and new and upgraded access tracks.

Construction noise from ancillary facilities

The amended project includes revised and new construction compounds and combined worker accommodation facilities and construction compounds. Assessment is included for all ancillary facilities except for the following which are sufficiently distant to sensitive receivers such that construction noise impacts are not expected:

- Amended Bannaby 500 kV substation compound (C12)
- Amended Honeysuckle Road compound (C07)
- Snubba Road compound (C18)
- Crookwell accommodation facility and compound (AC06).

The construction noise impacts from amended project ancillary facilities are summarised below.

- Noise from ancillary facilities would be greatest during ‘site establishment’, which is expected to take around three to four weeks per construction compound and eight to twelve weeks per combined worker accommodation facility and construction compound. Worst-case daytime impacts are predicted to be:
    - ‘Highly intrusive’ (>20 dB) at up to six residential receivers closest to the Amended Memorial Avenue compound (C14), one residential receiver closest to the Yass accommodation facility and compound (AC05) and one residential receiver closest to the Green Hills accommodation facility and compound (AC07) during ‘site establishment’ which is expected for a duration of around eight to twelve weeks for combined accommodation facilities and construction compounds.
    - ‘Highly intrusive’ (>20 dB) at up to four of the residential receivers closest to the Amended Memorial Avenue compound (C14) during ‘compound operation’, which is expected for the duration of the amended project construction. The predicted noise impacts at these receivers are consistent with Technical Report 9 – Noise and Vibration Impact Assessment prepared for the EIS and has not changed due to the Amended Memorial Avenue compound (C14).
    - ‘Highly intrusive’ (>20 dB) at one residential receiver directly adjacent to the Ardrossan Headquarters Road compound (C17) during ‘site establishment’ and ‘compound operation’, however, this receiver is worker accommodation owned by the Forestry Corporation of NSW (FCNSW) and is not permanently inhabited.
    - ‘Moderately intrusive’ (11-20 dB) at the three residential receivers closest to the Tarcutta accommodation facility and compound (AC03) during ‘site establishment’ which is expected to take around eight to twelve weeks.
    - ‘Moderately intrusive’ (11-20 dB) at the one residential receiver closest to Adjungbilly accommodation facility and compound (AC04) during both ‘site establishment’ and ‘compound operation’, which is expected for the duration of the amended project construction.

  - ‘Clearly audible’ (1-10 dB) at the three residential receivers closest to the Amended Gregadoo Road compound (C06) during both ‘site establishment’ and ‘compound operation’, which is expect for the duration of the amended project construction.
  - ‘Clearly audible’ (1-10 dB) at the two residential receivers closest to Gadara Road compound (C19) and one residential receiver closest to Ellerslie Road compound (C21) during ‘site establishment’, which is expected to take around three to four weeks.
- The combined worker accommodation facilities and construction compounds would operate as worker accommodation facilities during all hours for the duration of the amended project construction. Predicted worst-case night-time impacts from ‘worker accommodation facility operation’ include:
  - 'Moderately intrusive’ (16-25 dB) at the one residential receiver closest to the Green Hills accommodation facility and compound (AC07).
  - ‘Clearly audible’ (6-15 dB) at up to four of the residential receivers closest to the Yass accommodation facility and compound (AC05) and one residential receiver closest to the Adjungbilly accommodation facility and compound (AC03).
  - ‘Noticeable’ (1-5 dB) at the three residential receivers closest to the Tarcutta accommodation facility and compound (AC03).
- Some ‘other sensitive’ receivers (medical, educational and places of worship) in Batlow are predicted to be impacted by ‘site establishment’ work at the Memorial Avenue compound (C14). These impacts at ‘other sensitive’ receivers are consistent with the assessment of the EIS project and no ‘other sensitive’ receivers are predicted to be impacted during ‘compound operation’.

Construction noise from transmission lines

The amended project includes the preferred western route through Green Hills State Forest. The amended project also includes six other minor realignments and one narrowing of the transmission line corridor compared to the EIS project.

Construction noise impacts from the construction of revised and new transmission lines are summarised below:

- Noise from construction of the Green Hills corridor amendment is predicted to result in a ‘moderately intrusive’ (11-20 dB) worst-case noise at the closest residential receiver to the corridor and ‘clearly audible’ (1-10 dB) impacts at up to 15 other residential receivers.
- The predicted impacts would be relatively short-term with up to around nine weeks of work required for the construction of each transmission line structure. Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Durations of any particular construction activity, and inactive/respite periods, may vary for a number of reasons including (but not limited to) multiple work fronts, resource and engineering constraints, work sequencing and location. Therefore, the worst-case predicted noise impacts are expected to be short-term at each residential receiver.
- Transmission line construction for the amended project is also predicted to remove noise impacts between Wondalga and Buddong, relative to the EIS project. The total number of receivers predicted to have transmission line construction noise impacts above the NMLs is approximately equivalent for the EIS project and the amended project.

- The transmission line refinement near Kyeamba Creek and Tumbarumba Road, Book Book is predicted to result in one additional residential receiver with 'clearly audible' (1-10 dB) worst-case impacts during 'earthwork and clearing', which is expected for a duration of around one to five days per transmission line structure.
- The narrowing of the project footprint at Wondalga, Gobarralong and Bowning is predicted to reduce transmission line construction noise impacts at four to eight residential receivers, depending on the work scenario.

Additional telecommunications connections between the amended project and existing Transgrid substations are proposed along the transmission line corridor at three locations. The construction noise impacts from construction of additional telecommunications connections to existing substations are summarised below:

- 'Clearly audible' (1-10 dB) worst-case impacts are predicted for the one residential receiver closest to the Gadara telecommunications connection site and Gullen Range telecommunications connection site.
- Construction at Crookwell 2 telecommunications connection site is predicted to comply with the management levels at the nearest sensitive receivers
- The additional telecommunications connections construction work is expected for a duration of around two months per location.

Further construction planning has confirmed the need for controlled blasting in areas along the transmission line corridor. Crushing may subsequently be required to break up hard rock after controlled blasting. Crushing is expected for a duration of up to around one month at any given potential controlled blasting location. The construction noise impacts from crushing are summarised below:

- 'Highly intrusive' (>20 dB) worst-case noise impact is predicted at the residential receiver closest to the potential controlled blasting areas.
- 'Moderately intrusive' (11-20 dB) impacts are predicted at up to 13 of the closest residential receivers to the potential controlled blasting areas.
- 'Clearly audible' (1-10 dB) impacts are predicted at a further 66 residential receivers.

Revised access arrangements along the length of the transmission line corridor require constructing new access tracks, upgraded access tracks and intersection upgrades across the amended project footprint.

The construction noise impacts from access tracks and intersection construction are summarised below:

- 'Highly intrusive' (>20 dB) worst-case day-time noise impacts are predicted at up to 21 and 45 of the residential receivers closest to the proposed new and upgraded access tracks, respectively.
- 'Highly intrusive' (>20 dB) worst-case day-time noise impacts are also predicted at up to six of the residential receivers closest to the potential intersection upgrades.
- Two of the residential receivers closest to new access tracks, 25 of the residential receivers closest to upgraded access tracks and one residential receiver closest to potentially upgraded intersections are predicted to be highly noise affected.
- One place of worship ('other sensitive' receiver), Greendale Uniting Church (ID: R12) is predicted to have a 'clearly audible' (1-10 dB) impact during construction of the closest new access track.

- A total of up to 474 sensitive receivers are predicted to have daytime noise impacts above the NMLs from access track construction across the amended project footprint.
- Access track construction work would be relatively short-term and is only expected to impact individual sensitive receivers for up to a few days.

Construction road traffic noise

Construction road traffic noise has been considered on all identified routes for project construction traffic. The likely influence of construction road traffic noise is assessed in accordance with the *Road Noise Policy* (RNP) criteria, which requires an increase compared to existing road traffic noise, and for the total road traffic noise (existing plus construction) to exceed a certain threshold.

Increases in road traffic noise due to construction are predicted on the majority of the construction routes, particularly on local roads, because they include local roads with relatively low existing traffic volumes. Construction traffic noise impacts will depend on how close receivers are to the proposed routes. Road traffic noise impacts are not expected for most roads where the nearest residential receiver is at least 250 metres from the road edge.

Construction vibration

Where vibration intensive equipment is required for work near to 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.

Twenty-seven of the receivers closest to the amended project footprint are within the cosmetic damage minimum working distance and 67 of the nearest sensitive receivers are within the human comfort minimum offset. The number of receivers within the recommended working distances is notably increased compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS, due to the newly defined access track locations.

Controlled blasting

Controlled blasting would be required during construction for excavation and foundation work with difficult geotechnical conditions. Twenty-one potential controlled blasting areas have been identified for the amended project. This report presents a methodology to assess impacts from airblast overpressure and ground vibration based on Australian Standard (AS) 2187.2-2006. Indicative ranges of Maximum Instantaneous Charge (MIC) have been determined to meet recommended ground vibration and overpressure limits at the closest sensitive receiver to each potential blast location. When specific controlled blasting locations are known, geotechnical investigations and further blast overpressure and vibration assessment would be undertaken, including development of a Blast Management Plan.

Aircraft

Additional information and assessment for the use of helicopters and drones for stringing transmission lines is now available with the engagement of construction contractors. Drones are also expected to be used for additional activities such as, but not limited to, surveys and vegetation management.

Noise modelling and assessment is included in this report to present indicative noise levels from the use of aircraft 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 predicted helicopter noise levels from arrivals and departures at ancillary facility potential helipads show that high maximum noise levels are predicted at residential receivers close to the potential helipads. Helicopter maximum noise levels are predicted to be greater than 85 dBA at the closest receiver to Amended Memorial Avenue compound (C14), Ardrossan Headquarters Road compound (C17) and Yass accommodation facility and compound (AC05), however, the receiver closest to Ardrossan Headquarters Road compound (C17) is worker accommodation owned by the FCNSW.

The predicted helicopter noise from arrival and departure also shows that there are several potential helipad locations where significant impacts to the noise amenity of surrounding sensitive receivers are considered unlikely due to sensitive receivers being sufficiently distant. The potential helipad locations where the maximum helicopter noise from arrival and departure is predicted to be less than 75 dBA at all nearby sensitive receivers are listed below.

- Maragle 500 kV substation compound (C05)
- Snubba Road compound (C18)
- Amended Honeysuckle Road compound (CO7)
- Crookwell accommodation facility and compound (AC06)
- Amended Bannaby 500 kV substation compound (C12)
- Ellerslie Road compound (C21)
- Gadara Road compound (C19)
- Amended Gregadoo Road compound (C06).

Helicopter noise at sensitive receivers near to potential helipads can be minimised by designing arrival and departure paths to avoid sensitive receivers.

Helicopter flight outside of the amended project footprint would be at a minimum height of either 500 ft or 1,000 ft above ground level (AGL), depending on whether the flight passes over a town. Helicopter flight outside of the amended project footprint is considered unlikely to cause significant annoyance or impact the noise amenity of sensitive receivers due the relatively high height and speed of these flight paths. It is recommended that flight paths outside the amended project footprint are alternated to avoid repeated helicopter noise at the same sensitive receivers, noting that flight paths are not known at this stage and would be subject to consultation with the Civil Aviation Safety Authority and Airservices Australia.

The maximum helicopter noise levels for work within the transmission line corridor is predicted to be greater than 85 dBA at up to 20 sensitive receivers. The maximum drone noise levels are predicted to be less than 80 dBA at all sensitive receivers. Aircraft work within the transmission line corridor would be relatively short-term for individual sensitive receivers as the work passes through the closest transmission line location. Stringing and helicopter platform work are expected to take around six to nine days per six kilometre transmission line section.

Although aircraft noise is not required to be assessed to specific construction NMLs, specific management measures are recommended to reduce aircraft noise at sensitive receivers where practicable and appropriate.

Operation

Compared to the EIS project, operation of the amended project would include changes to the proposed Gugaa 500 kV substation, transmission line corridor realignments and assessment of the Wagga to Gugaa transmission line as operating at 500 kV, noting that energisation to 500 kV would only occur at the commissioning stage of the Victoria to NSW Interconnector West (VNI West) project.

Operational noise from substations

The amended project includes adjustment of the proposed Gugaa 500 kV substation location and inclusion of additional noise generating equipment compared to the EIS project.

Operational noise impacts are predicted at up to three of the closest residential receivers depending on the inclusion of transformer walls and the presence of noise enhancing weather conditions, such as source to receiver winds. The predicted noise levels at the nearest residential receivers are generally slightly increased compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS, with increases of 1 dB to 5 dB. However, the outcome of the assessment is the same with the impacts generally being considered minor in nature and are only expected to be noticeable during noise enhancing weather conditions. It is expected that the noise criteria can be achieved via suitable positioning of transformer barriers and/or selection of equipment with consideration of sound power levels. The proposed Gugaa 500 kV substation would be designed to comply with the relevant noise criteria.

Operational noise from transmission lines

Operational transmission line noise has been assessed based on the horizontal offset distance from the amended project where audible noise is expected to exceed the night-time PNTL. The operational transmission line noise assessment is an updated assessment for the entire amended project, which considers the transmission line corridor amendments and the refinement to assess the transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV as operating at 500 kV for the amended project.

The final transmission line route will be finalised during further detailed design. The assessment conservatively assumes that the transmission line may be anywhere within the amended project transmission line corridor, with consideration of a 70 metre minimum easement. The distance at which operational transmission line noise impacts are expected varies across the amended project but is generally around 70 to 180 metres during typical fair weather conditions and 350 to 450 metres during light rain conditions. It is important to note that the assessment does not account for local topography and other factors which affect sound propagation, so this assessment is considered conservative.

During typical fair weather conditions (applicable for the majority of time), up to 16 residential receivers are identified to potentially have operational transmission line audible noise impacts. The magnitude of the potential impacts is ‘significant’ at 15 of the residential receivers and ‘negligible’ at one of the residential receivers, based on the categories outlined in the *Noise Policy for Industry* (NPfI). Based on this conservative assessment most the potential impacts during typical fair weather are likely to be ‘significant’ due to the residential receivers being within or very close to the amended project transmission line corridor.

During light rain conditions, which are expected to be the infrequently occurring worst-case condition for transmission line audible noise impacts, up to a total of 78 residential receivers have been identified to potentially have operational transmission line noise impacts. The magnitude of the potential impacts is likely to be ‘significant’ at 42, ‘moderate’ at nine, ‘marginal’ at two and ‘negligible’ at 25 of the residential receivers.

The number of residential receivers predicted to potentially experience noise impacts from transmission lines has increased by two during typical fair weather and 13 during light rain conditions, compared to the EIS project. The increase in the number of predicted impacts is primarily due to the transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV being assessed as operating at 500 kV for the amended project, where it was assessed as operating at 330 kV for the EIS project. The number of residential receivers predicted to experience noise impacts from other sections of the amended project transmission line are generally consistent with the EIS project.

Cumulative

Since the public exhibition of the EIS, an updated cumulative impact search has been undertaken and identified the following two proposed projects that were not considered in the EIS:

- Belhaven Battery Energy Storage System
- Yass Solar Farm.

Based on the proposed timing of these two projects, potential cumulative or consecutive construction noise impacts may occur with the amended project. Cumulative operational noise impacts are not expected with Yass Solar Farm and are considered unlikely with Belhaven Battery Energy Storage System. However, cumulative operational noise impacts would be subject to the operational noise assessment of these projects, which have not been completed at the time of this report.

Mitigation and management of impacts

All feasible and reasonable measures would be applied to reduce the potential noise and vibration impacts from the amended project. The noise and vibration mitigation approach would generally be consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. New and revised specific mitigation measures have been recommended based on the predicted impacts of the amended project.

The exact construction mitigation strategies would be determined as the project progresses when detailed planning information becomes available. The construction contractor(s) would be required to prepare a Noise and Vibration Management Plan (NVMP), detailing the mitigation measures and strategies, and a Blast Management Plan to minimise the potential for impacts.

Operational transmission line noise impacts would be confirmed as the project progresses. It is likely that individual agreements would be the most feasible and reasonable mitigation strategy where operational noise impacts are identified. These agreements may include property treatments to reduce noise ingress. Any agreements would be subject to the outcomes of noise monitoring and further discussions with property owners.

Summary and comparison to the EIS project

The outcomes of the construction noise assessment for the amended project are generally consistent with the outcomes of the EIS assessment.

The updates to ancillary facilities result in 42 fewer residential receivers predicted to exceed the day-time NMLs during ‘site establishment’ for the amended project compared to the EIS project and nine additional residential receivers predicted to exceed the day-time NMLs during ‘compound operation’. ‘Site establishment’ is expected to be completed within a period of three to twelve weeks, depending on whether the facility is a construction compound or combined worker accommodation facility and construction compound. ‘Compound operation’ is expected for the duration of the amended project construction which is around two and a half years.

For the majority of transmission line construction scenarios that are consistent between the amended project and the EIS project (‘site establishment’, ‘earthwork and clearing’, ‘construction of structures’, etc), the number of residential receivers with day-time NML exceedances predicted from transmission line construction for the amended project is within plus or minus four per cent of the equivalent result for the EIS project, depending on the scenario..

A further assessment of access track construction has been conducted based on the nomination of access tracks in the amended project. The magnitude and location of predicted noise impacts from access track construction represents additional information compared to the EIS assessment, which presented indicative offset distances at which impacts were expected.

Additional noise scenarios have also been considered for the proposed telecommunications connections and crushing activities for the amended project. The noise impacts from additional telecommunications connections are approximately equivalent to the telecommunications hut construction from the EIS assessment and are only predicted to exceed the day-time NML at three of the residential receivers closest to the work locations. The noise impacts from crushing are predicted to exceed the day-time NML at a total of 80 residential receivers. The assessment conservatively assumes that crushing may occur up to the boundary of each of the potential controlled blasting areas. In reality, crushing locations would be positioned away from nearby receivers where possible to reduce the potential noise impacts and may not occur at all potential blasting areas.

At the proposed Gugaa 500 kV substation the operational noise impacts are predicted to increase by 1 dB to 5 dB at the potentially impacted residential receivers compared to the EIS project. Consistent with the EIS project, the proposed Gugaa 500 kV substation would be designed to comply with the relevant noise criteria.

Additional potential operational noise impacts have been identified adjacent to the transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV substation due to this section of the transmission line being assessed to operate at 500 kV for the amended project, where it was assessed as operating at 330 kV for the EIS project.

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Attachments

Tables in Text

Figures in Text

Acronyms and Abbreviations

Term	Description / definition
AEMO	Australian Energy Market Operator
AGL	above ground level
am/pm	before noon / afternoon
amended project (the)	The CSSI project “HumeLink”, which is the subject of the Amendment Report and inclusive of the proposed amendments and project refinements to the project as described in the EIS. The project involves the construction and operation of high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.
amended project footprint (the)	The area that has been assumed for the purpose of the Amendment Report 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.
amendment	A change in what the proponent is seeking approval for following the public exhibition of the EIS. It requires changes to the project description in the EIS and amendments to the associated infrastructure application.
ANZECC	Australian and New Zealand Environment and Conservation Council
AS	Australian Standard
Bannaby 500 kV substation	The existing 500 kV substation at Bannaby
BOM	Bureau of Meteorology
brake and winch sites	A brake and winch site is a temporarily cleared area where plant and equipment are located to spool and winch conductors into place on transmission line structures. The locations of the brake and winch sites may or may not be within the nominated transmission line easement. These sites are only required for construction of the project and do not need to be maintained during operation.
CEMP	Construction Environmental Management Plan
CORTN	Calculation of Road Traffic Noise
CNVG	Construction Noise and Vibration Guideline (Roads), Transport for NSW, 2023
construction compounds	Main construction compounds proposed for construction of the project. Each main construction compound would accommodate a range of facilities which may include (but not limited to): • laydown areas • site offices • amenities • construction support facilities such as vehicle and equipment storage, maintenance sheds, chemical/fuel stores and stockpile areas • concrete batching plants • helipads • crushing/screening plants • parking.

Term	Description / definition
CPA	Closest Point of Approach
CSSI	Critical State Significant Infrastructure
DA	Development Application
dB	decibel
dBA	decibel A-weighted
CASA	Civil Aviation Safety Authority
DECC	Department of Environment and Climate Change (now EPA)
DECCW	Department of Environment, Climate Change and Water (now EPA)
DIN	Deutsches Institut für Normung (German institute for standardisation)
DPHI	NSW Department of Planning, Housing and Infrastructure
EIS	Environmental Impact Statement
EIS project (the)	The CSSI project "HumeLink", which was the subject of the Environmental Impact Statement. The project involves the construction and operation of high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environment Protection Licence
FCNSW	Forestry Corporation of NSW
future Maragle 500 kV substation	The future Maragle 500/330 kV substation that would be built under the Snowy 2.0 Transmission Connection Project, which is subject to separate planning approval (reference SS1-9717, EPBC 2018/836)
helicopter platform work	Workers on a suspended aerial platform attached to a helicopter.
HNA	highly noise affected. Relates to construction noise levels of ≥75 dBA and is the point above which there may be strong community reaction to construction noise levels.
HumeLink	The project
Hz	Hertz
ICNG	Interim Construction Noise Guideline, Department of Environment and Climate Change, 2009
Impact magnitude	The numeric value of a predicted level above the criteria.
Impact significance	The importance of a residual impact in relation to determining receiver-based mitigation per the NPfI.
INP	*Industrial Noise Policy* (EPA, 2000)
kV	kilovolt
kVA	kilovolt-amps
km	kilometre
L_{Aeq}	The average noise level during a measurement period, such as the day-time or night-time

Term	Description / definition
L_{AFmax}	The maximum noise level measured during a monitoring period, using 'fast' weighting
LEP	Local Environmental Plan
LGA	Local Government Area
m	metre
MIC	maximum instantaneous charge, which is the effective charge mass per delay
MVA	megavolt amperes
MVAr	megavolt ampere of reactive power
m/s	metres per second
mm/s	millimetres per second
NER	Neutral Earthing Reactor
NSW	New South Wales
NML	Noise Management Level
NPfI	*Noise Policy for Industry* (EPA, 2017)
NVMP	Noise and Vibration Management Plan
OOH	out-of-hours
OOHW	out-of-hours work
PNTL	Project Noise Trigger Level
POEO Act	*Protection of the Environment Operations Act 1997*
proposed Gugaa 500 kV substation	The new 500/330 kV substation proposed near Wagga Wagga
RBL	Rating Background Level
refinement	Refinements to the project are defined as aspects of the project that generally fit within the limits set by the project description in the EIS. Refinements do not change what is being sought for approval or require an amendment to the infrastructure application for the project
RPA	Remote Piloted Aircraft
SEARs	Secretary's Environmental Assessment Requirements
transmission line corridor	An area generally 200 metres wide that the transmission line route and easement would be located within
transmission line easement	A legal right attached to a parcel of land that enables the non-exclusive use of the land by a third party other than the owner. For transmission lines, an easement defines the corridor area where the lines are located and that allows access, construction and maintenance work to take place. The easements for the 500 kV transmission lines would typically be 70 metres wide. However, a few select locations would require wider easements up to 130 metres wide for specific engineering or property reasons. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets.
transmission line route	The location of the transmission line structures along the middle of the transmission line easement.

Term	Description / definition
transmission line structures	Proposed free standing structures to support the transmission lines
Transgrid	The project is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage transmission network in NSW and the ACT, and is the Authorised Network Operator for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*
VNI West	Victoria to NSW Interconnector West
Wagga 330 kV substation	The existing 330/132 kV substation located in Wagga Wagga
worker accommodation facility	Temporary worker accommodation facilities that would be established for the construction workers.
work site	A general word to describe a defined construction location.

1 Introduction

1.1 Background

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 365 kilometres (km) of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across six Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire, Yass Valley and Goulburn Mulwaree. HumeLink is a priority project for the Australian Energy Market Operator (AEMO) and the Commonwealth and NSW governments and has been declared as Critical State Significant Infrastructure (CSSI). The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future.

An Environmental Impact Statement (EIS) was prepared in accordance with the requirements of Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The EIS was placed on public exhibition by the NSW Department of Planning, Housing and Infrastructure (DPHI) (formerly the NSW Department of Planning and Environment (DPE)) for a period of 42 days, between 30 August 2023 and 10 October 2023.

Transgrid has proposed amendments and refinements to the project as described in the EIS. The amendments provide functional improvements to the design and construction methodology of the project. The proposed amendments take into account submissions received during the public exhibition of the EIS and ongoing design and construction methodology development following the selection of the construction contractors. Project refinements have also been made as part of the ongoing design and construction methodology development since the EIS was exhibited. These amendments and refinements have been described and considered in relevant impact assessments.

1.2 Key features of the project (as publicly exhibited)

The key components of the project as outlined and assessed in the EIS included:

- construction and operation of around 360 kilometres of new double circuit 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle
- construction of a new 500/330 kV substation at Gregadoo (Gugaa 500 kV substation) approximately 11 kilometres south-east of the existing Wagga 330/132 kV substation (Wagga 330 kV substation)
- demolition and rebuild of a section of Line 51 (around two kilometres in length) as a double circuit 330 kV transmission line connecting into the Wagga 330 kV substation
- modification of the existing Wagga 330 kV substation and Bannaby 500/330 kV substation (Bannaby 500 kV substation) to accommodate the new transmission line connections
- connection of transmission lines to the future Maragle 500/330 kV substation (Maragle 500 kV substation, approved under the Snowy 2.0 Transmission Connection Project (SSI-9717))
- provision of one optical repeater telecommunications hut and associated connections to existing local electrical infrastructure
- establishment of new and/or upgraded temporary and permanent access tracks

- ancillary works required for construction of the project such as construction compounds, worker accommodation facilities, utility connections and/or relocations, brake and winch sites, and helipad/helicopter support facilities.

1.3 Overview of the proposed amendments and refinements

Since the public exhibition of the EIS, several amendments and refinements to the project have been proposed.

The proposed amendments to the project include:

- changes to the transmission line corridor, including the realignment of the route through Green Hills State Forest to the west of Batlow
- change to the number and location of construction ancillary facilities, including worker accommodation facilities and construction compounds
- nomination of access tracks to support the construction and operation of the project
- additional telecommunications connections to existing substations.

The proposed refinements to the project include:

- transmission line and substation design refinements at Gregadoo
- identification of areas where controlled blasting may be required
- use of approved water sources
- use of helicopters and drones.

Refer to **Chapter 2** of this report for a detailed description of amendments and refinements relevant to this assessment.

Figure 1-1 shows the location of the amended project and **Figure 1-2** shows the key components of the amended project.

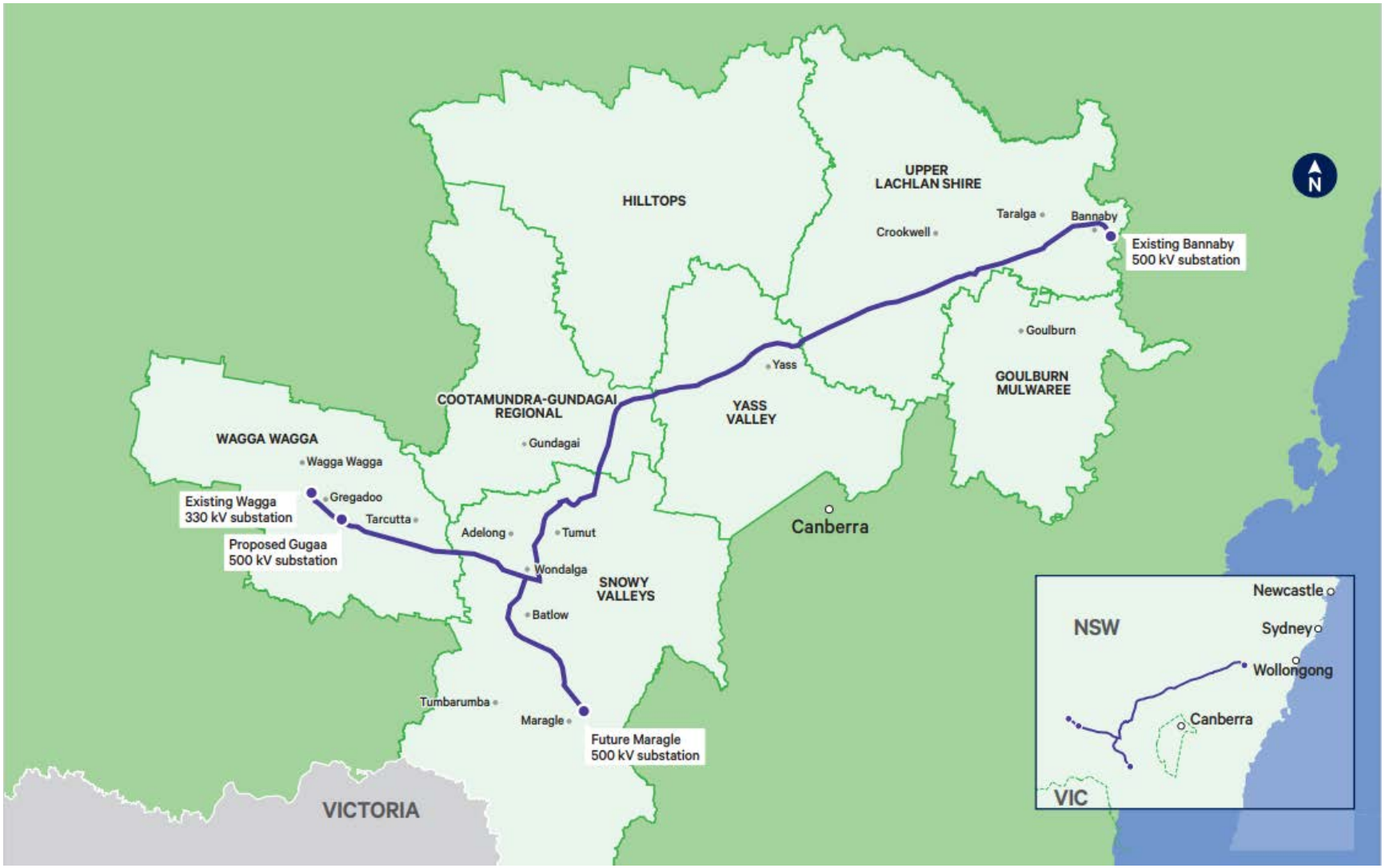
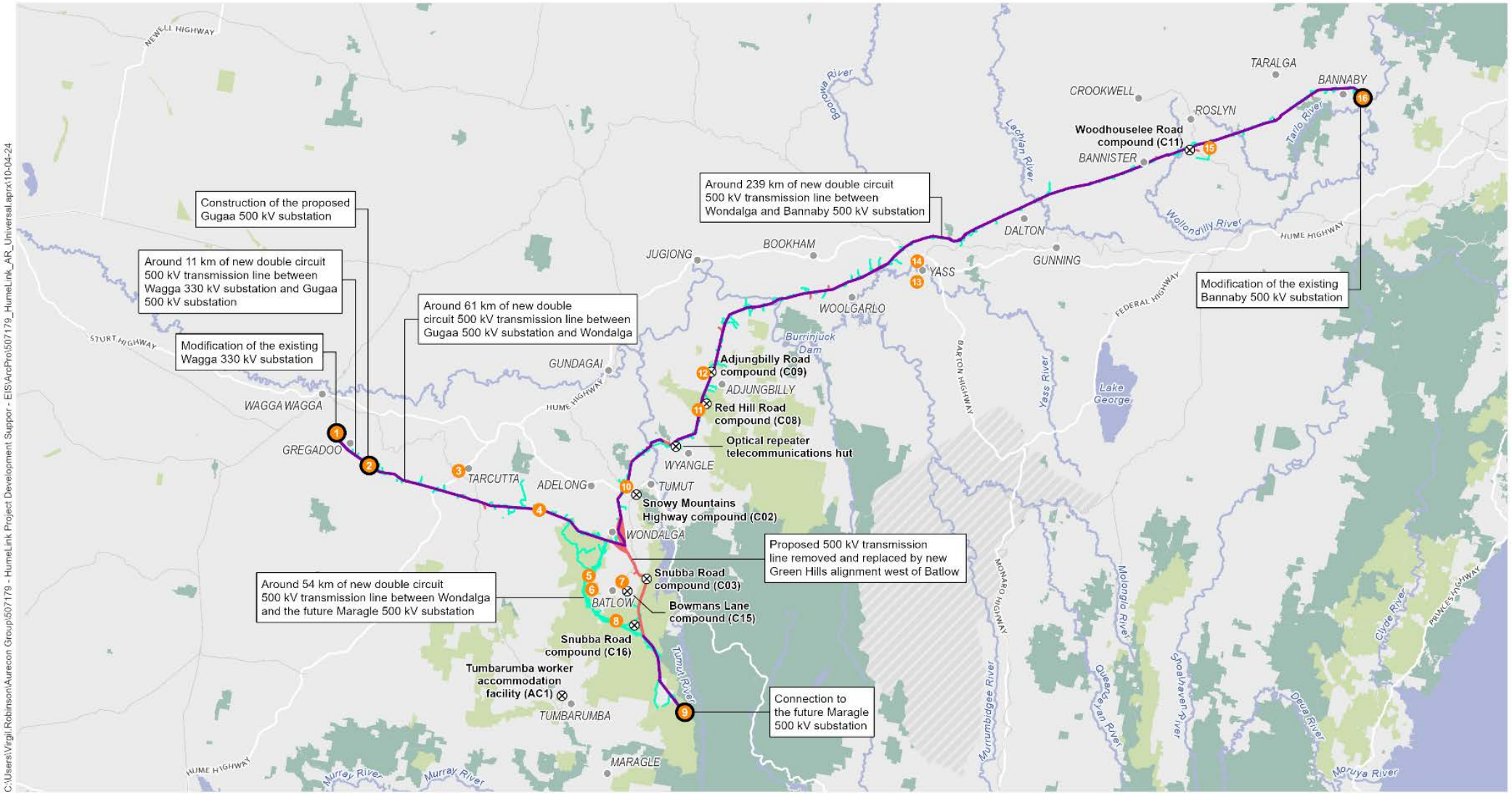


Figure 1-1 Location of the amended project



EIS project footprint
Removed footprint
Amendments
Removed project facility
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway

Construction ancillary facilities

1. Wagga 330 kV substation compound (C01)
2. Amended Gregadoo Road compound (C06)
3. Tarcutta accommodation facility and compound (AC03)
4. Ellerslie Road compound (C21)
5. Ardrossan Headquarters Road compound (C17)
6. Green Hills accommodation facility and compound (AC07)
7. Amended Memorial Avenue compound (C14)
8. Snubba Road compound (C18)
9. Maragle 500 kV substation compound (C05)
10. Gadara Road compound (C19)
11. Amended Honeysuckle Road compound (C07)
12. Adjungbilly accommodation facility and compound (AC04)
13. Yass substation compound (C10)
14. Yass accommodation facility and compound (AC05)
15. Crookwell accommodation facility and compound (AC06)
16. Amended Bannaby 500 kV substation compound (C12)

Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40 km

Projection: GDA 1994 MGA Zone 55

C:\Users\Virgil.Robinson\Aurecon Group\507179 - HumeLink Project Development Suppor - EIS\ArcPro\507179_HumeLink_AR_Universal.aprx\10-04-24

Figure 1-2: Key components of the amended project

1.4 Purpose and structure of this report

This report forms an addendum to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The purpose of this report is to support the HumeLink Amendment Report by assessing the potential noise and vibration impacts associated with the proposed amendments and refinements to the project.

This report is structured as follows:

- Chapter 1 (Introduction) – provides an overview of the project, the proposed amendments and the purpose of this report.
- Chapter 2 (Summary of the proposed amendments and refinements) – provides a description of the proposed amendments and refinements relevant to this assessment.
- Chapter 3 (Legislative and policy context) – provides an outline of the key legislative requirements and policy guidelines relating to the proposed amendments to the project.
- Chapter 4 (Methodology) – provides an outline of the methodology used for the preparation of this report.
- Chapter 5 (Existing environment) – describes the existing environment with reference to the potential for noise and vibration impacts.
- Chapter 6 (Assessment of construction impacts) – describes the potential construction noise and vibration impacts associated with the proposed amendments and refinements of the project.
- Chapter 7 (Assessment of aircraft noise) – provides a prediction of potential aircraft noise levels during construction associated with the proposed amendments to the project.
- Chapter 8 (Assessment of operational impacts) – describes the potential operational noise and vibration impacts associated with the proposed amendments to the project.
- Chapter 9 (Assessment of cumulative impacts) – describes the potential cumulative noise and vibration impacts associated with the proposed amendments to the project.
- Chapter 10 (Management of impacts) – outlines any new or revised mitigation measures for the proposed amendments to the project.
- Chapter 11 (Conclusion) – provides a conclusion of the potential impacts of the proposed amendments to the project with reference to the potential for noise and vibration impacts.
- Chapter 12 (References) – identifies the key information sources (including reports and documents) used to generate the assessment.

This report generally follows the same methodology as *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and responds directly to the Planning Secretary's Environmental Assessment Requirements (SEARs) specific to noise and vibration.

This report presents indicative construction and operational noise and vibration impacts for the purpose of planning approval and is not intended to be used for any other purpose.

1.5 Key project terms

The report uses specific acoustic terminology, and an explanation of common terms is included in **Attachment A**. A glossary is also provided at the start of this report which lists the various terms used.

The key project terms used in this assessment include:

Amended project

The CSSI project “HumeLink”, which is the subject of the Amendment Report and inclusive of the proposed amendments and project refinements to the project as described in the EIS. The project involves the construction and operation of high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.

Amended project footprint

The area that has been assumed for the purpose of the Amendment Report 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.

EIS project

The CSSI project “HumeLink”, which was the subject of the EIS. The project involves the construction and operation of high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.

EIS project footprint

The area that was assumed for the purpose of the 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.

Amended study area

The noise and vibration study area is defined by a two kilometre buffer around the amended project footprint. This buffer distance is consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and is expected to represent the extent of all sensitive receivers potentially impacted by noise and vibration from the construction and operation of the amended project. The amended study area has been updated based on amended project footprint.

The amended noise and vibration study area, sensitive receivers and key project features described in this assessment are shown in **Attachment B**.

2 Summary of the proposed amendments and refinements

Transgrid has identified several proposed amendments and refinements to the project as described in the EIS. These amendments and refinements reflect functional improvements to the design and construction methodology of the project. They consider:

- feedback received from stakeholders prior to and during the public exhibition of the EIS
- comments made in formal submissions on the EIS
- ongoing design and construction methodology development by the construction contractors.

Amendments to the project are defined as changes in what the proponent is seeking approval for following the public exhibition of the EIS. Project amendments require changes to the project description in the EIS and amendments to the associated infrastructure application.

The proposed amendments to the project include:

- changes to the transmission line corridor including the realignment of the route through Green Hills State Forest to the west of Batlow
- changes to the number and location of construction ancillary facilities including worker accommodation facilities and construction compounds
- nomination of access tracks to support the construction and operation of the project
- additional telecommunications connections to existing substations.

Refinements to the project are defined as aspects of the project that generally fit within the limits set by the project description in the EIS. Refinements do not change what is being sought approval for or require an amendment to the infrastructure application for the project. For completeness, these refinements have been considered in this report.

The proposed refinements to the project include:

- transmission line and substation design refinements at Gregadoo
- identification of areas where controlled blasting may be required
- use of approved water sources
- use of helicopters and drones.

Table 2-1 describes the proposed amendments and refinements relevant to this technical report. A full description of the amended project is provided in Chapter 3 (Description of the amended project) of the Amendment Report. The construction contractors will continue to refine and confirm the design and construction methodology during detailed design and construction planning.

Table 2-1 Proposed amendments and refinements relevant to this assessment

Amendment / refinement	Description
Amendments	
Changes to the transmission line corridor	The amended project includes the preferred western route through Green Hills State Forest. The new 32.5 km route extends from Wondalga through the Green Hills State Forest before travelling to the west and south of Batlow and connecting to the EIS project transmission line corridor in Bago State Forest. In addition, the following minor changes have been made to the transmission line corridor following design considerations and feedback from landholders: • 1.4 km realignment of the corridor to the north between Ashfords Road to Ivydale Road, Gregadoo • 2.5 km realignment of the corridor to the south across Kyeamba Creek and Tumbarumba Road, Book Book • 2.7 km realignment of the corridor to the east near Snowy Mountains Highway, Gadara • 1.4 km realignment of the corridor to the east adjacent Minjary National Park at Gocup • 5.9 km realignment of the corridor from north of the crossing of Tumut River to south of the crossing of Killimicat Creek, Killimicat (including a minor 50 m shift to the north for 2.1 km and a 2.6 km shift to the south from Brungle Road to before the crossing of Killimicat Creek) • 0.4 km realignment of the corridor to the north at Bannister, about 2.7 km west of Crookwell Road/Goulburn Road • narrowing of the project footprint at Wondalga, Gobarralong and Bowning.
Updates to construction ancillary facilities including worker accommodation facilities and construction compounds	**Changes to construction compounds** Following further construction planning and consultation with landowners, the following compounds described and assessed in the EIS have been removed from the project: • Snowy Mountains Highway compound (C02) • Snubba Road compound (C03) • Red Hill Road compound (C08) • Adjungbilly Road compound (C09) • Woodhouselee Road compound (C11) • Bowmans Lane compound (C15) • Snubba Road compound (C16).

Amendment / refinement	Description
	These have been replaced with the following compounds: • Ardrossan Headquarters Road compound (C17) – located about 7.6 km west of Batlow • Snubba Road compound (C18) – located about 7.7 km south of Batlow • Gadara Road compound (C19) – located about 4.9 km west of Tumut • Ellerslie Road compound (C21) – located about 13.1 km south-west of Adelong. The proposed footprint for the Gregadoo Road compound (C06), Honeysuckle Road compound (C07), Bannaby substation compound (C12) and Memorial Avenue compound (C14) have also been revised. Following these changes, there are now 11 standalone construction compounds proposed.
	Changes to accommodation facilities The Tumbarumba accommodation facility (AC01) is no longer required. The amended project includes the following new combined worker accommodation facilities and compounds: • Tarcutta accommodation facility and compound (AC03) – located about 1.5 km south-west of Tarcutta • Adjungbilly accommodation facility and compound (AC04) – located about 21.7 km east of Gundagai • Yass accommodation facility and compound (AC05) – located on the north-western outskirts of the Yass township • Crookwell accommodation facility and compound (AC06) – located off Graywood Siding Road, about 18.1 km north of Goulburn • Green Hills accommodation facility and compound (AC07) – located about 6.5 km west of Batlow.
Nomination of access tracks	New access tracks or upgrades to existing access tracks are proposed to connect construction areas and the transmission line easement to the existing road network. Existing unsealed local roads, forest roads, and tracks proposed for use as part of the access arrangements may also require minor improvement work, such as grading or resurfacing, or drainage work.
Additional telecommunications connections to existing substations	Removal of the telecommunications hut at Killimicat from the scope and inclusion of additional telecommunications connections to the following Transgrid substations: • Gadara 132 kV substation • Gullen Range 330 kV substation • Crookwell 2 330 kV substation.

Amendment / refinement	Description
Refinements	
Transmission line and substation design refinements at Gregadoo	The transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV substation has been assessed as operating at 500 kV for the amended project. However, energisation to 500 kV would only occur at the commissioning stage of the Victoria to NSW Interconnector West (VNI West) project, which is subject to a separate Planning Approval. Until such time, the line will operate at 330 kV.
	Associated changes with energisation to 500 kV include additional infrastructure at the proposed and relocated Gugaa 500 kV substation. The area of land required for the proposed Gugaa 500 kV substation has also increased in size.
Identification of areas where controlled blasting may be required	Preliminary geotechnical investigations and further consideration of terrain along the amended project alignment have identified several potential areas where controlled blasting may be required.
Use of helicopters and drones	Additional information and assessment for the use of helicopters and drones for stringing transmission lines is now available with the engagement of construction contractors and this information has been presented in the Amendment Report. Drones are also expected to be used for additional construction activities such as, but not limited to, surveys and vegetation management. With the use of helicopters confirmed by the construction contractors and the proposed changes to ancillary facilities, the potential helipad locations have also been revised.

3 Legislative and policy context

There have been no changes to the legislative and policy context presented in Chapter 3 of *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

4 Methodology

The assessment in this report generally follows the same methodology as *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. Any new or updated aspects of the methodology are summarised in the following section. A detailed methodology is provided in Chapter 4 of *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

Generally, components of the construction impact assessment in this report address additional areas or new activities for the amended project and should be read in conjunction with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. Components of the EIS project that are no longer included in the amended project are also noted in the following section in terms of reduced impacts relative to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The operational assessment in this report is an updated assessment of all operational noise sources associated with the amended project and supersedes *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

Table 4-1 summarises the proposed amendments in relation to the noise and vibration assessment and describes where in this report the further assessment has been addressed.

Table 4-1 Proposed amendments and refinements for noise and vibration impact assessment

Amendment / refinement[1]	Noise and vibration context	Where addressed in Addendum Report
Amendments		
Changes to the transmission line corridor	Transmission line corridor amendments are assessed for potential construction and operational impacts. Construction noise assessment for the 32.5 km amended corridor area from Wondalga through the Green Hills State Forest is included as a standalone section in this report. Other minor corridor amendments are briefly summarised, identifying any potential additional or changed noise and vibration impacts. Amendments resulting in a narrowing of the transmission line corridor are not expected to result in additional or changed impacts and have not been assessed.	**Section 6.2**

Amendment / refinement[1]	Noise and vibration context	Where addressed in Addendum Report
Updates to construction ancillary facilities including worker accommodation facilities and construction compounds	**Changes to construction compounds** All revised and new construction compounds have been considered for potential construction noise impacts. Assessment is included for all construction compounds except for the following, which are sufficiently distant to the nearest sensitive receivers such that no construction noise impacts are predicted: • Amended Bannaby 500 kV substation compound (C12) (1.1 km to nearest receiver) • Amended Honeysuckle Road compound (C07) (1.6 km to nearest receiver) • Snubba Road compound (C18) (3 km to nearest receiver).	**Section 6.1**
	Changes to accommodation facilities All new combined worker accommodation facilities and construction compounds have been considered for potential construction noise impacts. Assessment is included for all new combined worker accommodation facilities and construction compounds except for the Crookwell accommodation facility and compound (AC06), which is over 1.5 km from the nearest sensitive receiver and is sufficiently distant such that no construction noise impacts are predicted.	**Section 6.1**
Nomination of access tracks	Access tracks have been assessed for potential construction noise and vibration impacts based on revised access track locations. *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS noted that potential access tracks would be spread across the project footprint. Since final locations were not known at the time, the assessment included indicative screening distances at which potential impacts were expected. At the time of this assessment new or upgraded access tracks are proposed, and they have been included in the assessment accordingly. There are also several intersections across the amended project footprint connecting existing roads to the new and upgraded access tracks that would be used by construction vehicles. The intersections may require traffic control, additional signage or upgrade work.	**Section 6.2.5**
Additional telecommunications connections to existing substations	This amendment involves a new construction activity and is assessed for potential construction noise impacts.	**Section 6.2.3**
Refinements		
Transmission line design refinements	The operation of the 500 kV transmission line to the existing Wagga 330 kV substation is assessed for potential operational noise impacts.	**Section 8.2**

Amendment / refinement[1]	Noise and vibration context	Where addressed in Addendum Report
Substation design refinements	The updated proposed Gugaa 500 kV substation layout is assessed for potential operational noise impacts.	**Section 8.1**
Identification of areas where controlled blasting may be required	Potential controlled blasting areas have been included as part of the amended project and have been included in a more detailed blasting assessment compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. Indicative maximum instantaneous charge (MIC) calculations are undertaken for each potential controlled blasting area to achieve compliance at the nearest sensitive receiver.	**Section 6.6**
Use of helicopters and drones	Additional information regarding the potential use of helicopters and drones has been included in a new qualitative component of the noise assessment for the amended project. *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS noted that regulation does not require a specific assessment of aircraft noise during construction. This is unchanged; however, prediction of potential aircraft noise is included in this assessment for information purposes.	**Chapter 7**
Note 1: Refer to **Table 2-1** for further descriptions of amendments and refinements.		

Areas and components of the amended project that are not included in the construction assessment in this report are expected to be unchanged from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS in terms of potential construction noise and vibration impacts. Project components with unchanged noise and vibration impacts from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS include:

- Construction noise from the following ancillary facilities:
  - Wagga 330 kV substation compound (C01)
  - Maragle 500 kV substation compound (C05)
  - Amended Honeysuckle Road compound (C07)
  - Yass substation compound (C10)
  - Amended Bannaby 500 kV substation compound (C12).
- Construction noise impacts from transmission line construction in areas other than the Green Hills corridor amendment and the seven other corridor refinements (refer to **Section 6.2**).

4.1 Monitoring approach

Additional unattended ambient noise monitoring was completed in the amended study area during October 2023. The measured noise levels have been used to determine the existing noise environment and to set criteria to assess the potential impacts from the amended project.

Monitoring locations were selected where the amended project includes additional long term construction noise sources near to groups of sensitive receivers. The noise monitoring equipment and methodology is consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

All noise monitoring locations are shown in **Attachment B**.

4.2 Construction assessment approach

4.2.1 Construction scenarios

Consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS; representative construction scenarios have been used to assess the likely impacts from construction activities. Updated scenarios due to the amended project are described in **Table 4-2**.

Scenarios that have not changed since *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS are also included in the assessment of the amended project (refer to **Chapter 6**) and are described in Section 4.3 of *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

Equipment lists and sound power level data is provided in **Attachment C**, for all unchanged, new and updated scenarios associated with the amended project.

Table 4-2 Construction scenario descriptions relevant to the noise and vibration assessment

Scenario	Description
Updated scenarios	
Transmission lines – Earthwork and clearing	**EIS assessment:** Clearing of vegetation at and between the transmission line structures. Clearing of topsoil and excavation work at each transmission line structure work site for the installation of foundations, levelling around the individual structure foundations, drainage and grading or preparation for construction at the structure work site. Excavations would typically be up to five metres in depth. Earthwork and establishment of construction pads and brake and winch sites. This scenario is also representative of the demolition of the existing section of Line 51 connecting to Wagga 330 kV substation. **Amendment Report assessment:** The requirement for a tub grinder/mulcher and chainsaw has been identified for this scenario's equipment list. Although, the noise scenario is designed to be representative of concurrent equipment being used in the same area, and this scenario already includes noise intensive equipment such as a rockbreaker and vibratory roller, the tub/grinder mulcher and chainsaw are not expected to be used in the same area and at the same time as the noise intensive earthwork equipment. Therefore, the sound power level applied to this scenario in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS is considered representative of the reasonable 'worst-case' scenario for the amended project and has not been changed for this assessment.

Scenario	Description
Transmission lines – Construction of structures	**EIS assessment:** Construction of transmission line structures by assembling sections of the structures on the ground and hoisting or lifting successive sections into place using cranes. Alternatively, transmission line structures may be erected in place on the footings by installing individual sections. These transmission line structures would include infrastructure such as step bolts, climbing attachment plates, ladders, platforms, climbing barriers, identification plates, warning plates and other fixtures and fittings for the attachment of earth wires and insulators. **Amendment Report assessment:** The requirement for an elevated working platform has been identified for this scenario's equipment list. This has been added to the assessed scenario but does not result in an increase of the sound power level applied to this scenario due to other more noise intensive equipment items controlling the overall noise level.
Access tracks	**EIS assessment:** Construction of access tracks to accommodate safe access for construction machinery and materials to each transmission line structure work site. The scenario presented in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS focussed on access tracks being sited primarily within the EIS project footprint. **Amendment Report assessment:** The requirement for construction of new and upgrading of existing tracks/roads to support the amended project represents a substantial change to the scenario presented in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. For this assessment, proposed access tracks are part of the amended project footprint with multiple intersection arrangements along the transmission line corridor. This addendum report focusses on access track construction within two sub-scenarios, namely new tracks and upgraded tracks for the purposes of assessing potential noise and vibration impacts. The upgrade scenario is expected to require slightly less noise intensive equipment over a likely shorter duration. The upgrade scenario is also conservatively applied to all identified intersections for the amended project.
Additional scenarios (design amendments)	
Additional telecommunications connections to existing substations	Additional telecommunications connections are proposed between the amended project and existing Transgrid substations at three locations. This work is expected to include noise producing equipment for excavation, deliveries, cable installation and compaction.
Crushing	Crushing of rock is expected in areas where controlled blasting is undertaken. Crushing would be required to break down hard rock for transport. The work is expected to include noise producing equipment such as excavators, loaders, trucks, mobile crushers and screeners.

There are no changes to the proposed working hours or indicative work durations presented in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The additional scenarios 'Additional telecommunications connections to existing substations' and 'Crushing' in **Table 4-2** are proposed during standard construction hours only, as defined in the Department of Environment and Climate Change, Interim Construction Noise Guideline (ICNG) (DECC, 2009).

4.2.2 Construction road traffic noise approach

The potential impacts from construction traffic on public roads have been predicted using the Calculation of Road Traffic Noise (CORTN) algorithm, consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

The roads expected to carry traffic for construction of the amended project have been updated based on extractive materials locations and the newly proposed construction compounds and combined worker accommodation facilities and construction compounds (refer to *Technical Report 16 – Revised Traffic and Transport Impact Assessment* of the Amendment Report for full road details).

The assessment of potential construction traffic noise in **Section 6.3** in this report includes consideration of all roads expected to carry traffic for construction of the amended project.

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, using the same methodology and assumptions as *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

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

4.2.3 Construction vibration approach

The potential impacts during vibration intensive work have been assessed using the Construction Noise and Vibration Guideline (Roads) (CNVG) (TfNSW, 2023) minimum working distances for cosmetic damage and human response consistent with the methodology in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The assessment identifies structures which are within the minimum working distances based on the vibration intensive construction scenarios shown in **Table 4-3**.

Table 4-3 Vibration intensive equipment

Scenario	Vibration intensive equipment	Minimum working distance		
		Cosmetic damage	Heritage items	Human response
Substations: Earthwork and vegetation clearance **Transmission lines:** Access tracks Earthwork and clearing	Medium hydraulic hammer	7 m	15 m	23 m
Transmission lines: Brake and winch sites	Medium vibratory roller	15 m	31 m	100 m
Substations: Earthwork and vegetation clearance **Transmission lines:** Access tracks Earthwork and clearing	Large vibratory roller	25 m	50 m	100 m
Note 1: Other items of vibration generating equipment may be required at times during the works, however, they are expected to be less vibration intensive.				

The construction vibration assessment in **Section 6.5** includes consideration of the entire amended project footprint to account for the updated access track locations.

4.2.4 Construction controlled blasting approach

The approach for the assessment of controlled blasting is generally consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS in accordance *ANZECC Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) and implementing *Australian Standard* (AS) *2187.2-2006* methodology.

Further construction planning has confirmed the need for controlled blasting since the preparation of *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. For the amended project, 21 potential controlled blasting areas are nominated based on geotechnical investigations. Potential controlled blasting areas and the nearest sensitive receivers are shown in **Attachment B**.

It is important to note that while some of these areas are relatively large, these are nominated areas of potential controlled blasting for some construction activities where hard rock is expected to occur. Controlled blasting may be required within these areas to facilitate construction.

The assessment in **Section 6.6** includes indicative MIC calculations for the potential controlled blasting areas. The MIC values are optimised to meet the criteria at the closest sensitive receivers.

4.3 Aircraft noise approach

4.3.1 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*. This Regulation applies to the noise emissions from aircraft including helicopters and remote piloted aircraft (RPAs, commonly referred to as drones).

The regulations require that a noise certificate be issued for the aircraft or RPA 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 supporting aircraft operation such as truck refuelling at potential helipads during construction is assessed against the ICNG.

Compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS, additional information regarding aircraft use during construction is now available and is summarised below:

- Stringing work for the entire transmission line corridor may utilise helicopters or drones. Stringing work would include flights within the transmission line corridor around transmission line structure height to install draw wires between the transmission line structures. Helicopters and drones may also be used for helicopter platform work, which involves workers on a suspended aerial platform.
- Drones may also be used for surveys and vegetation management within the transmission line corridor.
- Helicopters would be based at potential helipads, located at the following construction compounds and combined worker accommodation facilities and construction compounds:
    - Maragle 500 kV substation compound (C05)
    - Amended Gregadoo Road compound (C06)

- Amended Honeysuckle Road compound (CO7)
- Amended Bannaby 500 kV substation compound (C12)
- Amended Memorial Avenue compound (C14)
- Ardrossan Headquarters Road compound (C17)
- Snubba Road compound (C18)
- Gadara Road compound (C19)
- Ellerslie Road compound (C21)
- Tarcutta accommodation facility and compound (AC03)
- Adjungbilly accommodation facility and compound (AC04)
- Yass accommodation facility and compound (AC05)
- Crookwell accommodation facility and compound (AC06)
- Green Hills accommodation facility and compound (AC07).

- Helicopters may be based overnight at airports including Goulburn, Wagga Wagga and Tumut.
- Stringing work would typically involve flight from the potential helipad to the designated transmission line structure then flight along the transmission line route pulling the draw wire.
- Helicopters would be single engine for stringing and twin engine for helicopter platform work (AS350/H125 and EC135/H125 or similar).
- Drones would be multi-rotor with a maximum take-off weight of around 50 kg (Callisto 50 or similar).

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.

4.3.2 Aircraft noise scenarios

The assessment considers the following aircraft noise scenarios:

- Helicopter arrival and departure at the 14 nominated construction compounds and combined worker accommodation facilities and construction compounds listed in **Section 4.3.1**.
- Helicopter flight between potential helipads and the amended project footprint. This component of the assessment is limited to prediction of aircraft noise at indicative offset distances, due to the unknown flight paths at this time.
- Helicopter and drone flight within the amended project footprint for stringing, helicopter platform work, etc. Aircraft work may also include landing and refueling at brake and winch sites within the transmission line corridor.

The assessment is focussed on the potential helipad sites and operation within the amended project footprint to account for the frequency of aircraft use in these areas. It is considered most likely that the noise amenity of sensitive receivers may be impacted in these areas due to the duration of noise exposure. Conversely, noise from flight paths outside of the amended project footprint 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.

4.3.3 Aircraft noise modelling

Aircraft noise is predicted with a three-dimensional noise model implemented using SoundPLAN. 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 following aircraft noise sources have been modelled:

- Helicopters – H1.1 group (maximum take-off mass of more than 1,000 kg up to 3,000 kg).
- Drones – H1.0 group (maximum take-off mass of up to 1,000 kg) with a 10 dB reduction applied based on review of currently available literature regarding the sound power levels of similar drones.

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, etc.

4.3.4 Operational aircraft noise

The transmission lines would be inspected on a regular schedule once operational. This could include annual flyover inspections with helicopters and/or drones. The prediction of helicopter noise from work within the transmission line corridor in **Section 7.3** is considered to be conservatively representative of aircraft noise from flyover inspections. However, during inspections helicopters would likely fly at higher elevations and move more quickly along the corridor, reducing the potential for noise impacts to nearby sensitive receivers.

4.4 Operational assessment approach

The potential operational noise impacts from the amended project have been predicted in accordance with the NSW Environment Protection Authority *Noise Policy for Industry* (NPfI) (EPA, 2017), consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

The assessment has been updated based on the refinements to the layout and additional noise generating equipment at the proposed Gugaa 500 kV substation.

The operational transmission line noise assessment in this report is an updated assessment for the entire amended project, which includes consideration of the transmission line corridor amendments and the refinement to operate the transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV at 500kV for the amended project. The operational transmission line assessment in this report supersedes the assessment in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

Audible noise associated with the operation of high voltage transmission lines is primarily attributed to the ionisation of air in a small area around the conductors. The electrical discharge from the conductors, known as corona discharge, causes the small surrounding area to become conductive and continually transfer charge from the conductors, resulting in the emission of a hum or crackling noise known as corona noise.

To assess the potential operational noise impacts associated with the amended project transmission lines, a revised Audible Noise Report has been prepared (Aurecon, 2024). The revised audible noise assessment is included in **Attachment E**.

The revised audible noise assessment (refer to **Attachment E**) includes noise curves representing the predicted transmission line noise levels versus distance from the centreline and tabulated distances where 35 dBA is predicted for the different sections of project transmission line and varying weather conditions. The distances from the transmission line at which 35 dBA are predicted have been used as indicative zones of impact in this assessment (as per the EIS). It is noted that the indicative zones of impact do not account for local topography and other factors which affect sound propagation over longer distances (ie over 200 metres). Hence the presented number of potentially impacted residential receivers and the extent of the zones of impact are inherently conservative.

At this stage of the amended project development the final transmission line route is still subject to further detailed design. The operational transmission line noise assessment therefore conservatively assumes that the transmission line may be anywhere within the amended project transmission line corridor, with consideration of a 70 metre minimum easement (ie the transmission line may be anywhere up to a 35 metre buffer within the amended project transmission line corridor). When the final transmission line route and easement is defined within the amended project footprint, it is expected that the centreline will be more distant to most of the surrounding receivers compared to the conservative scenario based on the amended project transmission line corridor that has been used for this assessment. The operational transmission line noise assessment in this report has considered the magnitude of the potential impacts at receivers within the indicative zones of impact based on interpolating the transmission line noise curves presented in the revised audible noise assessment (refer to **Attachment E**). The significance of the potential impacts have been categorised based on guidance in the NPfI. This represents an additional component of the assessment compared to the assessment of the EIS project.

4.4.1 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. It is also understood that higher altitudes and higher temperatures generally result in higher noise emissions and were considered in the assessment scenarios.

Three weather scenarios were considered in the revised 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 for the relevant section of transmission line and L50 rain simulated at a rate of 0.75 millimetres per hour (noting temperature variation is not supported in the modelling methodology used to represent L50 conditions.
- Heavy rain – Typical temperatures during rain, maximum altitude for the region and heavy rain simulated at a rate of 18 millimetres per hour.

The fair weather scenario is considered to be representative of transmission line audible noise producing conditions most commonly occurring in the relevant region, or 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. It is assumed that the 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 area surrounding the amended project has been reviewed based on climate records available from several nearby Bureau of Meteorology (BOM) stations and is summarised in **Table 4-4**. The percentage of rain days is calculated based on the average number of days per month where one millimetre or more of rain was recorded.

Table 4-4 Occurrence of rain days

Station	Station ID	Years in dataset	Percentage of rain days			
			Summer	Autumn	Winter	Spring
Burrinjuck	073007	1908-2024	18%	20%	**34%**	27%
Yass	070028	1898-2011	16%	16%	27%	23%
Goulburn Tafe	070263	1971-2024	20%	18%	22%	24%
Taralga Post Office	070080	1882-2024	23%	22%	28%	25%
Wagga Wagga AMO	072150	1941-2024	14%	16%	27%	21%
Gundagai	073141	1955-2022	16%	15%	29%	22%
Tumbarumba Post Office	072043	1885-2024	18%	21%	**36%**	28%
Adelong	072159	1907-1994	16%	19%	**32%**	24%
Crookwell Post Office	070025	1883-2024	18%	20%	**31%**	25%

Table 4-4 shows that rain days in the amended project study area have historically been observed for between 14 and 36 per cent of days, depending on the location and season. The highest proportion of rain days has been recorded during winter, with an average of 29 per cent across the considered weather stations.

The historical rain days include periods of both light and heavy rain. 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 per cent of the a given assessment period. 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, assessment of operational transmission line noise during L50 (light rain or mist) conditions has been included in the assessment of the EIS project and in this assessment to conservatively represent the potential worst-case scenario.

5 Existing environment

5.1 Sensitive receivers

The amended study area is defined by a two kilometre buffer around the amended project footprint. Additional sensitive receivers have been identified within the amended study area. Receivers potentially sensitive to noise and vibration have been categorised as residential buildings, commercial/industrial buildings, or 'other sensitive' land uses. All sensitive receivers within the amended study area are shown in **Attachment B**. Sensitive receivers that have been newly identified for the assessment of the amended project relative to the assessment of the EIS project are highlighted as 'Amended receiver' in **Attachment B.**

Additional sensitive receivers have been modelled as points surrounding most of the amended project footprint, where sensitive receivers are relatively isolated. Additional sensitive receivers have been digitised as 3D buildings in the towns of Yass and Tarcutta.

Some sensitive receivers have been identified within the amended project transmission line corridor. It is assumed that these receivers will remain and they have been included in the assessment accordingly.

One residential receiver is located within the Ellerslie Road compound (C21) and another within the Green Hills accommodation facility and compound (AC07) (receiver IDs: D25 and Z23). These properties would be leased and the residential buildings would be vacant during construction and have therefore not been included in the assessment of potential construction noise impacts.

5.1.1 Sensitive heritage receivers

The heritage listed buildings and structures near to the amended project footprint which are potentially sensitive to vibration are detailed in **Table 5-1**, with additional heritage items compared to those identified in the EIS project shown in rows highlighted in green.

Table 5-1 Heritage listed items

Item Name	Address	Heritage significance	Council Local Environmental Plan (LEP) item number	Distance to nearest structure[1]
Ivydale Woolshed	9 Ivydale Road, Gregadoo	Local	I73	600 m
Stone ruin	1149 Gregadoo East Road, Gregadoo	Local	I71	500 m
Elizabeth Nugent grave on College Creek	1615 Humula Road, Tarcutta	Local	I202	430 m
Kiley's Run	Red Hill State Forest, Adjungbilly	Indicative on the Register of National Estate (RNE)	16005	200 m
Coolalie Limestone Kilns and Quarry	879 Cooks Hill Road, Bango	Local	A297	180 m

Note 1: Approximate minimum horizontal distance from the amended project footprint to the nearest structure of the heritage listed item.

Refer to *Technical Report 3 – Historic Heritage Impact Assessment Addendum* prepared for the Amendment Report for more information on historic heritage items near the amended project footprint.

All identified potentially vibration sensitive heritage structures are beyond the recommended minimum working distances for vibration intensive equipment likely required for construction of the amended project, shown in **Table 4-3** (refer to **Section 4.2.3**).

5.1.2 Updated sensitive receivers

During the development of the Amendment Report and this assessment, several minor updates to the assessed sensitive receivers have been identified based on landowner feedback and further ground based investigations. The receiver updates include reclassifying receivers to remove non sensitive buildings, removing receivers which have been demolished, relocating receivers and identifying one additional receiver. It should be noted that sensitive receivers will continue to be reviewed during further detailed design and as part of ongoing stakeholder engagement.

There are 27 residential receivers assessed in this report which have since been confirmed to be sheds, uninhabited, demolished buildings or similar. These 27 receivers vary in distance to the amended project footprint and some are predicted to be impacted by noise and/or vibration in this assessment based on their previous classification as residential sensitive receivers. Removing these receivers would marginally reduce the number of noise and vibration impacted receivers presented in this report but would not change the recommended approach to noise management and mitigation at other receivers.

There are 10 relocated residential receivers which have had their location adjusted to represent the dwelling location more accurately. The change in distance between the receivers and the amended project footprint is generally small, around 10 to 30 metres, and is not expected to materially change the predicted construction noise and vibration impacts. For the relocated receivers which are currently predicted to have construction noise impacts in this assessment, the revised locations generally move the receivers further from the amended project footprint and are expected to change the predicted construction noise levels by less than 1 dB. The relocated receivers are all beyond the distance from the amended transmission line route where operational noise impacts are expected (refer to **Section 8.2**). The relocated receivers are not expected to change the assessment outcomes.

There is one newly identified residential receiver around 35 metres to the west of receiver ID: H17. The potential noise and vibration impacts at this new receiver are expected to be similar to the construction noise impacts predicted at H17, which are:

- 6-10 dB during day-time access track construction and transmission line construction scenario ‘earthwork and clearing’
- 1-5 dB during day-time transmission line construction scenario ‘site establishment and deliveries’
- compliant with the noise management levels (NMLs) during all other construction scenarios.

The amended project would apply all feasible and reasonable mitigation measures to minimise the potential construction noise impacts at this receiver. The newly identified receiver is beyond the distance from the amended transmission line route where operational noise impacts are expected (refer to **Section 8.2**).

5.2 Noise survey and monitoring locations

All noise monitoring locations and results used for the assessment are summarised in **Table 5-2**, with the additional monitoring locations for the amended project shaded green. Monitoring locations L03 and L09 have been removed from the table, due to the removal of the Snowy Mountains Highway compound (C02) and the Tumbarumba accommodation facility (AC1) from the amended project.

The noise monitoring locations are shown in **Attachment B.** Descriptions of each monitoring location and the measured noise environment, together with graphs of the daily measured noise levels, are provided in **Attachment F**.

Short-term attended noise monitoring was completed at each ambient monitoring location. The attended measurements allow the contributions of the various noise sources at each location to be determined. Detailed observations from the attended measurements are provided in **Attachment F**.

The attended measurements were generally found to be consistent with the results of the unattended noise monitoring and showed that the existing noise environments are generally controlled by natural sources, such as wildlife and weather, as expected in rural areas. Urban noise sources, such as road traffic noise, were also noted to influence the background environment at the additional monitoring locations at Tarcutta (Location ID: L10 and L11) and Yass (Location ID: L12 and L13). The background noise in the area to the north of Yass near to Faulder Avenue is also influenced by existing industrial activity such as the Yass Transfer Station.

Table 5-2 Summary of noise monitoring results

Location ID	Address	Noise level (dBA)[1,2]					
		Background noise (RBL)			Average noise (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
L01[3]	83 Ashfords Road, Wagga Wagga	31	29	26	46	43	38
L02	1070 Livingstone Gully Road, Gregadoo	29	<25	<25	52	41	42
L04[4]	1428 Adjungbilly Road, Adjungbilly	39	39[5] (47)	38	53	57	51
L05	Hanworth Road, Bannaby	26	26[5] (27)	<25	44	39	46
L06	14 Memorial Avenue, Batlow	35	35	32	60	53	49
L07	Bowmans Lane, Batlow	29	29[5] (30)	29[5] (30)	46	43	43
L08	Perry Street, Yass	38	38[5] (42)	34	56	58	52
L10	Mates Gully Road, Tarcutta	39	39[5] (41)	39	50	51	50
L11	Sydney Street, Tarcutta	42	42[5] (44)	42[5] (44)	55	55	55
L12	Faulder Avenue, Yass	37	37[5] (41)	37	50	51	51
L13	Wargeila Road, Yass	36	36[5] (38)	34	46	47	46
Note 1:	The RBL and L_{Aeq} noise levels have been determined with reference to the procedures in the NPfI.						
Note 2:	Day-time is 7am to 6pm, evening is 6pm to 10pm and night-time is 10pm to 7am.						
Note 3:	Data taken from EnergyConnect (NSW – Eastern Section) Environmental Impact Statement, conducted in 2020.						

Location ID	Address	Noise level (dBA)[1,2]					
		Background noise (RBL)			Average noise (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
Note 4:	The ambient noise environment at this location was found to be influenced by extraneous noise (likely mechanical plant/equipment in the vicinity of the monitor) and is not considered representative of the surrounding area.						
Note 5:	The monitored evening or night level was found to be higher than the day-time. In this situation the NPfI requires that the evening or night level be reduced to match the day-time. The monitored level is shown in brackets.						

5.2.1 Summary of residential noise management levels

The residential NMLs, for the assessment of construction noise, have been determined using the results from the unattended ambient noise monitoring, including the additional monitoring undertaken for the amended project, and are shown in **Table 5-3**.

Table 5-3 Residential receiver construction NMLs

Location	Representative background monitoring location	NML ($L_{Aeq15minute}$ – dBA)				Sleep disturbance screening criteria (52 dBA or RBL + 15 dB whichever is higher)
		Standard construction (RBL +10 dB)	Out-of-hours (RBL + 5 dB)			
		Day-time	Day-time[1]	Evening	Night-time	
Batlow	L06	45	40	40	37	52
Yass – south of Yass River	L08	48	43	43	39	52
Yass – north of Yass River[2]	L13	46	41	41	39	52
Tarcutta[3]	L10	49	44	44	44	54
All other receivers[4]	L01, L02, L05, L07	45	10	35	35	52
Note 1:	Day-time out-of-hours is 7am to 8am and 1pm to 6pm on Saturday, and 8am to 6pm on Sunday and public holidays.					
Note 2:	Background noise monitoring results at north Yass L13 were measured to be marginally lower than nearby location L12. The lower L13 levels have conservatively been applied to determine the NMLs in this area.					
Note 3:	Background noise monitoring results at rural Tarcutta location L10 were measured to be lower than nearby location L11 within the town of Tarcutta. Location L11 was influenced by industrial noise from the nearby service station which may not be representative of the ambient noise environment at nearby residential receivers. Therefore, the lower L10 levels have conservatively been applied to determine the NMLs in this area.					
Note 4:	The minimum RBLs in the NPfI are listed as 35 dBA in the day-time and 30 dBA in the evening and night-time. These minimum RBLs have been adopted for all rural areas of the amended project. Unattended noise monitoring at several locations confirmed the RBLs to be equal to or less than these levels.					

5.2.2 Project Noise Trigger Levels

The trigger levels for operational industrial noise from the amended project are summarised in **Table 5-4**, based on the measured background noise levels. The Project Noise Trigger Levels (PNTLs) are the most stringent of the intrusiveness and amenity trigger level for each period and are shaded green. The PNTLs are consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

Table 5-4 Project Noise Trigger Levels

Period	Noise Level (dBA)				
	Recommended Amenity Noise Level – L_{Aeq}	Measured Noise Level		Project Noise Trigger Level – $L_{Aeq(15minute)}$	
		RBL[1,2]	$L_{Aeq(period)}$	Intrusiveness	Amenity[3,4]
Day-time	50	35	44-52	**40**	48
Evening	45	30	39-48	**35**	43
Night-time	40	30	36-46	**35**	38
Note 1: RBL = Rating Background Level.					
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 recommended amenity noise levels have been reduced by 5 dB, to give the project amenity noise levels due to other sources of industrial noise being present in the area, as outlined in the NPfI.					
Note 4: The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.					

6 Assessment of construction impacts

The following assessment shows the predicted construction noise impacts, which have been assessed based on the exceedance of the NMLs. Exceedances of the NMLs are presented with refence the CNVG (TfNSW, 2023) exceedance categories in **Table 6-1**, consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The CNVG is a suitable reference guideline for the management of construction noise impacts from the amended project.

Table 6-1 Exceedance bands and impact colouring

Subjective Classification	Exceedance of Noise Management Level		Impact Colouring
	Day-time	Out of Hours	
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	

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 assume 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 amended project could be constructed and may not necessarily be the same methodology that the construction contractors engaged to construct the amended 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 in the EIS, **Chapter 10** of this report and Appendix B (Updated mitigation measures) of the Amendment Report is expected to reduce the predicted construction noise levels.

6.1 Construction noise impacts from ancillary facilities

The assessed construction compounds and combined worker accommodation facilities and construction compounds with the potential to cause increased or changed noise impacts are summarised in **Table 6-2.**

Table 6-2 Assessed construction compounds and combined worker accommodation facilities and construction compounds

Site name	Locality	Approximate distance to closest sensitive receiver
Amended Gregadoo Road compound (C06)	Gregadoo	600 m
Amended Memorial Avenue compound (C14)	Batlow	20 m
Ardrossan Headquarters Road compound (C17)	Wondalga	30 m (1,000 m)[1]
Gadara Road compound (C19)	Gilmore	680 m
Ellerslie Road compound (C21)	Wondalga	930 m
Tarcutta accommodation facility and compound (AC03)	Tarcutta	170 m
Adjungbilly accommodation facility and compound (AC04)	Gobarralong	210 m
Yass accommodation facility and compound (AC05)	Yass	120 m
Green Hills accommodation facility and compound (AC07)	Batlow	110 m

Note 1: The receiver closest to Ardrossan Headquarters Road compound (C17) is worker accommodation owned and operated by the FCNSW and not permanently occupied. The next closest receiver is around 1,000 m from the site.

The number of residential receivers where NML exceedances are predicted for the construction compounds and the combined worker accommodation facilities and construction compounds, is summarised in **Table 6-3** and **Table 6-4** for day-time and out-of-hours (OOH) work, respectively. Results presented in the tables are colour coded as per the exceedance bands shown **Table 6-1**. 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** for day-time 'site establishment' and **Attachment G.2** for night-time 'accommodation facility operation'.

A summary of the number of 'other sensitive' receivers where NML exceedances are predicted by the new and revised construction compounds and combined worker accommodation facilities and construction compounds is shown in **Table 6-5**. 'Other sensitive' receivers are only predicted to be impacted at the Amended Memorial Avenue compound (C14).

Table 6-3 Day-time NML exceedances – construction compounds and combined worker accommodation facilities and construction compounds

Scenario	Duration[1]	Number of residential receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Amended Gregadoo Road compound (C06)					
Site establishment	3-4 weeks	-	3	-	-
Compound operation	Construction duration	-	1	-	-
Amended Memorial Avenue compound (C14)					
Site establishment	3-4 weeks	1	446	84	6
Compound operation	Construction duration	1	347	19	4
Ardrossan Headquarters Road compound (C17)					
Site establishment	3-4 weeks	1	-	-	1
Compound operation	Construction duration	-	-	-	1
Gadara Road compound (C19)					
Site establishment	3-4 weeks	-	2	-	-
Compound operation	Construction duration	-	-	-	-
Ellerslie Road compound (C21)					
Site establishment	3-4 weeks	-	1	-	-
Compound operation	Construction duration	-	-	-	-
Tarcutta accommodation facility and compound (AC03)					
Site establishment	8-12 weeks	-	3	3	-
Compound operation	Construction duration	-	5	-	-
Accommodation facility operation	Construction duration	-	-	-	-
Adjungbilly accommodation facility and compound (AC04)					
Site establishment	8-12 weeks	-	2	1	-
Compound operation	Construction duration	-	2	1	-
Accommodation facility operation	Construction duration	-	1	-	-
Yass accommodation facility and compound (AC05)					
Site establishment	8-12 weeks	-	59	5	1
Compound operation	Construction duration	-	12	2	-
Accommodation facility operation	Construction duration	-	2	-	-
Green Hills accommodation facility and compound (AC07)					
Site establishment	8-12 weeks	-	3	-	1
Compound operation	Construction duration	-	1	1	
Accommodation facility operation	Construction duration	-	1	-	-

Note 1: Durations should be regarded as indicative and representative of a typical work site. Construction duration is expected to be up to two and a half years.

Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).

Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1Table 6-1.**

Table 6-4 OOH NML exceedances – Accommodation facility operation

Combined worker accommodation facility and construction compound	Duration[1]	Number of residential receivers																
		HNA[2]	With NML exceedance[3]												Sleep disturbance screening criteria exceedance			
			Day-time OOH[4]				Evening				Night-time							
			1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB
Tarcutta accommodation facility and compound (AC03)	Construction duration	-	-	-	-	-	-	-	-	-	3	-	-	-	3	1	-	-
Adjungbilly accommodation facility and compound (AC04)		-	-	1	-	-	2	1	-	-	2	1	-	-	1	-	-	-
Yass accommodation facility and compound (AC05)		-	4	2	-	-	4	2	-	-	4	4	-	-	4	2	-	-
Green Hills accommodation facility and compound (AC07)		-	-	1	-	-	1	-	1	-	1	-	1	-	-	1	-	-

Note 1: Durations should be regarded as indicative and representative of a typical work site. Construction duration is expected to be up to two and a half years.

Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).

Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.

Note 4: OOH = Out-of-hours. During the day-time, this refers to the period on Saturday between 7am – 8am, and 1pm – 10pm.

Table 6-5 Other sensitive NML exceedances – construction compounds

Scenario	Duration[1]	Number of 'other sensitive' receivers with NML exceedance[2]											
		Commercial			Educational			Medical			Place of Worship		
		1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
Site establishment	3 – 4 weeks	1	-	-	7	-	-	-	1	-	2	-	-
Compound operation	Construction duration	-	-	-	-	-	-	-	-	-	-	-	-
Note 1: Durations should be regarded as indicative and representative of a typical work site. Construction duration is expected to be up to two and a half years.													
Note 2: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.													

The above assessment shows:

- The predicted noise impacts are generally limited to a few of the residential receivers closest to each combined worker accommodation facility and construction compound. The Amended Memorial Avenue compound (C14) and Yass accommodation facility and compound (AC05) are exceptions, where up to 536 and 65 residential receivers are predicted to be impacted during 'site establishment', respectively.
- 'Highly intrusive' (>20 dB) worst-case day-time impacts are predicted at up to six residential receivers closest to the Amended Memorial Avenue compound (C14), one residential receiver closest to Yass accommodation facility and compound (AC05) and one residential receiver closest to the Green Hills accommodation facility and compound (AC07) during 'site establishment', which is expected to take around eight to twelve weeks for combined worker accommodation facilities and construction compounds (refer to **Table 6-3**). This is primarily due to the proximity of these receivers, which are generally within 100 metres, and the low existing background noise levels.
- 'Highly intrusive' (>20 dB) worst-case day-time impacts are predicted at up to four of the residential receivers closest to the Amended Memorial Avenue compound (C14) during 'compound operation', which is expected for the duration of the amended project construction (refer to **Table 6-3**). The predicted noise impacts at these receivers are consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and have not changed due to the Amended Memorial Avenue compound (C14).
- 'Highly intrusive' (>20 dB) worst-case day-time impacts are also predicted at one residential receiver directly adjacent to the Ardrossan Headquarters Road compound (C17) during 'site establishment' and 'compound operation', however, this receiver is worker accommodation owned by the Forestry Corporation of NSW (FCNSW) and is not permanently inhabited.
- The residential receiver closest to the Ardrossan Headquarters Road compound (C17) is predicted to be highly noise affected (>75 dBA) (refer to **Table 6-3**) during both 'site establishment' and 'compound operation'. However, this receiver is worker accommodation owned by the FCNSW and is not permanently occupied.
- 'Moderately intrusive' (11-20 dB) worst-case day-time impacts are predicted at the three residential receivers closest to the Tarcutta accommodation facility and compound (AC03) during 'site establishment' which is expected to take around eight to twelve weeks. 'Moderately intrusive' (11-20 dB) worst-case day-time impacts are also predicted at the one residential receiver closest to the Adjungbilly accommodation facility and compound (AC04) during both 'site establishment' and 'compound operation', which is expected for the duration of the amended project construction (refer to **Table 6-3**).
- Clearly audible' (1-10 dB) worst-case day-time impacts are predicted at the receiver closest to the Amended Gregadoo Road compound (C06) during both 'site establishment' and 'compound operation', which is expected for the duration of the amended project construction. Clearly audible' (1-10 dB) worst-case day-time impacts are also predicted at Gadara Road compound (C19) and Ellerslie Road compound (C21) during site establishment, which is expected to around three to four weeks for construction compounds (refer to **Table 6-3**).

- The predicted impacts during ‘site establishment’ at the Amended Gregadoo Road compound (C06) are consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. However, there is now one residential receiver predicted to have a ‘clearly audible’ (1-10 dB) impact during ‘compound operation’ which is an additional impact compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS where no impacts were predicted during ‘compound operation’ (refer to **Table 6-3**). This is due to the expansion of the Amended Gregadoo Road compound (C06) footprint.
- The predicted impacts at the Amended Memorial Avenue compound (C14) are generally consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS, with a minor increase in the number of residential receivers predicted to have ‘moderately intrusive’ (11-20 dB) worst-case day-time impacts (refer to **Table 6-3**). This is due to the footprint of the amended compound being slightly closer to some receivers when compared to the EIS project.
- ‘Moderately intrusive’ (16-25 dB) worst-case night-time impacts are predicted at the one residential receiver closest to the Green Hills accommodation facility and compound (AC07) during ‘accommodation facility operation’. ‘Clearly audible’ (6-15 dB) night-time impacts are predicted at the four residential receivers closest to the Yass accommodation facility and compound (AC05) and the one residential receiver closest to Adjungbilly accommodation facility and compound (AC04) during ‘accommodation facility operation’. ‘Noticeable’ (1-5 dB) night-time impacts are predicted at the three residential receivers closest to the Tarcutta accommodation facility and compound (AC03) during ‘accommodation facility operation’ (refer to **Table 6-4**).
- Exceedances of the sleep disturbance screening criteria are predicted at up to 12 of the residential receivers closest to the combined worker accommodation facilities and construction compounds during ‘accommodation facility operation’ (refer to **Table 6-4**). Sleep disturbance impacts would generally be caused by heavy vehicle movements. The number of awakening events would depend on several factors, including the number of heavy vehicles accessing each facility during the night-time and the way in which vehicles are operated.
- ‘Other sensitive’ receivers in Batlow are predicted to be impacted during worst-case day-time ‘site establishment’ work at the Amended Memorial Avenue compound (C14) (refer to **Table 6-5**). The predicted impacts at ‘other sensitive’ receivers are consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and result in ‘moderately intrusive’ (1-10 dB) impacts at Batlow Technology School, Saint Mark’s School, Saint Mark’s Church and St John’s Anglican Church.
- ‘Site establishment’ work generates more noise and results in more exceedances compared to ‘compound operation’ and ‘accommodation facility operation’, due to the requirement for more noise intensive equipment, such as dozers and graders. ‘Site establishment’ would, however, be limited to a duration of approximately three to four weeks for construction compounds and eight to twelve weeks for combined accommodation facilities and construction compounds, with periods of respite between noisy activities.

The proposed mitigation measures to minimise and manage the predicted impacts are consistent with the EIS and are described in Appendix B (Updated mitigation measures) of the Amendment Report.

Recommended project specific measures for construction compounds and combined worker accommodation facilities and construction compounds include (but are not limited to):

- Plan traffic flow, parking and loading/unloading areas to minimise reversing movements.
- Install screens or use barriers to mitigate noise from stationary noise sources.
- 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.
- Turn off machinery when not in use.
- For accommodation facilities requiring OOH operation:
  - OOH vehicle movements will be minimised where possible.
  - Use non-tonal reversing alarms in place of traditional beeper reversing alarms during OOH where noise impacts are predicted.
  - Locate work site access points roads as far as possible from sensitive receivers.

The day-time construction noise impacts predicted in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS for ancillary facilities that have been removed from the amended project are shown in **Table 6-6**.

Table 6-6 Day-time NML exceedances removed by the amended project – construction compounds and worker accommodation facilities

Scenario	Duration[1]	Number of sensitive receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Snowy Mountains Highway compound (C02)					
Site establishment	3-4 weeks	-	1	-	-
Compound operation	Construction duration	-	-	-	-
Snubba Road compound (C03)					
Site establishment	3-4 weeks	-	1	-	-
Compound operation	Construction duration	-	-	-	-
Adjungbilly Road compound (C09)					
Site establishment	3-4 weeks	-	2	-	-
Compound operation	Construction duration	-	-	-	-
Bowmans Lane compound (C15)					
Site establishment	3-4 weeks	-	64	5	3
Compound operation	Construction duration	-	13	3	1
Tumbarumba Accommodation Facility (AC1)					
Site establishment	8-12 weeks	-	41	6	1
Accommodation facility operation	Construction duration	-	2	1	-

Note 1: Durations should be regarded as indicative and representative of a typical work site. Construction duration is expected to be up to two and a half years.

Scenario	Duration[1]	Number of sensitive receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).					
Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.					

Table 6-6 shows that several residential receivers that were predicted to have construction noise impacts in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS would no longer be impacted by the amended project.

6.2 Construction noise impacts from transmission lines

The amended project includes a 32.5 kilometre amended transmission line corridor from Wondalga through the Green Hills State Forest before travelling to the west and south of Batlow and connecting to the transmission line corridor as described in the EIS in Bago State Forest. The amended project also includes six other minor realignments and one narrowing of the transmission line corridor compared to the EIS project.

The requirement for additional construction activities has also been identified at three additional telecommunications connections to existing substations and potential crushing at all potential controlled blasting areas.

The following sections summarise the assessment of potential construction noise impacts at these discrete locations, using the same methodology as *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

6.2.1 Green Hills corridor amendment number of NML exceedances

A summary of the number of residential receivers where NML exceedances are predicted for the transmission line construction work in the Green Hills corridor amendment is shown in **Table 6-7**. No ‘other sensitive’ receivers are predicted to be impacted by the Green Hills corridor amendment construction work.

It is noted that the existing land use in this area includes plantation harvesting with heavy vehicle haulage. Harvesting activity is expected to influence the background noise environment at times and the noise may be similar in nature to transmission line construction noise. However, harvesting activity is not expected to be constant throughout the year and the minimum background noise levels have been applied in this area based on noise monitoring in similar locations across the amended project footprint (refer to **Section 5.2**).

The worst-case transmission line construction noise impacts from ‘earthwork and clearing’ for this section of the transmission line corridor are shown in **Figure 6-1**.

Table 6-7 Day-time NML exceedances – Green Hills corridor amendment construction

Scenario	Duration[1]	Number of residential receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Site establishment and deliveries	1-3 weeks per transmission line structure	-	7	1	-
Earthwork and clearing	1-5 days per transmission line structure	-	15	1	-
Construction of transmission line structures	2 weeks per transmission line structure	-	1	-	-
Overhead stringing of conductors and earth wires	3 weeks per stringing work site	-	1	-	-
Decommissioning and rehabilitation	2-3 days per transmission line structure	-	-	1	-

Note 1: Durations should be regarded as indicative and representative of a typical work site.

Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).

Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.

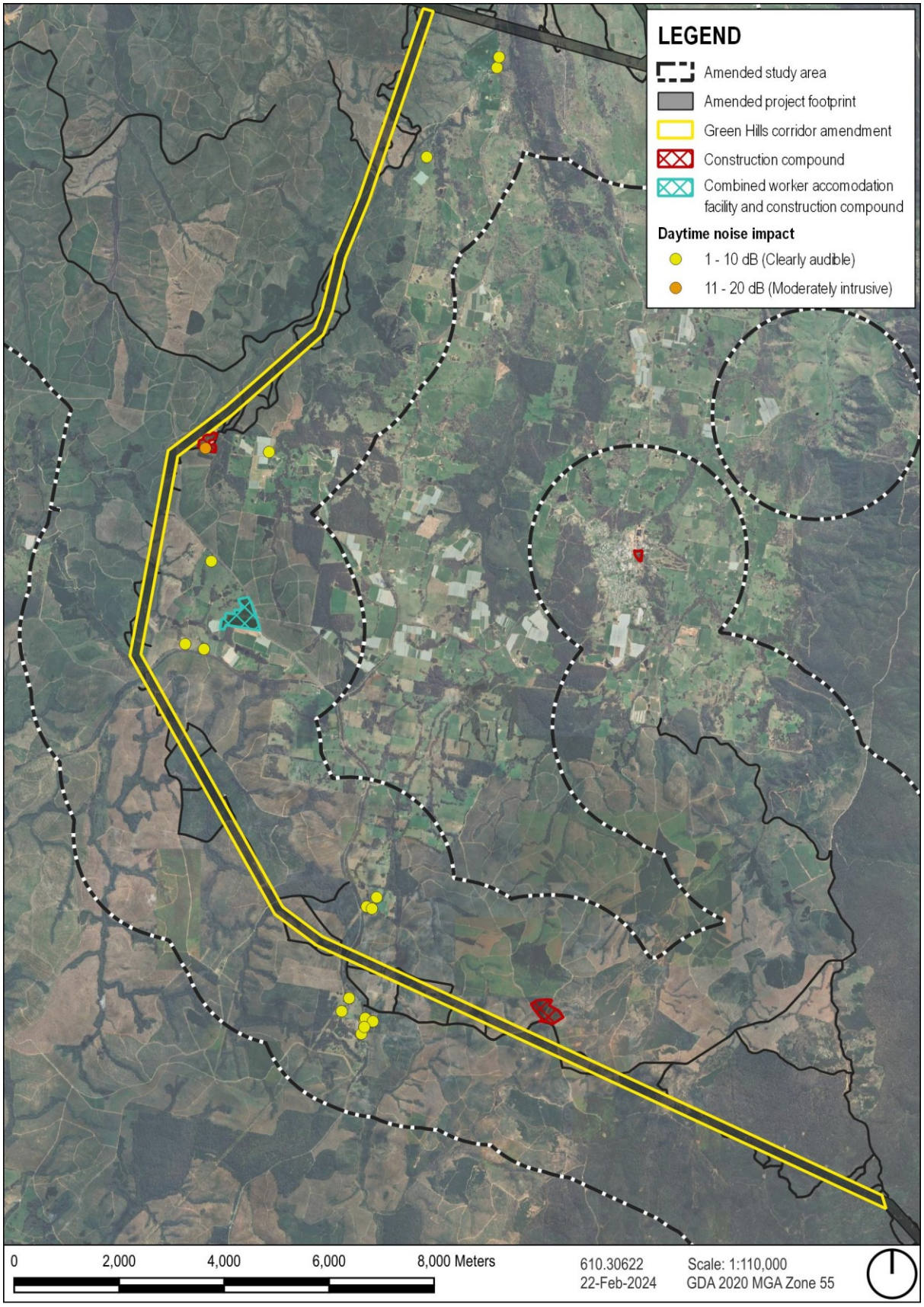


Figure 6-1 Green Hills corridor amendment day-time airborne noise impacts – earthwork and clearing

The above assessment shows:

- A ‘moderately intrusive’ (11-20 dB) worst-case noise impact is predicted at the closest residential receiver to the Green Hills corridor amendment during ‘site establishment and delivery’, ‘earthwork and clearing’ and ‘decommissioning and rehabilitation’, which are expected to have a combined duration of around two to four weeks per transmission line structure. ‘Clearly audible’ (1-10 dB) impacts are predicted at up to 15 of the next closest receivers during ‘earthwork and clearing’, which is expected to have a duration of around one to five days per transmission line structure (refer to **Table 6-7**).
- No residential receivers are predicted to be highly noise affected from transmission line construction in this area.
- Consistent with the *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS, brake and winch sites would be spread across the transmission line corridor, however, final locations would be determined during further detailed design. Residential receivers are predicted to exceed the day-time NMLs from construction work at brake and winch sites if they are located within around 600 metres.

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Durations of any particular construction activity, and inactive/respite periods, may vary for a number of reasons including (but not limited to) multiple work fronts, resource and engineering constraints, work sequencing and location. Therefore, the worst-case noise impacts at a receiver would likely be short-term as the noise intensive work passes. Additionally, it is expected there would be long periods of respite between different phases of noise intensive work near to any individual receiver.

The proposed mitigation measures to minimise and manage the predicted impacts would be consistent with the measures identified in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS for mitigation of potential transmission line construction noise impacts.

The EIS project included a section of transmission line construction between Wondalga and Buddong that has now been replaced by the Green Hills corridor amendment (refer to **Section 6.2.1**). The day-time construction noise impacts predicted in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS for transmission line construction between Wondalga and Buddong that has been removed from the amended project are shown in **Table 6-8**.

Table 6-8 Day-time NML exceedances removed by the amended project – Wondalga to Buddong transmission line construction

Scenario	Duration[1]	Number of residential receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Site establishment and deliveries	1-3 weeks per transmission line structure	-	6	2	-
Earthwork and clearing	1-5 days per transmission line structure	-	10	2	-
Construction of transmission line structures	2 weeks per transmission line structure	-	3	-	-
Overhead stringing of conductors and earth wires	3 weeks per stringing work site	-	1	-	-
Decommissioning and rehabilitation	2-3 days per transmission line structure	-	3	1	-
Note 1: Durations should be regarded as indicative and representative of a typical work site.					
Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).					
Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.					

Table 6-8 shows that several residential receivers that were predicted to have construction noise impacts in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS would no longer be impacted by the amended project. The number of receivers where impacts are removed due to the amended project is approximately equivalent to the number of receivers predicted to be impacted by the Green Hills corridor amendment construction (refer to **Table 6-7**).

6.2.2 Transmission line alignment refinements

A summary of the predicted changes to construction noise impacts from the minor transmission line corridor realignments is shown in **Table 6-9**, including consideration of all transmission line construction noise scenarios (refer to **Attachment C**). **Table 6-9** includes discussion of any predicted changed impacts relative to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The amended project transmission line corridor refinements are shown in Chapter 3 (Description of the amended project) of the Amendment Report.

Table 6-9 Transmission line corridor realignment – construction noise impact review

Transmission line corridor realignment	Noise impact
1.4 km realignment of the corridor to the north between Ashfords Road to Ivydale Road, Gregadoo.	No change from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
2.5 km realignment of the corridor to the south across Kyeamba Creek and Tumbarumba Road, Book.	One additional residential receiver (ID: B20) is predicted to have noise impacts from transmission line construction due to this realignment shifting the corridor around 200 m closer. This residential receiver is predicted to have a 'clearly audible' (1-10 dB) noise impact during 'earthwork and clearing', which is expected for a duration of around one to five days per transmission line structure but is predicted to comply with the NML during all other work.
2.7 km realignment of the corridor to the east near Snowy Mountains Highway, Gadara.	No change from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
1.4 km realignment of the corridor to the east adjacent Minjary National Park at Gocup.	No change from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
5.9 km realignment of the corridor from north of the crossing of Tumut River to south of the crossing of Killimicat Creek, Killimicat (including a minor 50 m shift to the north for 2.1 km and a 2.6 km shift to the south from Brungle Road to before the crossing of Killimicat Creek).	No change from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
0.4 km realignment of the corridor to the north at Bannister, about 2.7 km west of Crookwell Road/Goulburn Road.	No change from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
Narrowing of the project footprint at Wondalga, Gobarralong and Bowning	Reduced noise impacts – refer to **Table 6-10** below.

Transmission line construction noise impacts are predicted to reduce at the receivers surrounding the narrowing of the project footprint at Wondalga, Gobarralong and Bowning. The change in the predicted transmission line construction noise impacts due to the refinement is shown in **Table 6-10**, where positive values indicate additional receivers in an impact category for the amended project and negative values indicate fewer receivers in an impact category for the amended project.

Table 6-10 shows that several residential receivers are predicted to have reduced impacts for the amended project compared to the EIS project. The increase in receivers with 1-10 dB impacts for 'earthwork and clearing' is because these receivers are reduced from the 11-20 dB impact category that was predicted for the EIS project. The impacts predicted from 'earthwork and clearing' for the narrowing of the project footprint at Wondalga, Gobarralong and Bowning are also shown in **Figure 6-2**.

Table 6-10 Day-time NML exceedances reduced by the amended project – Wondalga refinement

Scenario	Duration[1]	Number of residential receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Site establishment and deliveries	1-3 weeks per transmission line structure	-	-2	-2	-
Earthwork and clearing	1-5 days per transmission line structure	-	+3	-4	-
Construction of structures	2 weeks per transmission line structure	-	-5	-	-
Overhead stringing of conductors and earth wires	3 weeks per stringing work site	-	-2	-	-
Decommissioning and rehabilitation	2-3 days per transmission line structure	-	-7	-1	-
Note 1: Durations should be regarded as indicative and representative of a typical work site.					
Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $LA_{eq(15minute)}$ noise at residential receiver is 75 dBA or greater).					
Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.					

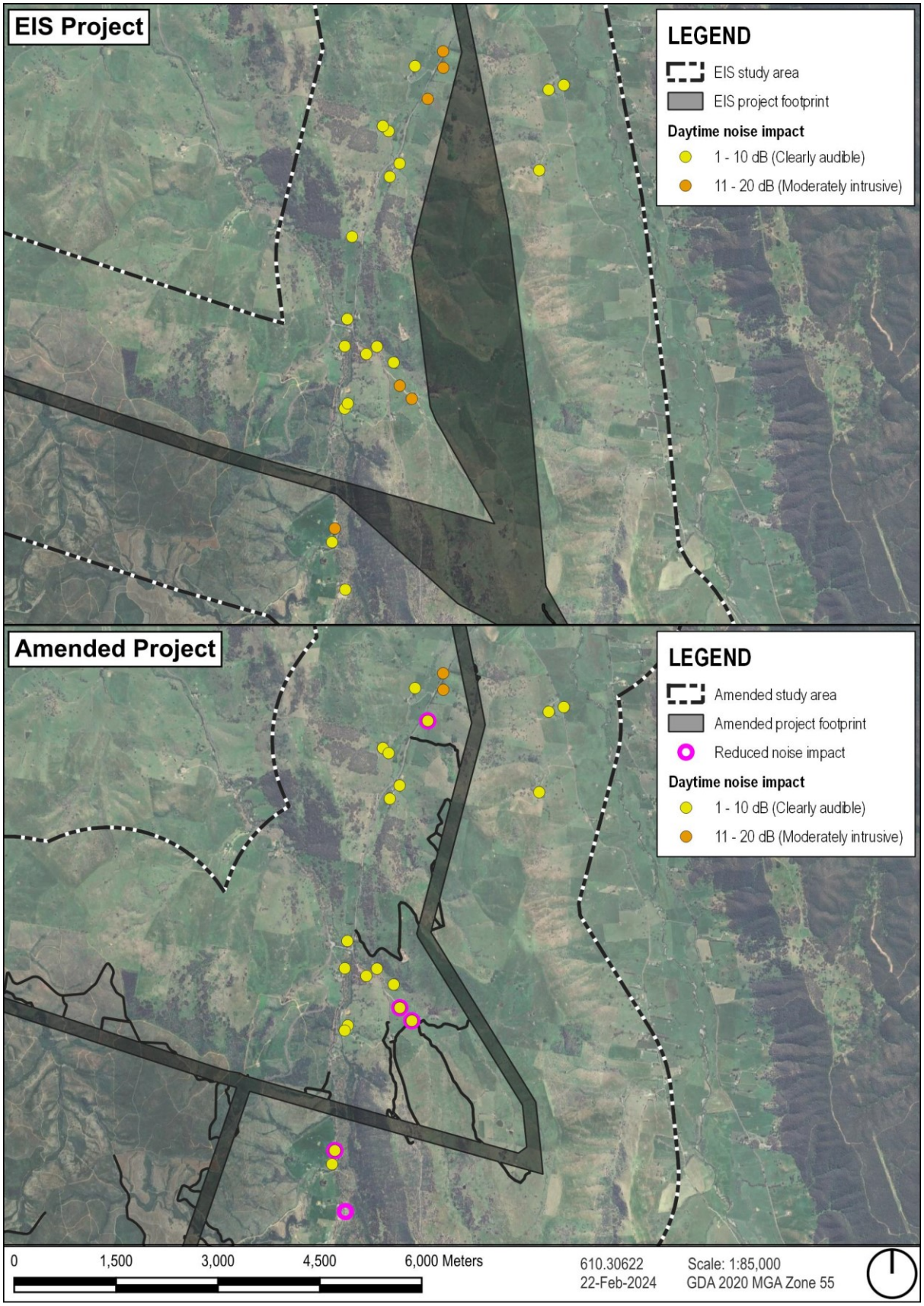


Figure 6-2 Earthwork and clearing day-time airborne noise impact comparison – Wondalga corridor refinement

The proposed mitigation measures to minimise and manage the predicted impacts would be consistent with the measures identified in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS for mitigation of potential transmission line construction noise impacts.

6.2.3 Additional telecommunications connections to existing substations

Additional telecommunications connections between the amended project and existing Transgrid substations are proposed along the transmission line corridor at three locations. The additional telecommunications connections to existing substations will connect the amended project to Gadara 132 kV substation, Gullen Range 330 kV substation and Crookwell 2 330 kV substation.

A summary of the number of residential receivers where NML exceedances are predicted for the additional telecommunications connections to existing substations construction work is shown in **Table 6-11**. No 'other sensitive' receivers are predicted to be impacted by additional telecommunications connections to existing substations construction work.

The work locations and nearby sensitive receivers are shown in **Attachment B**.

Table 6-11 Day-time NML exceedances – additional telecommunications connections to existing substations

Location	Duration[1]	Number of residential receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Gadara	2 months per location	-	1	-	-
Gullen Range		-	2	-	-
Crookwell 2		-	-	-	-
Note 1: Durations should be regarded as indicative and representative of a typical work site.					
Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).					
Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.					

The above assessment shows that 'clearly audible' (1-10 dB) worst-case impacts are predicted for the residential receiver closest to the Gadara telecommunications connection (receiver ID: H38) and the two residential receivers closest to Gullen Range telecommunications connection (receiver ID S18 and S19) (refer to **Table 6-11**). The additional telecommunications connections to existing substations construction work is expected for a duration of around two months per location.

The proposed mitigation measures to minimise and manage the predicted would be consistent with the measures identified in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS for mitigation of potential transmission line construction noise impacts.

6.2.4 Crushing

Preliminary geotechnical investigations and further consideration of terrain along the amended project alignment have identified several potential areas where controlled blasting may be required as an alternative to ripping or hammering of rock. The extent of the potential areas identified has been developed for assessment purposes.

The 21 potential blasting areas are generally spread across the amended project transmission line corridor and vary in length between around 250 metres and 11,300 metres, with an average length of around 2,700 metres. Figure 3-8 in Chapter 3 (Description of the amended project) of the Amendment Report provides an overview of the indicative blasting locations.

Controlled blasting would not be required for the any whole area and would be limited to specific locations, such as construction benches for transmission line structures. The benefit of controlled blasting would be minimising the earthwork duration at the identified areas. Crushing would subsequently be required to break up hard rock after controlled blasting.

A summary of the number of residential receivers where NML exceedances are predicted for the proposed crushing work is shown in **Table 6-12**.

No 'other sensitive' receivers are predicted to be impacted by crushing work.

The potential controlled blasting areas and nearby receivers are shown in **Attachment B**.

Table 6-12 Day-time NML exceedances – crushing

Scenario	Duration[1]	Number of residential receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
Crushing	One month per potential controlled blasting area	-	66	13	1
Note 1:	Durations should be regarded as indicative and representative of a typical work site.				
Note 2:	Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).				
Note 3:	Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.				

The above assessment shows:

- A 'highly intrusive' (>20 dB) worst-case noise impact is predicted at the residential receiver closest to potential controlled blasting area 4 (receiver ID: F2) (refer to **Table 6-12**).
- 'Moderately intrusive' (11-20 dB) impacts are predicted at up to 13 of the closest residential receivers to the potential controlled blasting areas spread across the transmission line corridor. 'Clearly audible' (1-10 dB) impacts are predicted at a further 66 residential receivers (refer to **Table 6-12**).
- Crushing is expected for a duration of up to around one month at any given potential controlled blasting location.

The assessment conservatively assumes that crushing may occur up to the boundary of each of the potential controlled blasting areas. In reality, crushing locations would be positioned away from nearby receivers where possible to reduce the potential noise impacts and would occur for discrete periods of time to break up blast spoil and would not be continuous.

The proposed mitigation measures to minimise and manage the predicted impacts are consistent with the EIS and are described in Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for crushing include (but are not limited to):

- Maximise the offset distance between noisy plant and sensitive receivers.
- Orient noisy plant and equipment away from sensitive receivers.
- Turn off machinery when not in use.
- Notify and consult with potentially noise affected receivers about upcoming noisy activities.

6.2.5 Nominated access tracks

Revised access arrangements along the length of the transmission line corridor require construction of new or upgraded access tracks. Existing unsealed local roads, forest roads, and trails proposed for use as part of the revised access arrangements may also require minor improvement work, such as grading or resurfacing. Intersections connecting existing tracks/roads may also require upgrade work.

The number of sensitive receivers where NML exceedances are predicted for the access track and intersection construction work is summarised in **Table 6-13**. The worst-case access track and intersection construction noise impacts across the amended project footprint are shown in **Attachment G.3**.

Table 6-13 Day-time NML exceedances – access tracks and intersections

Scenario	Duration[1]	Number of receivers			
		HNA[2]	With NML exceedance[3]		
			1-10 dB	11-20 dB	>20 dB
New tracks	1-2 days per track	2	260	90	21
Upgraded tracks		24	184	57	45
Intersections		1	179	52	6
Note 1: Durations should be regarded as indicative and representative of a typical work site.					
Note 2: Highly Noise Affected, based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).					
Note 3: Based on worst-case predicted noise levels. Impact colouring based on CNVG exceedance categories in **Table 6-1**.					

The above assessment shows:

- ‘Highly intrusive’ (>20 dB) worst-case day-time noise impacts are predicted at up to 21 and 45 of the residential receivers closest to the proposed new and upgraded access tracks, respectively. ‘Highly intrusive’ (>20 dB) worst-case day-time noise impacts are also predicted at up to six of the residential receivers closest to the potential intersection upgrades.
- Up to two of the residential receivers closest to new access tracks, 24 of the residential receivers closest to upgraded access tracks and one receiver closest to potentially upgraded intersections are predicted to be highly noise affected.
- One place of worship (‘other sensitive’ receiver), Greendale Uniting Church (receiver ID: R12), is predicted to have a ‘clearly audible’ (1-10 dB) impact during construction of the closest new access track.

- A total of up to 474 sensitive receivers are predicted to have day-time noise impacts from access track construction across the amended project footprint.
- Access track and intersection construction work would be relatively short-term and is only expected to impact individual sensitive receivers for up to one to two days per access track.

The proposed mitigation measures to minimise and manage the predicted impacts are consistent with the EIS and are described in Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for access track and intersection construction include (but are not limited to):

- Use noise source controls, such as residential class mufflers, to reduce noise from all regularly used plant including excavators and trucks.
- Notify and consult with potentially noise affected sensitive receivers about upcoming noisy activities.

6.3 Amended project construction noise impacts compared to the EIS Project

6.3.1 Ancillary facilities

Comparison of the total number of residential receivers with day-time NML exceedances from ancillary facilities for the amended project and the EIS project, shows:

- 42 fewer residential receivers are predicted to exceed the day-time NMLs during ‘site establishment’ for the amended project, compared to the EIS project. ‘Site establishment’ is expected for a duration of around 8-12 weeks per location.
- Nine additional residential receivers are predicted to exceed the day-time NMLs during ‘compound operation’ for the amended project, compared to the EIS project. ‘Compound operation’ is expected for the duration of the amended project construction.
- The majority of the ancillary facility construction noise impacts are predicted at the Amended Memorial Avenue compound (C14), which is generally consistent between the amended project and the EIS project in terms of construction noise.

6.3.2 Transmission line

The total number of residential receivers predicted to have transmission line construction noise impacts is generally consistent between the EIS project and the amended project. Comparison of the total number of residential receivers with day-time NML exceedances from the transmission line construction scenarios which are consistent between the amended project and the EIS project, shows:

- Six and 17 additional residential receivers are predicted to exceed the day-time NMLs during ‘site establishment and deliveries’ and ‘earthwork and clearing’, respectively. ‘Site establishment and deliveries’ is expected for one to three weeks and ‘earthwork and clearing’ is expected for one to five days per transmission line structure.
- Three, two and six fewer residential receivers are predicted to exceed the day-time NMLs during ‘construction of structures’, ‘overhead stringing of conductors and earth wires’ and ‘decommissioning and rehabilitation’, respectively. ‘Construction of structures’ is expected for two weeks, ‘overhead stringing of conductors and earth wires’ is expected for three weeks, and ‘decommissioning and rehabilitation’ is expected for two to three days per transmission line structure.

Areas where there are a greater number of impacts predicted for the amended project are primarily due to additional sensitive receivers which have been identified since *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS (refer to **Section 5.1** and shown as 'Amended receiver' in **Attachment B**).

6.4 Construction road traffic noise impacts

The amended 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 increases are shown in **Attachment D** for all roads on the proposed routes.

A summary of the number of roads where there is predicted to be an exceedance of the Department of Environment, Climate Change and Water, *Road Noise Policy* (RNP) (DECCW, 2011) criteria for residential receivers at various distances from the road edge is shown in **Table 6-14**. The change in the number of roads in each category are shown in brackets. For example 100 (+20) would represent 100 roads for the amended project and indicate that this is an increase of 20 compared to the equivalent results for the EIS project. No change from the EIS project is indicated by (-).

Table 6-14 Summary of construction road traffic noise

Road	Local roads – unsealed	Local roads – sealed	Arterial / sub-arterial roads
RNP criteria	**>2.0 dB increase and $L_{Aeq(1hour)}$ 50 dBA**	**>2.0 dB increase and $L_{Aeq(1hour)}$ 50 dBA**	**>2.0 dB increase and $L_{Aeq(15hour)}$ 60 dBA / $L_{Aeq(9hour)}$ 55 dBA**
Total roads	149 (-1)	73 (-31)	101 (+32)
Roads with >2.0 dB increase	149 (-1)	73 (-31)	25 (-4)
Roads with RNP exceedance for receivers within 10 m of the road edge	149 (-1)	73 (-31)	16 (+11)
Roads with RNP exceedance for receivers within 50 m of the road edge	149 (-1)	70 (-29)	4 (+4)
Roads with RNP exceedance for receivers within 100 m of the road edge	148 (-2)	25 (-39)	- (-)
Roads with RNP exceedance for receivers within 250 m of the road edge	7 (-66)	4 (-6)	- (-)
Roads with RNP exceedance for receivers within 500 m of the road edge	- (-)	- (-1)	- (-)

The above assessment shows:

- Construction traffic is likely to result in a noticeable increase in noise levels (>2 dB) on all local roads and around 25 per cent of the arterial / sub-arterial roads due to low existing traffic volumes on these routes
- For unsealed local roads, exceedances of the RNP criteria are predicted for:
  - all roads if receivers are within 50 metres of the road edge
  - seven roads if receivers are within 250 metres of the road edge

    - no roads where receivers are 500 metres from the road edge.
- For sealed local roads, exceedances of the RNP criteria are predicted for:
    - all roads if receivers are within 10 metres of the road edge
    - 25 roads if receivers are within 100 metres from the road edge
    - no roads where receivers are 500 metres from the road edge.
- For arterial / sub-arterial roads, no exceedances of the RNP criteria are predicted for roads where receivers are at least 100 metres from the road edge, which is generally expected to be the case for this class of road.
- Compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS, potential construction road traffic noise impacted receivers have generally decreased for local roads and slightly increased for arterial/sub-arterial roads.

The assessment is based on the worst-case scenario when the peak construction workforce mobilises in the night-time period. It is likely that there will be times during construction when less vehicle movements are required and/or the construction peak occurs during the day-time period, resulting in reduced road traffic noise impacts.

The proposed mitigation measures to minimise and manage the predicted impacts are consistent with the EIS and are described in Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for construction road traffic noise include (but are not limited to):

- OOH 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.

6.5 Construction vibration impacts

Vibration offset distances for the vibration intensive equipment required to complete the work at substations, transmission lines and access tracks have been determined from the CNVG recommended minimum working distances for cosmetic damage and human response, consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.

Receivers within the minimum working distances for construction work have been determined for the amended project and are summarised in **Table 6-15** for both the EIS project and the amended project.

The construction vibration impacts from the amended project are shown in **Attachment H**.

Table 6-15 Summary of vibration

Assessment	Number of receivers within recommended working distance[1]	
	Cosmetic damage	Human comfort
EIS project	13	20
Amended project	27	67
Note 1: Based on worst-case use of a large vibratory roller.		

The above assessment shows:

- The 27 receivers closest to transmission line construction are likely to be within the minimum working distance for cosmetic damage (ie 20 metres for a large vibratory roller). Of these receivers, 10 are within the amended project footprint.
- The 67 sensitive receivers closest to transmission line construction are likely to be within the human comfort minimum working distance (ie 100 metres for a large vibratory roller).
- The number of receivers within the recommended working distances is notably increased compared to the *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. This is due to the newly defined access track locations.
- One of the sensitive receivers within the human comfort minimum working distance is Greendale Uniting Church (ID: R12). Two receivers within the cosmetic damage minimum working distance are dilapidated residences (ID: U19 and N25). All other receivers identified within the vibration minimum working distances are residential. The 'other sensitive' receivers within the minimum working distances are consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
- Vibration intensive equipment is generally expected to be used intermittently as required, rather than continuously for the duration of the scenarios that it is included in. The construction scenarios and indicative total scenario durations where vibration intensive equipment is potentially required within the recommended working distances are:
    - transmission line 'earthwork and clearing' – one to five days per transmission line structure
    - transmission line 'brake and winch sites' – one to three weeks per site
    - access tracks construction – one to two days per track.

These predictions represent a worst-case situation where a large vibratory roller is in use at the boundary of the amended project footprint.

The proposed mitigation measures to minimise and manage the predicted impacts are consistent with the EIS and are described in Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for potential vibration impacts include:

- Review of required vibration intensive equipment work locations to confirm minimum working distances as detailed construction methodology develops.
- Where vibration intensive work is required within the recommended minimum working distances and is considered likely to exceed the cosmetic damage criteria, alternate work methods will be investigated, and vibration monitoring will be undertaken.

6.6 Controlled blasting

The need for controlled blasting would typically be associated with difficult geotechnical conditions. This could be in areas where geological material changes within a foundation or where fault lines or fractures within the foundation dictate the need to change a foundation to a mass or grillage style. With modern rock drilling equipment and an appropriate suite of rock anchor foundation designs, the need for controlled blasting work can be minimised but it is expected that some controlled blasting work would be required.

A summary of the controlled blasting proposed during construction is provided below:

- Controlled bench blasting would be used for some transmission line structure pads where hard rock has been identified from geotechnical investigations.
- A single blast (or single consecutive series of blasts) would be required for each transmission line structure pad.
- Controlled smooth blasting is the preferred method. This technique involves a row of closely spaced drill holes which are loaded with decoupled charges (charges with a smaller diameter than the drill hole) and fired simultaneously to produce an excavation contour without fracturing or damaging the rock behind or adjacent to the blasted face.

Based on *AS 2187.2*, assuming average conditions site constants, the relationship between airblast overpressure and vibration versus scaled distance (ie distance per kg of charge mass) are presented in **Figure 6-3** and **Figure 6-4**, respectively.

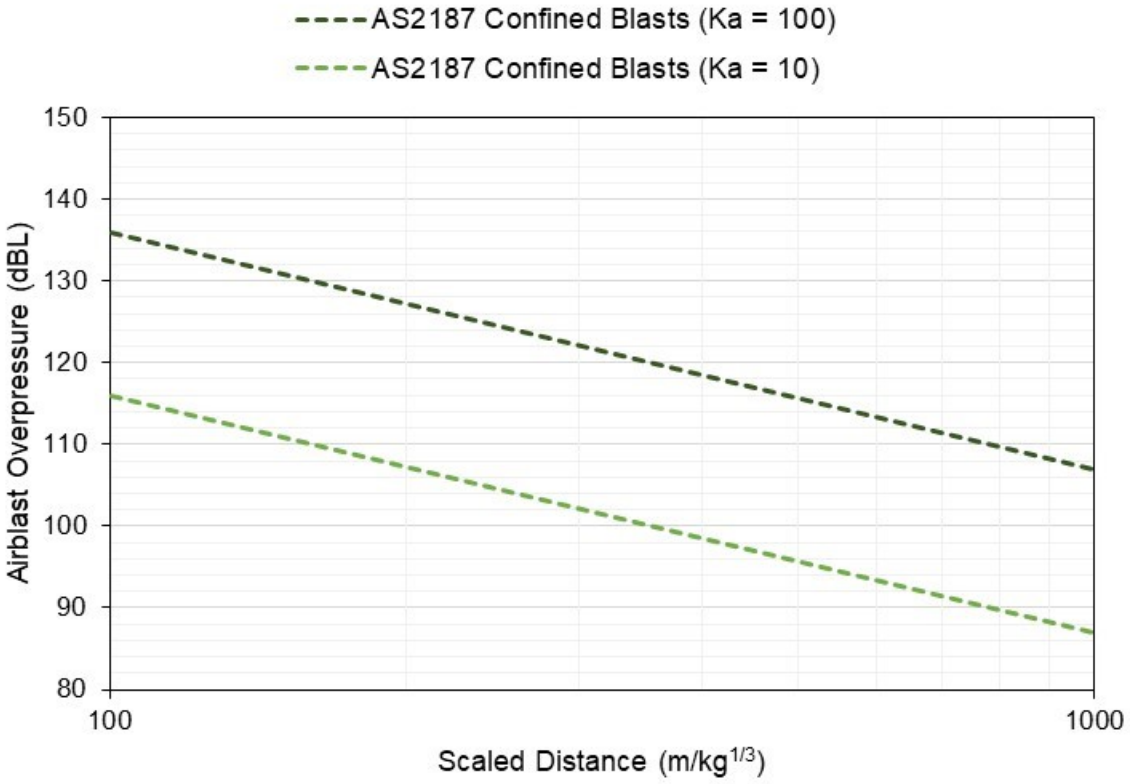


Figure 6-3 Airblast overpressure vs scaled distance

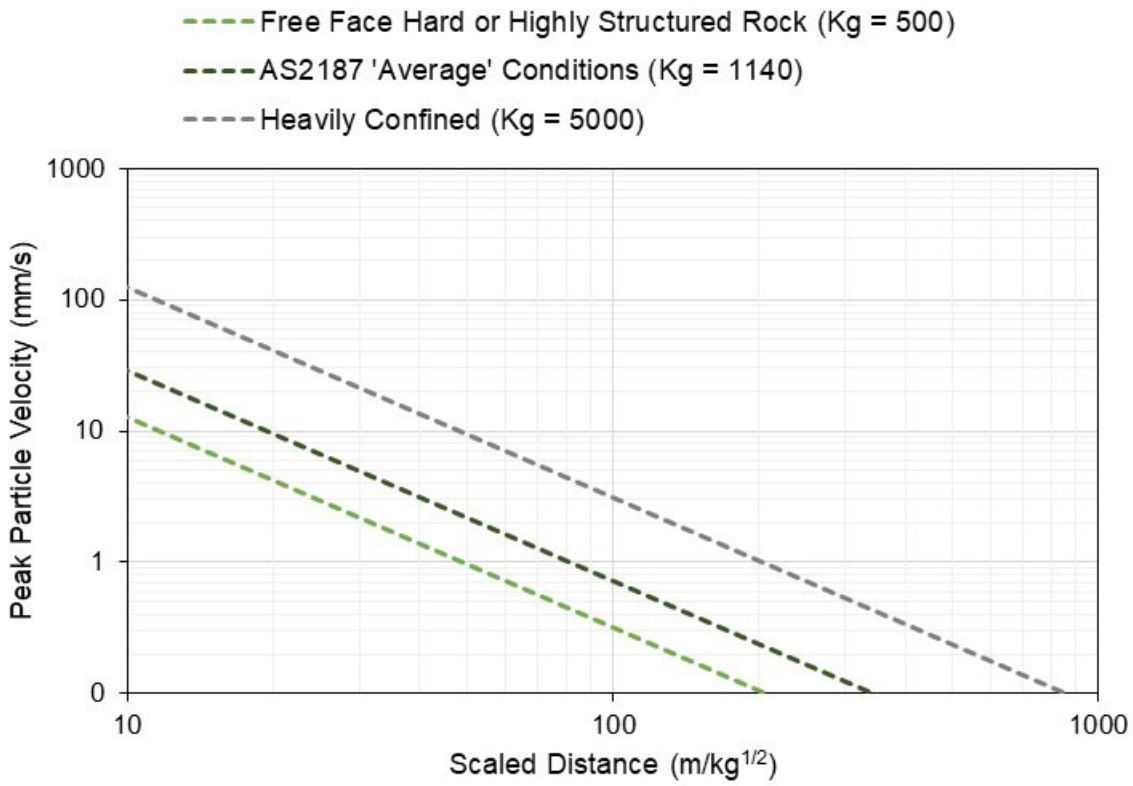


Figure 6-4 Ground vibration vs scaled distance

Figure 6-4 includes the calculated scaled distance for three indicative site constants for estimation purposes, which relate to the rock properties. *AS 2187-2* includes the site constant of 1,140 for 'average' conditions, which are representative of moderately hard free face rock. Lower values represent less confinement (ie rock with more room to expand) and higher values represent more confinement (ie rock with less room to expand). Controlled blasting constants are site specific and would be developed based on local conditions and test blasts where controlled blasting is required.

MIC calculations would be undertaken for specific work sites where controlled blasting is required. Individual blast designs are to be based on meeting the criteria rather than restrictions on MIC, noting that the blast design includes several variables including location, aspect, if near an open face, etc.

The controlled blasting variables are readily managed through good controlled blasting practices and the implementation of a Blast Management Plan which ensures the potential for impacts is minimised.

A review of nearby sensitive receivers has been undertaken based on the potential controlled blasting areas shown in **Attachment B**. The closest sensitive receivers to each potential controlled blasting area are residential receivers. An indicative range of MIC has been determined based on the confined blast site constants (Ka) presented in *AS 2187.2*, which correspond with the range attenuation rates for airblast overpressure commonly expected. The indicative MIC values are calculated conservatively assuming that controlled blasting may occur up to the edge of each potential controlled blasting area. These MIC limits would allow the recommended ground vibration and overpressure limits to be met.

It is important to note that while some of these areas are relatively large, the areas have been developed for assessment purposes and controlled blasting would be limited to specific locations within the areas and would only be required if the preferred construction method requires blasting.

This high-level assessment is provided in **Table 6-16.**

Table 6-16 Closest receivers to potential controlled blasting areas

Potential controlled blasting area	Locality	Closest Receiver ID	Distance to Receiver[1]	MIC Limit Site Constant (Ka = 100)	MIC Limit Site Constant (Ka = 10)
1	Oberne Creek	D10	449 m	<1 kg	72 kg
2	Oberne Creek	D53	783 m	3.2 kg	381 kg
3	Green Hills State Forest	E13	497 m	<1 kg	97 kg
4	Bago State Forest	F2	78 m	<1 kg	<1 kg
5	Gadara Park	H38	1,061 m	8.1 kg	946 kg
6	Minjary National Park	K13	839 m	4.0 kg	468 kg
7	Wyangle	K41	581 m	1.3 kg	155 kg
8	Brungle	M72	1,235 m	12.7 kg	1,493 kg
9	Gobarralong	N22	905 m	5.0 kg	586 kg
10	Bookham	N28	389 m	<1 kg	46 kg
11	Bookham	N33	537 m	1.0 kg	123 kg
12	Bookham	N35	152 m	24.0 kg	2,814 kg
13	Woolgarlo	O13	719 m	2.5 kg	294 kg
14	Woolgarlo	O18	781 m	3.2 kg	377 kg
15	Bango	Q36	732 m	2.6 kg	310 kg
16	Bango	Q63	413 m	<1 kg	56 kg
17	Pejar	T1	801 m	3.5 kg	408 kg
18	Myrtleville	U24	266 m	<1 kg	15 kg
19	Taralga	V7	523 m	1.0 kg	114
20	Bannaby	V17	235 m	<1 kg	10 kg
21	Bannaby	V26	1,010 m	7.0 kg	816 kg

Note 1: Distances measured from boundary of potential controlled blasting area to closest sensitive receiver.

This preliminary assessment is indicative only and further analysis would be required as part of the Blast Management Plan once discrete controlled blasting locations are confirmed. In accordance with *AS 2187.2*, a detailed analysis should also consider impacts to nearby utilities such as pipelines or infrastructure.

The proposed mitigation measures to minimise and manage the predicted impacts are discussed in **Chapter 10,** and Appendix B (Updated mitigation measures) of the Amendment Report, and would include a Blast Management Plan to be developed based on the detailed controlled blasting locations determined as the amended project progresses.

7 Assessment of aircraft noise

The following sections summarise the predicted aircraft noise from helicopters and drones used during construction. Indicative L_{Amax} noise levels are presented to illustrate expected aircraft noise levels.

7.1 Aircraft noise from potential helipads

Several of the proposed construction compounds and combined worker accommodation facilities and construction compounds 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 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 compounds and combined worker accommodation facilities and construction compounds with potential helipads are shown in **Attachment I.1**. The presented contours are representative of the maximum level predicted from both helicopter arrival and departure.

The potential helipad locations are listed in **Table 7-1**, including a summary of nearby residential receivers and predicted noise levels.

Table 7-1 Potential helipad locations and noise levels for the amended project

Site name	Distance to closest residential receiver	Number of receivers with potential aircraft L_{Amax} noise level	
		>75 dBA	>85 dBA
Maragle 500 kV substation compound (C05)	3,750 m	-	-
Amended Gregadoo Road compound (C06)	600 m	-	-
Amended Honeysuckle Road compound (C07)	1,650 m	-	-
Amended Bannaby 500 kV substation compound (C12)	1,000 m	-	-
Amended Memorial Avenue compound (C14)	20 m	290	30
Ardrossan Headquarters Road compound (C17)	30 m[1]	1	1
Snubba Road compound (C18)	3,000 m	-	-
Gadara Road compound (C19)	680 m	-	-
Ellerslie Road compound (C21)	930 m	-	-
Tarcutta accommodation facility and compound (AC03)	170 m	4	-
Adjungbilly accommodation facility and compound (AC04)	210 m	2	-
Yass accommodation facility and compound (AC05)	120 m	7	1
Crookwell accommodation facility and compound (AC06)	1,600 m	-	-

Site name	Distance to closest residential receiver	Number of receivers with potential aircraft L_{Amax} noise level	
		>75 dBA	>85 dBA
Green Hills accommodation facility and compound (AC07)	110 m	1	-
Note 1: The receiver closest to Ardrossan Headquarters Road compound (C17) is worker accommodation owned by the FCNSW.			

Helicopter L_{Amax} noise levels from arrival and departure at construction compounds and combined worker accommodation facilities and construction compounds are predicted to be above 85 dBA at the residential receivers nearest to three of the potential helipad locations. The predicted helicopter L_{Amax} noise levels also show that several locations are unlikely to experience significant impacts to the noise amenity due to receivers being sufficiently distant.

Helicopter L_{Amax} noise levels from arrival and departure at the Amended Memorial Avenue compound (C14) are predicted to be above 85 dBA at up to 30 residential receivers. High helicopter L_{Amax} noise levels at the Amended Memorial Avenue compound (C14) are also predicted at several commercial and other sensitive receivers. The other sensitive receivers with potential L_{Amax} helicopter noise levels predicted to be greater than 85 dBA are:

- Batlow/Adelong Multi Purpose Service (Hospital)
- Saint Mary's Church
- Saint John's Anglican Church
- Batlow Technology School
- The Apple Inn.

Use of potential helipad locations should be prioritised where they are most distant from sensitive receivers and unlikely to cause high L_{Amax} noise levels during regular movements throughout construction. The potential locations considered least likely to impact sensitive receiver noise amenity include:

- Maragle 500 kV substation compound (C05)
- Snubba Road compound (C18)
- Amended Honeysuckle Road compound (CO7)
- Crookwell accommodation facility and compound (AC06)
- Amended Bannaby 500 kV substation compound (C12)
- Ellerslie Road compound (C21)
- Gadara Road compound (C19)
- Amended Gregadoo Road compound (C06).

Helicopters may also be based overnight at airports including Goulburn, Wagga Wagga and Tumut. Any noise impact at sensitive receivers close to these 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 **Chapter 10**, and Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for aircraft noise from potential helipads at construction compounds and combined worker accommodation facilities and construction compounds include designing arrival and departure paths to avoid nearby sensitive receivers where possible. **Figure 7-1** shows an example of helicopter arrival and departure from all directions, versus a specific direction selected to avoid nearby sensitive receivers.

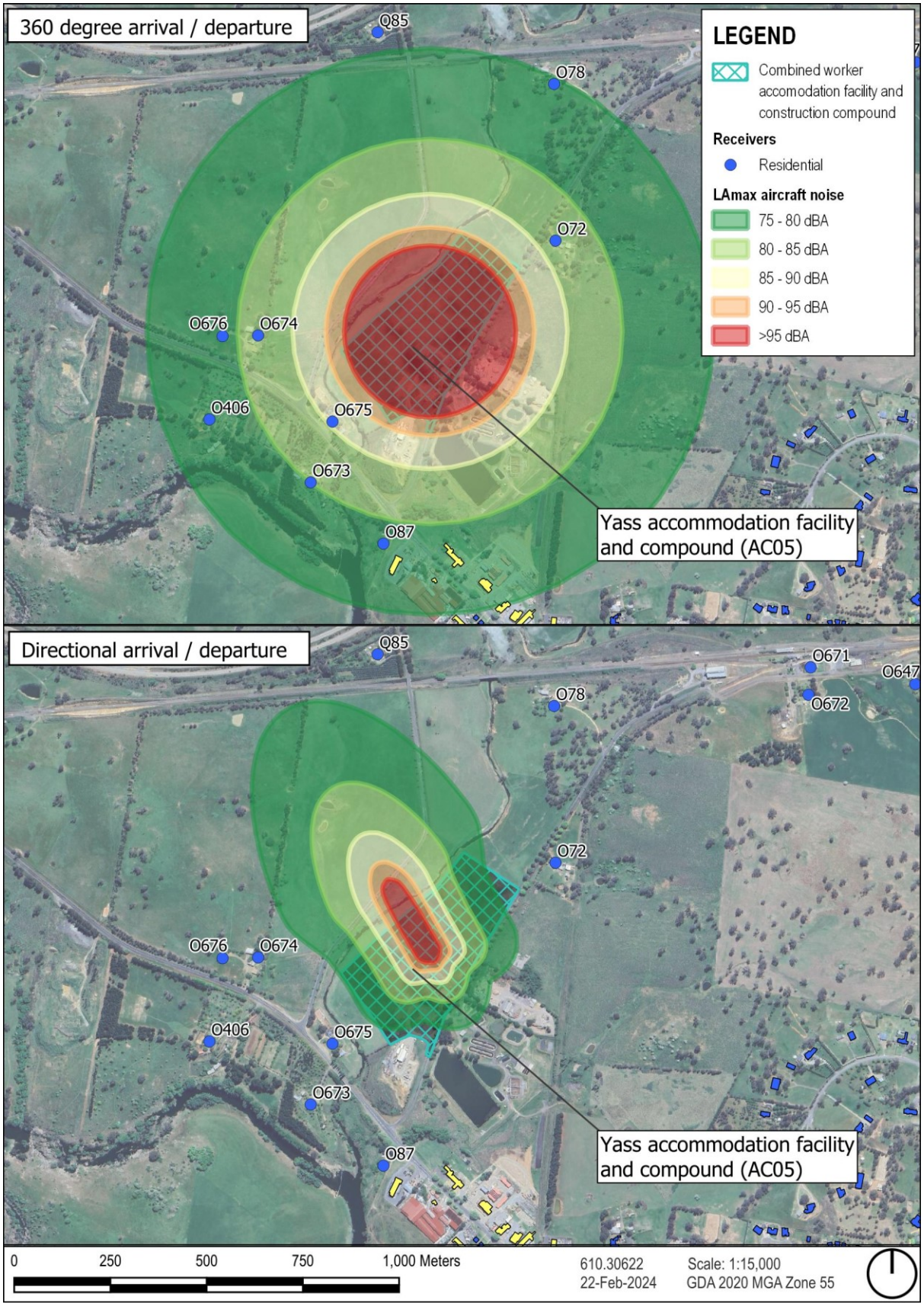


Figure 7-1 Example of helicopter arrival and departure to 1,000 ft

7.2 Aircraft noise from flight outside the amended project footprint

Helicopters would be required to fly from the nominated helipad to and from designated transmission line structure work sites within the transmission line corridor. This component of helicopter use would typically include flight over areas outside of the amended project footprint and potentially outside of the noise and vibration amended study 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 to helicopter flight paths.

Helicopters would be flown at a minimum height of 1,000 ft AGL over towns and 500 ft AGL over unpopulated areas when travelling outside of the amended project footprint. The ground offset distances at which various L_{Amax} noise levels are predicted during regular flight are shown in **Table 7-2**.

Table 7-2 L_{Amax} helicopter noise levels versus ground offset distance

L_{Amax} noise level	Ground offset distance where noise level is predicted[1]	
	500 ft flight	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 L_{Amax} noise levels show that helicopter flight outside of the amended project footprint is considered unlikely to cause significant annoyance or impact the noise amenity of sensitive receivers. At heights of 500 ft and 1,000 ft AGL helicopters are expected produce noise levels equivalent to or less than a car passing nearby for sensitive receivers directly below the flight path. Additionally, helicopter noise from flights outside of the amended project footprint is 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 **Chapter 10** and Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for helicopter noise from flight outside of the amended project footprint includes alternating flight paths to avoid repeated helicopter noise at the same sensitive receivers.

7.3 Aircraft noise from flight within the transmission line corridor

Most aircraft use within the transmission line corridor would be for stringing work via either helicopter or drone. Aircraft may also be used for platform work, and to install final components such as conductor spacers on the newly installed transmission lines.

Typically, aircraft would progressively fly draw wires through the transmission line structures between each brake and winch site. A total of eight draw wires would be required for the six phase conductors, optical ground wire and overhead earth wire. Drones may also be used for survey and vegetation management within the transmission line corridor.

The predicted L_{Amax} noise level contours for helicopter and drone flight within the transmission line corridor at a height of 170 ft AGL are shown in **Attachment I.2** and **Attachment I.3**, respectively. The 170 ft AGL height is representative of flight around transmission line structure height.

The number of sensitive receivers where various L_{Amax} noise levels are predicted during aircraft flight at 170 ft AGL within the transmission line corridor are shown in **Table 7-3**.

Table 7-3 Number of receivers with L_{Amax} helicopter noise levels from corridor flight

L_{Amax} noise level	Number of receivers predicted to exceed noise level[1]	
	Helicopter	Drone
60 dBA	260	57
65 dBA	170	32
70 dBA	91	20
75 dBA	58	10
80 dBA	33	-
85 dBA	20	-
Note 1: Eight of these sensitive receivers are within the transmission line corridor.		

The assessment shows that the number of sensitive receivers within the predicted L_{Amax} noise contours from helicopter flight within the transmission line corridor vary from 20 receivers with noise levels greater than 85 dBA to 260 receivers with helicopter noise levels greater than 60 dBA.

Drone flight at 170 ft AGL within the transmission line corridor is predicted to produce L_{Amax} noise levels less than 80 dBA at ground level and is considered unlikely to cause significant annoyance or impact the noise amenity of sensitive receivers.

The receivers identified in **Table 7-3** include following ‘other sensitive’ receivers:

- St James Anglican Church (former) (receiver ID: T15) – Helicopter L_{Amax} 65-70 dBA and Drone L_{Amax} <60 dBA
- Greendale Uniting Church (receiver ID: R12) – Helicopter L_{Amax} >90 dBA and Drone L_{Amax} 70-75 dBA.

All other receivers identified in **Table 7-3** are residential.

Construction using aircraft would generally be progressive in nature, so the worst-case noise levels at any sensitive receiver would only be apparent for a short duration as the work passes. Stringing and helicopter platform work are expected to take around six to nine days per six kilometre transmission line section. The predicted L_{amax} noise contours in **Attachment I.2** and **Attachment I.3** are representative of the transient noise levels when aircraft are flying at the edge of the transmission line corridor closest to each sensitive receiver.

The construction contractors would also require aircraft to land within the transmission line corridor at brake and winch sites and transmission line structure locations. Landing sites would be used for refuelling and would reduce the need to fly back and forth to the potential helipads at construction compounds and combined worker accommodation facilities and construction compounds. Takeoff and landing within the transmission line corridor has not been specifically assessed at this stage since the exact locations are unknown. However, landing sites at brake and winch sites and transmission line structure locations would generally be relatively centred within the transmission line corridor. Therefore, aircraft noise from takeoff and landing is expected to be less than the L_{Amax} noise levels predicted from aircraft flight at 170 ft AGL, which may occur anywhere up to the edge of the transmission line corridor.

The proposed mitigation measures to minimise and manage the potential noise impacts are discussed in **Chapter 10** and Appendix B (Updated mitigation measures) of the Amendment Report. Recommended project specific measures for helicopter noise from flight within the transmission line corridor includes community consultation to communicate specific construction scheduling that will involve aircraft near to sensitive receivers.

8 Assessment of operational impacts

8.1 Operational impacts from the proposed Gugaa 500 kV substation

The proposed Gugaa 500 kV substation is located at Gregadoo approximately 11 kilometres south-east of the existing Wagga 330 kV substation. The amended project includes adjustment of the proposed Gugaa 500 kV substation location and inclusion of additional noise generating equipment. The proposed Gugaa 500 kV substation location and nearby residential receivers is shown in **Figure 8-1**.

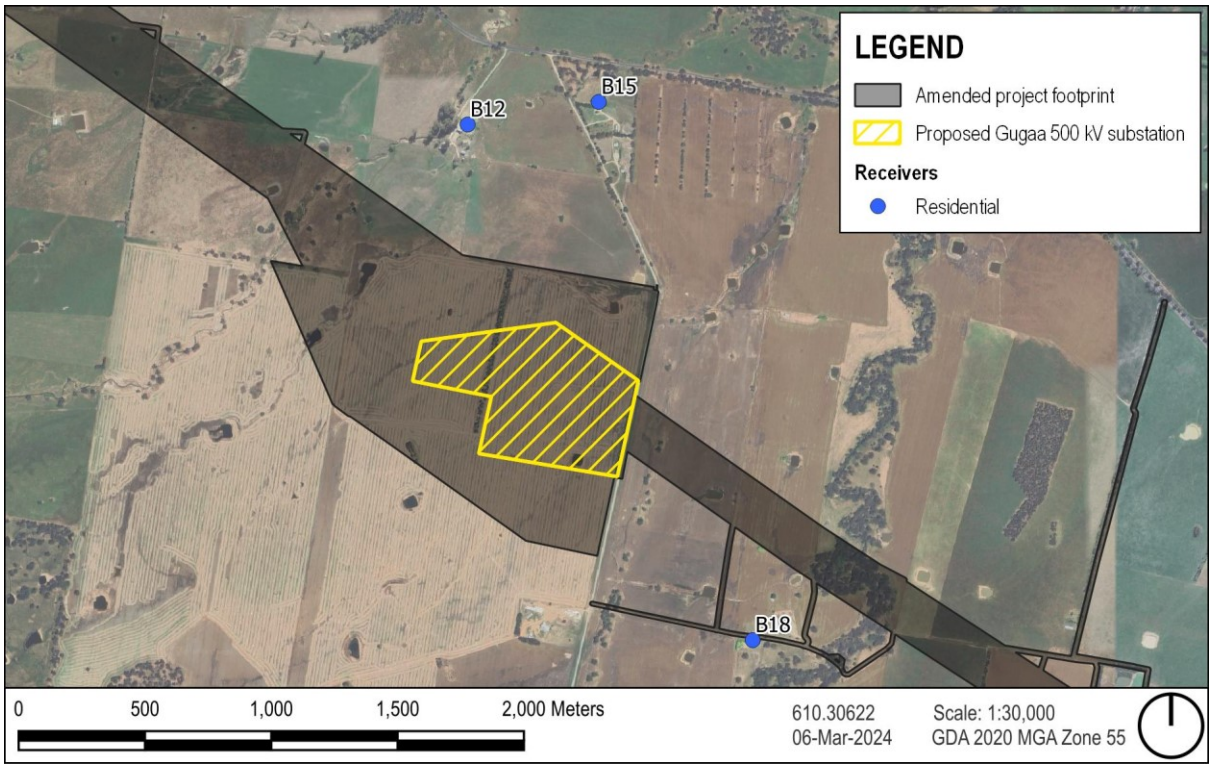


Figure 8-1 Proposed Gugaa 500 kV substation location and nearby receivers

Details of the noise generating equipment at the proposed Gugaa 500 kV substation are shown in **Table 8-1**, for both the EIS project and the amended project. The assessed indicative substation layout is shown in **Figure 8-2**.

Table 8-1 Noise generating substation equipment

Equipment	Quantity		Sound power level[1]
	EIS	Amendment	
525/345/34.5 kV 1,500 MVA power transformer (3 x single phase tanks)	6	9	105 dBA
34.5 kV/440 V 500 kVA 3 phase auxiliary transformer	2	3	85 dBA
550 kV 181 MVAr 3 phase shunt reactor	2	3	98 dBA
Neutral Earthing Reactor (NER)	1	3	80 dBA
Note 1: Based on maximum potential sound power levels provided by Transgrid			

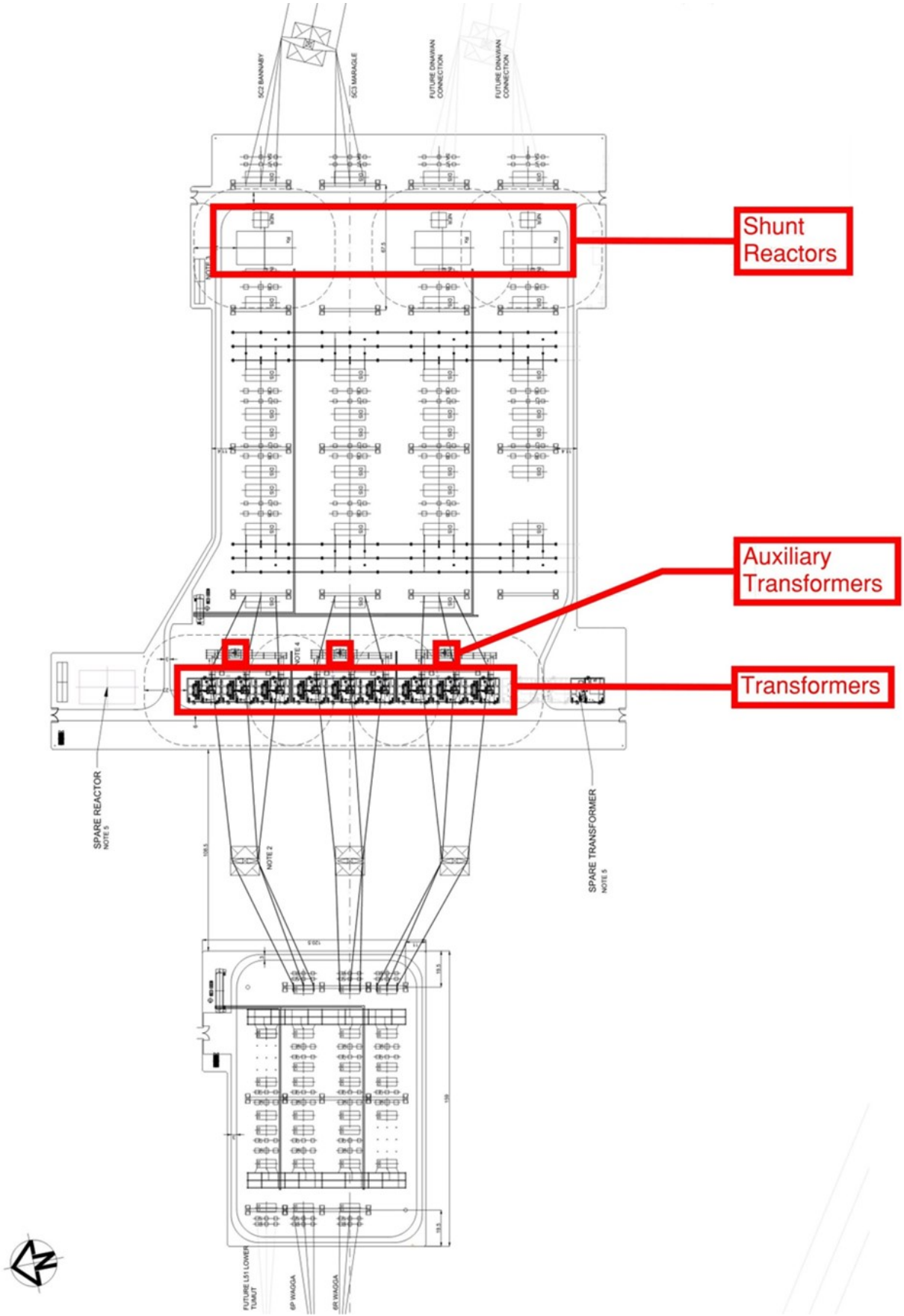


Figure 8-2 Indicative layout of the proposed Gugaa 500 kV substation

The assessment assumes that all noise generating equipment operates in a steady state nature on a 24/7 basis. All noise sources are modelled at a height of two metres AGL. The final substation design would continue to be refined during further detailed design. The operational noise impacts have been predicted both with and without indicative transformer barriers with a height of four metres.

8.1.1 Predicted noise levels

The three closest residential receivers are predicted to have potential noise impacts from the operation of the proposed Gugaa 500 kV substation. A summary of the worst-case operational noise assessment at these receivers is shown in **Table 8-2** for the scenario without transformer barriers and **Table 8-3** for the scenario with indicative transformer barriers. The predicted worst-case levels include consideration of noise enhancing weather for the night-time period and are compared to the PNTLs to determine the potential impact from the amended project.

The change in predicted noise levels compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS is shown in brackets, where applicable. For example, a result of 35 (+2) would represent a prediction of 35 dBA for the amended project and indicate that it is an increase of 2 dB compared to the equivalent result for the EIS project. No change from the EIS is indicated by (-).

Table 8-2 Proposed Gugaa 500 kV substation operational noise assessment without indicative transformer barriers

Receiver ID	Assessment period	Noise Level $L_{Aeq15minute}$ (dBA)					Compliance
		Criteria	Standard weather		Noise enhancing weather[1]		
			Predicted	Exceedance	Predicted	Exceedance	
B12	Day	40	37 (-)	-	42 (+1)	n/a	Yes
	Evening	35		2		n/a	No
	Night	35		2		7	No
	Sleep disturbance	40		-		2	No
B15	Day	40	36 (+2)	-	41 (+3)	n/a	Yes
	Evening	35		1		n/a	No
	Night	35		1		6	No
	Sleep disturbance	40		-		-	Yes
B18	Day	40	35 (+6)	-	39 (+5)	n/a	Yes
	Evening	35		-		n/a	Yes
	Night	35		-		4	No
	Sleep disturbance	40		-		-	Yes

Note 1: Noise enhancing conditions of stability category F with 2 m/s source to receiver wind during the night-time period based on historical data.

Table 8-3 Proposed Gugaa 500 kV substation operational noise assessment with indicative transformer barriers

Receiver ID	Assessment period	Noise Level $L_{Aeq15minute}$ (dBA)					Compliance
		Criteria	Standard weather		Noise enhancing weather[1]		
			Predicted	Exceedance	Predicted	Exceedance	
B12	Day	40	35 (+2)	-	39 (+1)	n/a	Yes
	Evening	35		-		n/a	Yes
	Night	35		-		4	No
	Sleep disturbance	40		-		-	Yes
B15	Day	40	32 (+5)	-	36 (+5)	n/a	Yes
	Evening	35		-		n/a	Yes
	Night	35		-		1	No
	Sleep disturbance	40		-		-	Yes
B18	Day	40	35 (+6)	-	39 (+5)	n/a	Yes
	Evening	35		-		n/a	Yes
	Night	35		-		4	No
	Sleep disturbance	40		-		-	Yes

Note 1: Noise enhancing conditions of stability category F with 2 m/s source to receiver wind during the night-time period based on historical data.

The above assessment shows:

- Predicted noise emissions from the proposed Gugaa 500 kV substation have increased compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The increase in predicted noise is due to the additional proposed noise producing equipment and the equipment locations moving closer to one residential receiver (receiver ID B18). It is noted that the noise producing equipment for the amended project has also moved slightly further from one residential receiver (receiver ID B12).
- Without transformer barriers, noise emissions from the proposed Gugaa 500 kV substation are predicted to potentially exceed the PNTLs at the three closest residential receivers (refer to **Table 8-2**).
- Without transformer barriers, noise emissions are predicted to exceed the PNTLs by up to 7 dB and 2 dB at the most affected residential receiver during the night-time with and without noise enhancing weather, respectively (refer to receiver ID: B12 in **Table 8-2**). This is consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS.
- With transformer barriers, noise emissions are predicted to be compliant with the PNTLs during standard weather. During noise enhancing weather, exceedances of up to 1 to 4 dB are predicted at the three closest residential receivers during the night-time period (refer to **Table 8-3**).

With indicative four metre high transformer barriers, the highest predicted exceedance of the PNTLs is 4 dB with noise enhancing weather during the night-time. It is expected that this exceedance could be mitigated through refinements during further detailed design including layout and positioning, the selection of equipment with lower sound power levels and/or increased barrier length and height. It is also noted that the modelled sound power levels represent the maximum potential levels for all equipment and would be reviewed as further detailed design is finalised.

The proposed Gugaa 500 kV substation will be designed to comply with the NPfI criteria as described in the EIS and Appendix B (Updated mitigation measures) of the Amendment Report.

8.2 Operational impacts from transmission lines

The EIS project included operation of the Gugaa to Wagga section of the transmission line at 330 kV. For the amended project, the transmission line between the two substations has been assessed as operating at 500 kV. However, energisation to 500 kV would only occur at the commissioning stage of the Victoria to NSW Interconnector West (VNI West) project which is subject to a separate Planning Approval. Until such time, the line will operate at 330 kV.

The amended project also includes the amended transmission line corridor section through the Green Hills State Forest and other minor corridor realignments.

8.2.1 Impacted receivers

The operational noise impacts from the transmission lines are assessed based on the offset distance at which the night-time PNTL of $L_{Aeq,15min}$ 35 dBA is expected to be reached. The night-time PNTL has been adopted as a conservative screening level representative of periods with low background noise that may also occur during the day-time. These distances are summarised across the length of the amended project corridor in **Table 8-4**, including the cumulative influence of existing transmission lines.

Table 8-4 Transmission line noise impact zones

Transmission line[1]	Maximum distance from proposed transmission line route where night-time impacts (noise levels >35 dBA) are expected[2]		
	Amended project only	Cumulative (amended project plus existing)	
		Direction of parallel line	Direction opposite parallel line
Fair Weather			
Wagga to Gugaa Cumulative with TL51 SC	70 m	187 m	74 m
Wagga to Gugaa Cumulative with TL51 DC	70 m	172 m	78 m
Gugaa to Wondalga Cumulative with TL51	82.5 m	120 m	118 m
Wondalga to Maragle	91.5 m	91.5 m	91.5 m
Wondalga to Bannaby Cumulative with TL03, 51 & 61	93 m	129 m	124 m

Transmission line[1]	Maximum distance from proposed transmission line route where night-time impacts (noise levels >35 dBA) are expected[2]		
	Amended project only	Cumulative (amended project plus existing)	
		Direction of parallel line	Direction opposite parallel line
Wondalga to Bannaby Cumulative with TL5A6 & 5A7	93 m	180 m	170 m
L50 (light rain or mist)			
Wagga to Gugaa Cumulative with TL51 SC	395 m	447 m	404 m
Wagga to Gugaa Cumulative with TL51 DC	395 m	487 m	435 m
Gugaa to Wondalga Cumulative with TL51	326 m	348 m	316 m
Wondalga to Maragle	366 m	366 m	366 m
Wondalga to Bannaby Cumulative with TL03, 51 & 61	348 m	372 m	337 m
Wondalga to Bannaby Cumulative with TL5A6 & 5A7	348 m	470 m	450 m
Note 1: All cumulative transmission line names are based on information in the *Audible Noise & Radio Interference Report*. Refer to **Attachment E** for further information.			
Note 2: All impact distances are based on the modelling presented in the *Audible Noise & Radio Interference Report*. Refer to **Attachment E** for further information.			

The indicative zones of impact based on the offset distances in **Table 8-4** have been applied assuming that the transmission line may be anywhere in the amended transmission line corridor, with consideration of a 70 metre minimum easement (ie the transmission line may be anywhere up to a 35 metre buffer within the amended project transmission line corridor).. The assessment does not account for local topography and other factors which affect sound propagation over longer distances (ie around 200 metres). Hence the presented number of potentially impacted residential receivers and the extent of the indicative zones of impact are conservative and are expected to be reduced when further detailed design of the transmission line is undertaken.

A summary of the typical fair weather and light rain or mist worst-case operational noise assessment at the residential receivers surrounding the amended transmission line route is summarised in **Table 8-5** and shown in **Attachment J**. No ‘other sensitive’ receivers are predicted to be impacted by amended transmission line operational noise emissions.

The change in predicted number of noise impacts compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS is shown in brackets, where applicable. For example, a result of 10 (+1) would represent 10 impacted residential receivers for the amended project and indicate that it is an increase of one receiver compared to the equivalent result for the EIS project. No change from the EIS is indicated by (-). The change is not shown for the Wagga to Gugaa section of the transmission line route as an assessment of this transmission line section operating at 500 kV did not form part of the scope of the EIS project.

Table 8-5 Transmission line operational noise assessment

Transmission line	Number of residential receivers with night-time exceedance			
	Amended project only		Cumulative (amended project and existing)	
	Fair weather	L50 (light rain or mist)	Fair weather	L50 (light rain or mist)
Wagga to Gugaa	1	10	1	14
Gugaa to Wondalga	2 (-)	5 (-1)	2 (-)	5 (-1)
Wondalga to Maragle	0 (-)	3 (-1)	0 (-)	3 (-1)
Wondalga to Bannaby	10 (+1)	54 (+2)	13 (+1)	56 (+1)
Total	13 (+2)	72 (+10)	16 (+2)	78 (+13)

The above assessment shows:

- During typical fair weather conditions, 13 of the residential receivers closest to the amended project footprint are predicted to experience noise levels from the amended project transmission line above the most stringent night-time PNTL.
- During L50 conditions (light rain or mist), which is expected to be the infrequently occurring worst-case condition for audible noise impacts, 72 of the residential receivers closest to the amended project footprint are predicted to experience noise levels from the amended project transmission line exceeding the most stringent night-time PNTL.
- Cumulative noise emissions from the amended project and existing 330 kV lines are expected to be marginally greater than the noise emission from the amended project transmission lines alone where the existing line would run parallel to the amended project. During typical fair weather conditions, 16 of the receivers closest to the amended project footprint are predicted to potentially exceed the night-time PNTL. During L50 conditions (light rain or mist), 78 of the receivers closest to the amended project footprint are predicted to potentially exceed the night-time PNTL.
- The total number of residential receivers predicted to have potential transmission line noise impacts has increased compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The number of residential receivers predicted to potentially have transmission line noise impacts has increased by two during typical fair weather and 13 during light rain conditions. The increase is primarily due to the refinement to assess the transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV as operating at 500 kV for the amended project, where it was assessed as operating at 330 kV for the EIS project. The number of residential receivers predicted to have potential noise impacts from other sections of the amended project transmission line are generally consistent with the assessment of the EIS project.

8.2.2 Significance of residual impacts

The NPfI defines residual noise impacts where noise from a development remains above the project noise trigger levels after all feasible and reasonable source and pathway noise mitigation have been considered. **Table 8-6** summarises the NPfI guidance on the significance of residual noise impacts and examples of potential receiver based treatments.

Table 8-6 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.
≥ 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 8-7,** based on the transmission line noise curves presented in the revised audible noise assessment Report (refer to **Attachment E**). The significance of the predicted residual impacts is also tabulated in **Attachment J**.

Table 8-7 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
Amended project only Fair weather	3	1	2	7
Amended project only L50 (light rain or mist)	26	7	11	28
Cumulative (amended project and existing) Fair weather	1	-	-	15
Cumulative (amended project and existing) L50 (light rain or mist)	25	2	9	42
Note 1: Potential impact significance based on the NPfI categories as outlined in **Table 8-6**.				

The above assessment shows:

- During typical fair weather conditions, the majority of the residential receivers with potential transmission line operational noise impacts are considered to be 'significant'. This is because the residential receivers with potential 'significant' impacts are located within or very close to (ie within 100 metres) the amended project transmission line corridor.
- During L50 conditions (light rain or mist), which is expected to be the infrequently occurring worst-case condition for audible noise impacts, the majority of the residential receivers with potential transmission line operational noise impacts are considered to be 'significant'. However, the potential impacts at around one third of the residential receivers are considered to be 'negligible' and would not typically warrant receiver based treatment.

It is noted that ten of the potentially impacted residential receivers are within the amended project transmission line corridor. Additionally, this assessment is based on the horizontal distance between the amended project and sensitive receivers and does not consider intervening terrain and some 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 8-7** and **Attachment J** 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 **Chapter 10** and Appendix B (Updated mitigation measures) of the Amendment Report.

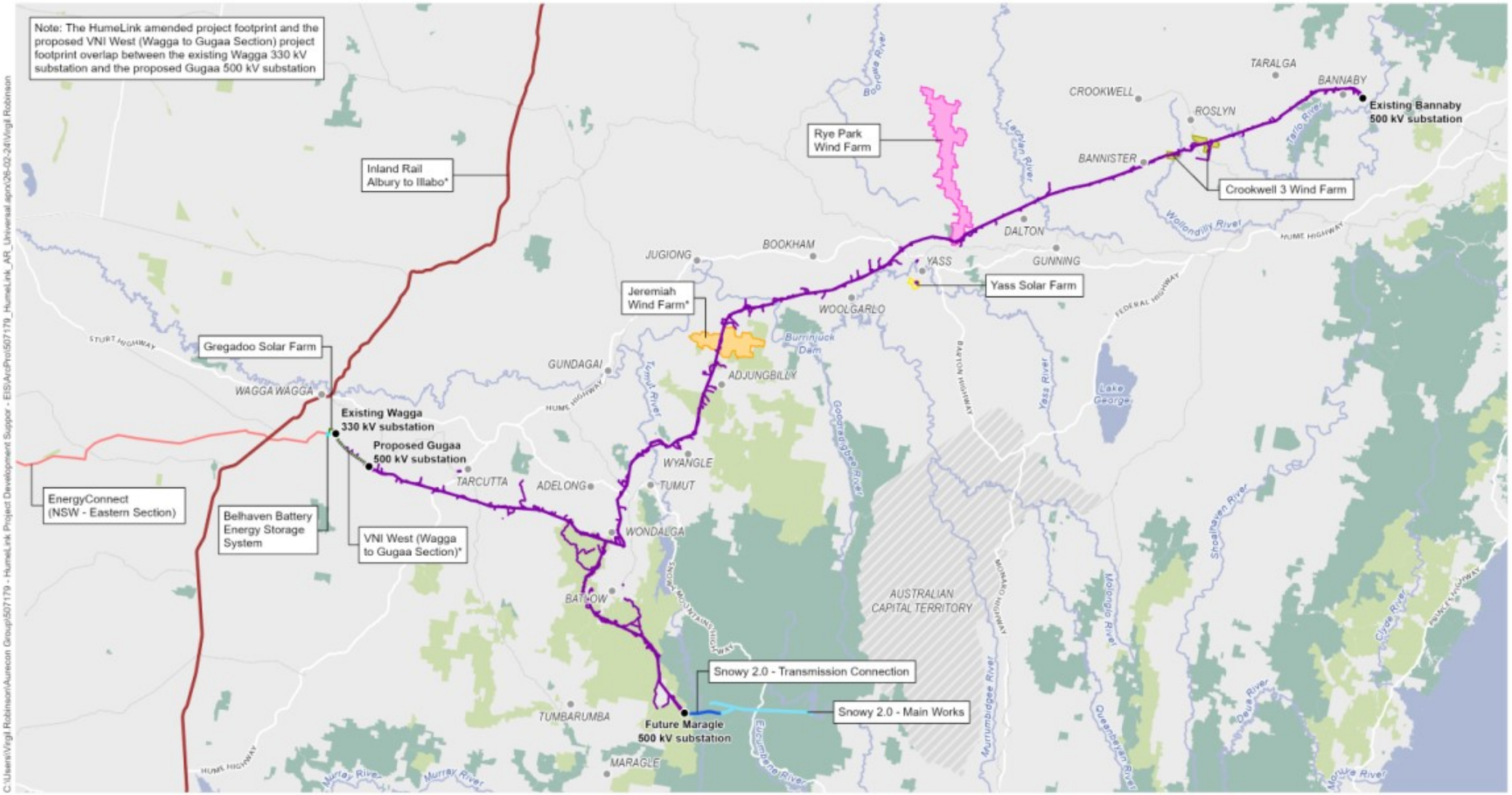
9 Assessment of cumulative impacts

Since the public exhibition of the EIS, an updated cumulative impact search has been undertaken. This updated search has identified the following two proposed projects that had not been considered in Chapter 25 (Cumulative impacts) of the EIS:

- Belhaven Battery Energy Storage System
- Yass Solar Farm.

Table 9-1 presents the cumulative impacts of the amended project for these two newly identified proposed projects.

The location of projects for which cumulative impacts were considered relative to the amended project is set out in **Figure 9-1**.



C:\Users\Virgil Robinson\Aurecon Group\507179 - HumeLink Project Development Suppor - EIS\ArcPro\507179_HumeLink_AR_Universal.aprx\26-02-24\Virgil Robinson

Amended project footprint
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway
Substation

Relevant future projects

- Belhaven Battery Energy Storage System
- Crookwell 3 Wind Farm
- EnergyConnect (NSW - Eastern Section)
- Gregadoo Solar Farm
- Inland Rail Albury to Illabo*
- Jeremiah Wind Farm*
- Rye Park Wind Farm
- Snowy 2.0 - Main Works
- Snowy 2.0 - Transmission Connection
- VNI West (Wagga to Gugga Section)*
- Yass Solar Farm

*Note: Subject to approval

Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Noise and Vibration**

FIGURE 9-1: Relevant future projects

A detailed review of the two newly identified projects and their potential interface with the amended project in terms of noise and vibration is shown in **Table 9-1**. The projects are considered in terms of the following potential noise impacts:

- **Cumulative construction noise**

  Where concurrent construction work is being completed near to a particular area, the worst-case noise levels could theoretically increase by around 3 dB (ie a logarithmic adding of two sources of noise at the same level). The likelihood of worst-case noise levels being generated by two different work activities at the same time is, however, considered low and rather than increase construction noise levels, the impact of concurrent construction work would generally be limited to a potential increase in the duration, and annoyance, of noise impacts on the affected receivers.

- **Consecutive construction noise**

  The successive work in a particular area may result in consecutive impacts (ie 'construction fatigue') at the surrounding receivers due to construction work being in the area for an extended period. Mitigation measures aimed at short-term construction work may be less effective where receivers are affected by longer duration impacts from several projects.

- **Cumulative operational noise**

  Where industrial noise of a similar nature is emitted near to a particular area, the worst-case noise levels could theoretically increase by around 3 dB (ie a logarithmic adding of two sources of noise at the same level). However, similar to cumulative construction noise, the likelihood of operational worst-case noise levels being generated by two different industrial sources at the same time is considered low and rather than increase operational noise levels, the impact would generally be limited to a potential increase in the duration, and annoyance, of noise impacts on the affected receivers.

  The operational noise criteria adopted for the assessment of noise impacts also takes the potential for future cumulative industrial noise into account. The application of the NPfI criteria reduces the risk of cumulative noise impacts above the recommended amenity criteria limits for sensitive receivers.

Table 9-1 Summary of potential cumulative noise and vibration impacts

Project	Details	Status	Distance and interface	Timing	Potential cumulative impacts
Belhaven Battery Energy Storage System	Construction and operation of a 400 MW / 800 MWh Battery Energy Storage System including transmission connection and associated infrastructure.	EIS being prepared SEARs issued on 18/05/2023	The main site is located about 1.5 km west of the existing Wagga 330 KV substation, but a connection from BESS to the substation (most likely underground) is proposed. Based on publicly available information there are likely to be overlapping construction programs.	Construction to occur in 2025-2026 (dependant on planning approval)	Cumulative and/or consecutive construction noise impacts with the Wagga 330 kV substation compound (C01) and nearby transmission line construction may occur based on the indicative proposed construction timing in the Belhaven Battery Energy Storage System Scoping Report. The project may also interface with the demobilisation of EnergyConnect work at the Wagga 330 kV substation. No cumulative operational noise impacts are expected at this stage, however, this is subject to the operational noise assessment of the Belhaven Battery Energy Storage System and should be reviewed as that project progresses.
Yass Solar Farm	The construction, operation and decommissioning of a 100 MW solar photovoltaic energy generating facility with an associated battery energy storage system.	EIS being prepared SEARs issued on 22/12/2023	The site surrounds the Yass substation, and based on publicly available information, there are likely to be overlapping construction programs. However, given the proximity and likely impacts, cumulative impacts are likely limited to the establishment and use of HumeLink's combined worker accommodation facility and construction compound proposed at Yass during construction only.	Construction to commence 2025 and run for a period of around 24 months (dependent on planning approval)	Cumulative and/or consecutive construction noise impacts with the Yass substation compound (C10) may occur based on the indicative proposed construction timing in the Yass Solar Farm Scoping Report. There are not expected to be any cumulative operational noise impacts.

10 Management of impacts

The assessment of the amended project has identified additional sensitive receivers that are predicted to have potential noise and vibration impacts. Mitigation and management measures would be applied to minimise additional noise and vibration impacts.

The noise and vibration mitigation approach would be consistent with *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and include the preparation of a:

- Noise and Vibration Management Plan (NVMP) to provide the framework and mechanisms for the management and mitigation of all potential noise and vibration impacts from the project.
- Blast Management Plan to minimise the potential for impacts. The Blast Management Plan would be based on the methodologies and requirements set out in *AS 2187.2-2006* and the ANZECC guideline.

10.1 Aircraft noise mitigation approach

Although aircraft noise is not required to be assessed to specific construction NMLs, all feasible and reasonable mitigation measures to minimise potential noise impacts should be considered.

Specific mitigation measures to minimise potential aircraft noise impacts are included in **Section 10.2**.

10.2 Specific mitigation measures

Table 10-1 provides a summary of the recommended new and revised project specific mitigation measures recommended for the project. New mitigation measures from those presented in the EIS are marked in **bold**. Text in revised mitigation measures from those presented in the EIS is marked in **bold** for additions and ~~struck out~~ for deletions.

Appendix B (Updated mitigation measures) of the Amendment Report presents a new consolidated list of environmental mitigation measures for the project.

Table 10-1 Revised and new mitigation measures

Reference	Impact	Mitigation measure	Timing	Relevant location	Responsibility
NV1	Construction noise	Where receivers are predicted to be noise affected and near construction compounds or fixed work ~~areas~~ **sites** with long durations (ie several months), path control, such as hoarding or earth bunds will be investigated. Practical measures will be implemented where required. Positioning of structures will also be considered to act as barriers between noisy work and receivers where practical.	Detailed design and construction	~~Wagga 330 kV substation compound (C01)~~ ~~Memorial Avenue compound (C14)~~ ~~Bowmans Lane compound (C15)~~ ~~Tumbarumba Accommodation Facility (AC1)~~ **Construction compounds and worker accommodation facilities**	Construction contractor
NV2	Construction noise	An out-of-hours work protocol that details how the project will identify, assess and approve out-of-hours work outside standard construction hours that are likely to generate noise levels that exceed the relevant noise management levels at sensitive receivers 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 and construction	All locations	Construction contractor

Reference	Impact	Mitigation measure	Timing	Relevant location	Responsibility
		The out-of-hours work protocol will not apply to the operation of the worker accommodation ~~facility~~ **facilities**.			
NV3	Construction noise and vibration	~~If blasting is required, a~~**A** Blast Management Plan will be developed to minimise the potential for **airblast overpressure and vibration** impacts. Maximum Instantaneous Charge calculations will be ~~carried out~~ **undertaken** for specific ~~sites where blasting is required~~ **locations within the potential controlled blasting areas**. Individual blast designs will be based on meeting the criteria rather than restrictions on maximum instantaneous charge. All ~~blasts~~**controlled blasting**, including initial **controlled** trial ~~blasts~~ **blasting**, will be monitored to obtain data which can be used to confirm site constants and compliance with **controlled** blasting criteria. Landowner notification and consultation requirements will be identified in the Blast Management Plan.	Detailed design and construction	All locations	Construction contractor

Reference	Impact	Mitigation measure	Timing	Relevant location	Responsibility
NV9	Operational transmission line noise	~~Receivers potentially noise affected by operational transmission line noise will be reviewed once the final project transmission line route, conductor arrangement and any property acquisitions are known.~~ **A detailed operational noise assessment will be undertaken based on the final project transmission line route, conductor arrangement and any confirmation of any property acquisitions, to confirm potentially noise affected receivers.** For each residence where potential operational noise levels are predicted to exceed project trigger noise levels, noise monitoring to confirm actual operational noise levels ~~would~~**will** be carried out: • at representative locations within six months of the commencement of operation; and • at the request of the landowner of the residence at any time within two (2) years after the commencement of operation. The noise monitoring will occur during weather/atmospheric conditions conducive to generating the corona effect. For residences where the monitoring identifies corona discharge levels above 35 dB(A) LAeq,15min at the reasonably most affected point of the residence, 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 within 12 months.	Detailed design and operation	Transmission lines	Construction contractor

Reference	Impact	Mitigation measure	Timing	Relevant location	Responsibility
NV10	**Construction aircraft noise**	**Management measures will be implemented to minimise aircraft noise at sensitive receivers where practicable and appropriate. Measures will include (but are not limited to):** • **Carrying out consultation to notify nearby sensitive receivers of upcoming work involving aircraft. This will include use of helipads within construction compounds and combined worker accommodation facilities and construction compounds, flight paths outside of the project footprint and stringing or other work within the transmission line corridor. Notification will include scheduled dates, locations, indicative hours and a description of the proposed work.** • **Prioritising use of helipad locations at the construction compounds and combined worker accommodation facilities and construction compounds with the maximum distance offset from sensitive receivers.** • **Varying flight paths between helipads and the transmission line corridor to avoid repeated helicopter noise at sensitive receivers.** • **Operating aircraft in accordance with Airservices Australia (ASA) *Environmental Principles and Procedures for Minimising the Impact of Aircraft Noise* (2002) and the *Helicopter Association International (HAI) Fly Neighbourly Guide*.**	**Construction**	**All locations**	**Construction contractor**

11 Conclusion

Since the public exhibition of the EIS, several amendments and refinements have been proposed which have been considered in this report. This report has been prepared to address the project SEARs in relation to the assessment of noise and vibration impacts of the amended project.

The report references the methodology of *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS and outlines any new or updated aspects of the methodology and assessment of impacts from the construction and operation of the amended project. The mitigation and management measures from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS have been reviewed and this report includes any revised or new mitigation measures for the project.

11.1 Construction

Compared to the EIS project, construction of the amended project would include changes to the transmission line corridor, additional telecommunications connections to existing substations, changes to ancillary facilities, and new and upgraded access tracks.

Representative work scenarios detailing typical plant and equipment to assess the potential construction noise impacts were developed for *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. Scenarios for the assessment of the amended project are generally consistent and have been updated to reflect the proposed construction methodology for the amended project as required.

The construction assessment considers areas where project amendments are expected to result in additional or changed impacts compared to *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS. The assessment identifies noise impacts during day-time and OOH periods as required based on the proposed working hours.

All revised and new ancillary facilities have been considered and the assessment has predicted construction noise impacts from nine of the construction compounds and combined worker accommodation facilities and construction compounds. The predicted impacts are generally limited to the residential receivers closest to each facility; however, a larger number of impacts are predicted at the Amended Memorial Avenue compound (C14) and Yass accommodation facility and compound (AC05) due to the number of sensitive receivers close to these facilities. The level of the predicted noise impacts above the NMLs from ‘site establishment’ is 1-10 dB in most cases, however, impacts >20 dB are predicted at some of the residential receivers closest to the amended project ancillary facilities.

‘Site establishment’ work at ancillary facilities would generate more noise and is predicted to result in more exceedances compared to ‘compound operation’ and ‘accommodation facility operation’. However, ‘site establishment’ would be relatively short-term with a duration of around three to four weeks per construction compound and eight to twelve weeks per combined worker accommodation facility and construction compound.

For ‘compound operation’, which is expected for the duration of the amended project construction, seven of the nine assessed ancillary facilities are predicted to have noise impacts at the closest residential receivers. The level of the predicted noise impacts above the NMLs from ‘compound operation’ is >20 dB at the four residential receivers closest to the Amended Memorial Avenue compound (C14) and one residential receiver closest to the Ardrossan Headquarters Road compound (C17) (noting that the impacted receiver is worker accommodation owned by the FCNSW). The level of the predicted noise impacts above the NMLs from ‘compound operation’ is 11-20 dB at the one residential receiver closest to the Adjungbilly accommodation facility and compound (AC03), two residential receivers closest to the Yass accommodation facility and compound (AC05) and one residential receiver closest to the Green Hills accommodation facility and compound. ‘Compound operation’ at the remaining ancillary facilities are predicted to be 1-10 dB or compliant with the NMLs.

For ‘accommodation facility operation’, which is also expected for the duration of construction, three of the four combined worker accommodation facilities and construction compounds are predicted to have noise impacts of 1-10 dB above the NMLs at the closest residential receivers during the day-time. All four of the combined worker accommodation facilities and construction compounds are predicted to have noise impacts above the NMLs at the closest residential receivers from ‘accommodations facility operation’ during the night-time. The level of the predicted night-time noise impacts above the NMLs from ‘accommodation facility operation’ is 16-25 dB at the residential receiver closest to the Green Hills accommodation facility and compound (AC07), 11-20 dB at Adjungbilly accommodation facility and compound (AC04) and Yass accommodation facility and compound (AC05), and 1-10 dB at Tarcutta accommodation facility and compound (AC03).

Transmission line construction 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 sensitive receiver which would be relatively short-term. The amended transmission corridor through the Green Hills State Forest is relatively distant from densely populated areas and is predicted to impact up to 16 of the closest residential receivers during noisy work. The amended project transmission line construction is also predicted to impact 12 fewer residential receivers between Wondalga and Buddong, where the transmission line corridor has been removed relative to the EIS project. Other corridor realignments are predicted to result in one additional residential receiver being impacted at the location near Kyeamba Creek and Tumbarumba Road, Book Book and reduced impacts at four to eight residential receivers, depending on the work scenario, surrounding the narrowing of the project footprint at Wondalga, Gobarralong and Bowning.

The additional telecommunications connections to existing substations work is predicted to impact one residential receiver closest to the Gadara and Gullen Range sites and is expected to take around two months per location.

Crushing is a highly noise intensive scenario that would be required where controlled blasting is undertaken. Crushing is predicted to result in noise impacts at the closest residential receivers to the potential controlled blasting areas. A total of up to 80 residential receivers are predicted to have worst-case noise impacts exceeding the NMLs during crushing, which is expected for a duration of up to around one month at any given potential controlled blasting location.

Revised access arrangements along the length of the transmission line corridor require new or upgraded access tracks. Intersections between existing tracks/roads and access tracks may also require upgrades. Access track and intersection construction is predicted to impact up to 474 sensitive receivers across the amended study area. Access track and intersection construction would be relatively short-term and is only expected to impact individual sensitive receivers for up to a few days.

Construction traffic has been compared to the existing traffic on all proposed routes 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 most construction routes, particularly where construction traffic is required on local roads with low existing traffic volumes.

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 offset distances for human comfort and cosmetic damage have been considered and 67 of the nearest receivers have been identified within the human comfort offset. The number of receivers within the recommended minimum offsets is increased from *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS due to the newly defined access track locations.

The requirement for controlled blasting has been confirmed and 21 potential controlled blasting areas have been identified for the amended project. Airblast overpressure and vibration levels versus distance have been presented based on a range of average conditions. Indicative ranges of Maximum Instantaneous Charge (MIC) have been determined to meet the recommended ground vibration and overpressure limits at the closest sensitive receiver to each potential blast location. Once specific controlled blasting locations are known, geotechnical investigations and further blast overpressure and vibration assessment would be undertaken, including development of a Blast Management Plan.

The amended project would apply all feasible and reasonable mitigation to reduce the potential construction impacts. The specific mitigation and management measures recommended in *Technical Report 9 – Noise and Vibration Impact Assessment* prepared for the EIS have been reviewed and updated based on the assessment in this report. Specific strategies would be determined as the amended project progresses and a Noise and Vibration Management Plan (NVMP) is developed.

11.2 Aircraft

Additional information and assessment for the use of helicopters and drones for stringing transmission lines is now available with the engagement of construction contractors. Helicopters may also be used for platform construction, which involves workers on a suspended aerial platform. Drones may be used for additional activities such as, but not limited to, surveys and vegetation management.

Noise modelling and assessment is included in this report to present indicative noise levels from 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 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 helipads. The predicted helicopter L_{Amax} noise levels are above 85 dBA at the receivers closest to three of the potential helipad locations and above 75 dBA at the receivers closest to six of the potential helipad locations. The predicted helicopter arrival and departure noise levels also show that there are several potential helipad locations where significant impacts to the noise amenity of surrounding sensitive receivers are considered unlikely due to sensitive receivers being sufficiently distant. Where potential 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.

Helicopter flight outside of the amended project footprint is considered unlikely to cause significant annoyance or impact the noise amenity of sensitive receivers due the relatively high height and speed of these flight paths.

Aircraft L_{Amax} noise levels from flight within the transmission line corridor have been predicted for helicopters and drones, at an indicative height of 170 ft AGL to represent transmission line stringing work. Helicopter flight within the transmission line corridor is predicted to produce L_{Amax} noise levels greater than 85 dBA at up to 20 sensitive receivers. Drone flight within the transmission line corridor is predicted to produce L_{Amax} noise levels less than 80 dBA at all receivers. Construction using aircraft would generally be progressive in nature, so the worst-case noise levels at any sensitive receiver would only be apparent for a short duration as the work passes. Stringing and helicopter platform work are expected to take around six to nine days per six kilometre transmission line section.

Although aircraft noise is not required to be assessed to specific construction noise management levels, specific management measures are recommended to reduce aircraft noise at sensitive receivers where practicable and appropriate.

11.3 Operation

The amended project includes adjustment of the proposed Gugaa 500 kV substation and operation of the transmission line between Wagga and Gugaa at 500 kV, noting that energisation to 500 kV would only occur at the commissioning stage of the VNI West project.

Assessment of the proposed Gugaa 500 kV substation as per the amended project identified potential noise impacts above the trigger levels at the closest residential receivers. Without transformer barriers, noise emissions from the proposed Gugaa 500 kV substation are predicted to be up to 2 dB and 6 dB above the trigger levels during standard weather and noise enhancing weather, respectively. With indicative transformer barriers, noise emissions from the proposed Gugaa 500 kV substation are predicted to be up to 4 dB above the trigger levels during noise enhancing weather and comply with the trigger levels during standard weather. The proposed Gugaa 500 kV substation would be designed to comply with the relevant noise criteria at all sensitive receivers.

The amended project includes operation of the transmission line at 500 kV between Wagga and Gugaa, the realignment of the route through Green Hills State Forest to the west of Batlow and other minor refinements to the amended transmission line corridor. Audible noise from the operation of the amended project transmission lines has been assessed based on the amended project transmission line corridor and a minimum easement of 70 metres. The assessment has considered the effect of weather conditions on audible noise emission.

Audible noise impacts are predicted at 16 of the closest residential receivers during typical fair weather conditions based on the most stringent night-time criteria. Up to 78 residential receivers expected to potentially experience audible noise impacts have been identified during light rain weather conditions.

Operational transmission line noise impacts will continue to be considered as the amended project progresses with further detailed operational noise assessments to confirm noise impacts. Individual receiver agreements are expected to be the most feasible and reasonable mitigation option where operational noise impacts remain.

11.4 Cumulative

Potential cumulative impacts from the construction and operation of the amended project and other nearby projects have been identified. An updated cumulative impact search identified two additional projects since the exhibition of the EIS, which have been considered in this report.

Consultation with applicable nearby projects will be undertaken to minimise potential cumulative construction noise impacts.

11.5 Summary and comparison to the EIS project

The outcomes of the construction noise assessment for the amended project are generally consistent with the outcomes of the EIS assessment.

The updates to ancillary facilities and transmission line construction result in a similar number and magnitude of predicted construction noise impacts compared to the EIS project. The location of the predicted impacts has changed corresponding with added and removed components of the amended project.

The detailed assessment of access track construction has been conducted based on the nomination of access tracks in the amended project. The magnitude and location of predicted noise impacts from access track construction represents additional information compared to the EIS assessment. Additional noise scenarios have also been considered for the telecommunications connections and crushing for the amended project.

The operational noise assessment for the amended project has updated all aspects of the assessment for the EIS project. At the proposed Gugaa 500 kV substation the operational noise impacts are predicted to slightly increase compared to the EIS project, however, it is expected that potential noise impacts could be mitigated through refinements during further detailed design, including layout and positioning, the selection of equipment with lower sound power levels and/or optimisation of transformer barriers.

. Additional potential operational noise impacts have been identified adjacent to the transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV substation due to this section of line being assessed to operate at 500 kV for the amended project, where it was assessed as operating at 330 kV for the EIS project.

The outcomes of the assessment and mitigation approach is generally consistent with the EIS assessment. New and revised mitigation measures have been recommended based on the assessment of the amended project. All other noise and vibration mitigation measures from the EIS are unchanged and would be applied to reduce the potential noise and vibration impacts from the amended project where feasible and reasonable.

12 References

Air Navigation (Aircraft Noise) Regulations 2018 (Cth).

Aurecon Australasia Pty Ltd, 2024, Audible Noise and Radio Interference, Sydney.

Australia and New Zealand Environment Conservation Council 1990, Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration

Department of Environment and Climate Change NSW 2009, Interim Construction Noise Guideline, Sydney.

Department of Environment, Climate Change and Water NSW 2011, NSW Road Noise Policy, Sydney.

Environment Protection Authority 2017, Noise Policy for Industry, Sydney.

Environmental Planning and Assessment Act 1979 (NSW).

German Institute for Standardisation 2013, Acoustics - Determination of aircraft noise exposure at airfields - Part 1: Calculation method, DIN 45684-1: 2013-07.

Protection of the Environment Operations Act 1997 (NSW).

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Attachment A Acoustic terminology

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

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.

'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.

Sound Power Level

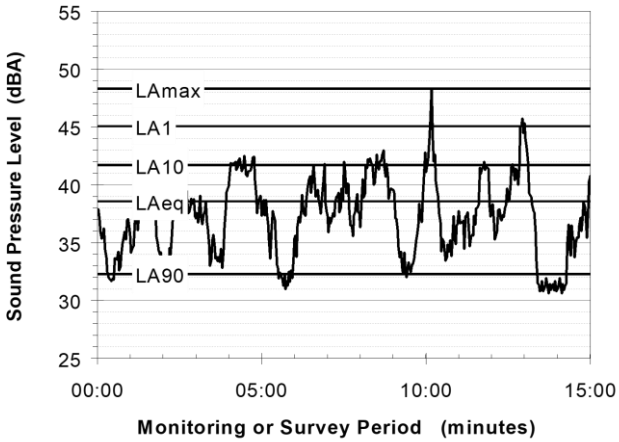
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{12} W.

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.

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:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 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.

LAeq 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.

Frequency Analysis

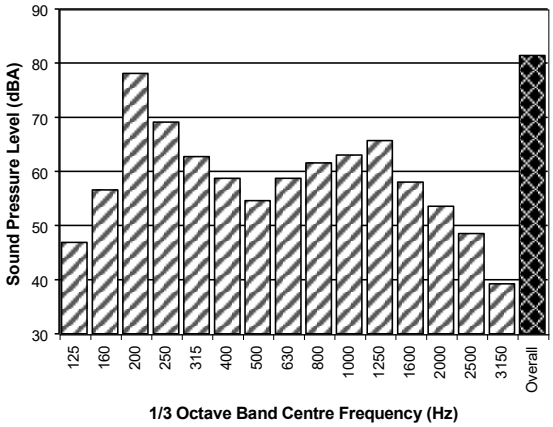
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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.



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.

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.

Human Perception of Vibration

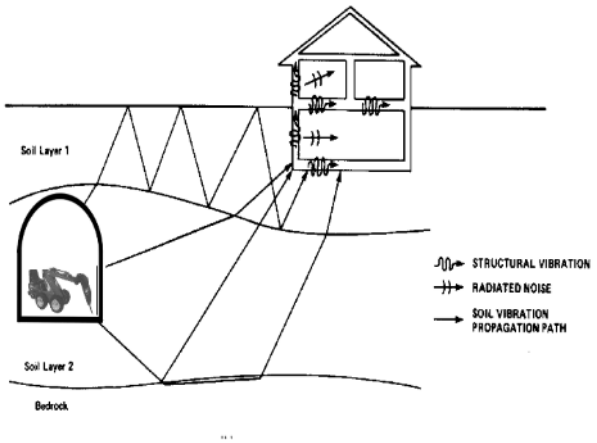
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience 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.

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 Amended project and receiver map

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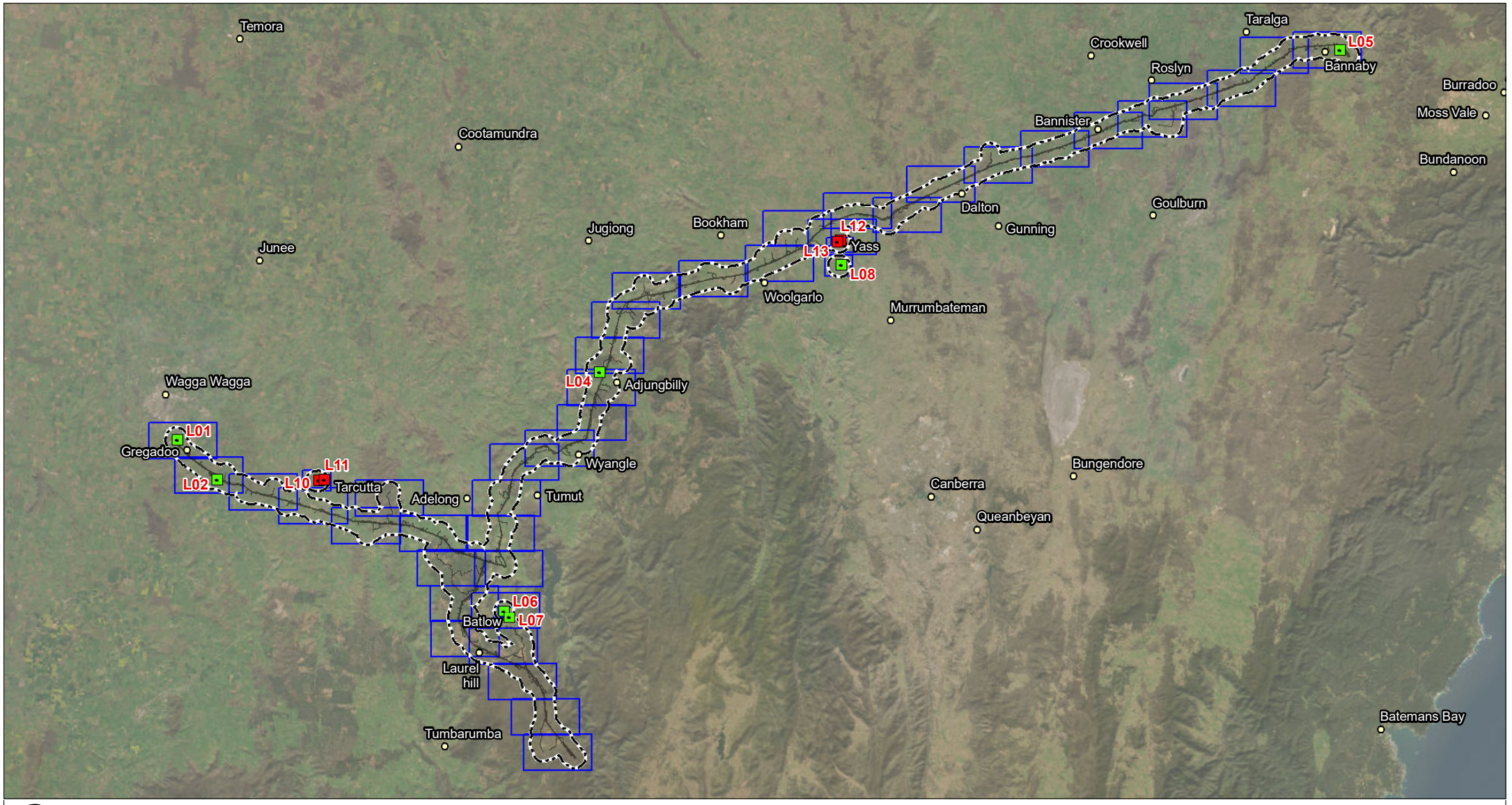

0 6,500 13,000 26,000 Metres

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Project Number:	610.30622
Date:	09-Feb-2024
Drawn by:	JG

- Population centre
- New monitoring location
- EIS monitoring location
- Amended study area
- Amended project footprint
- Mapsheet

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

ATTACHMENT A

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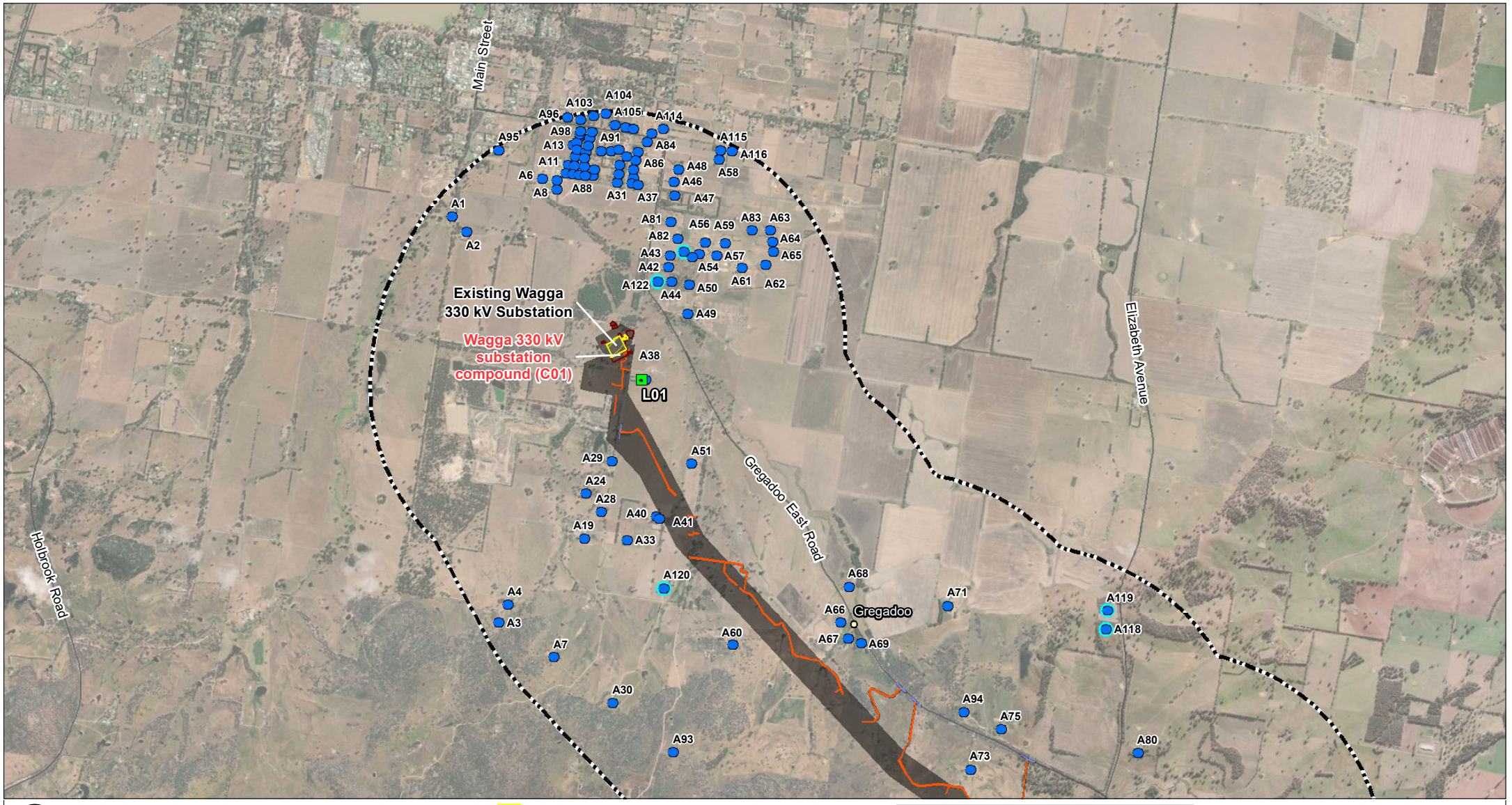

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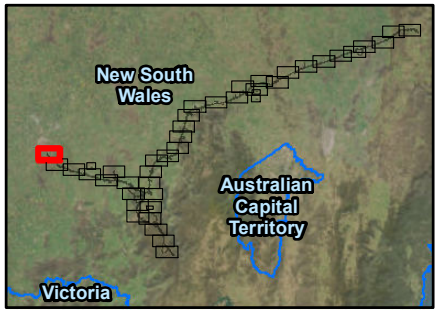

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 1 OF 44

ATTACHMENT B

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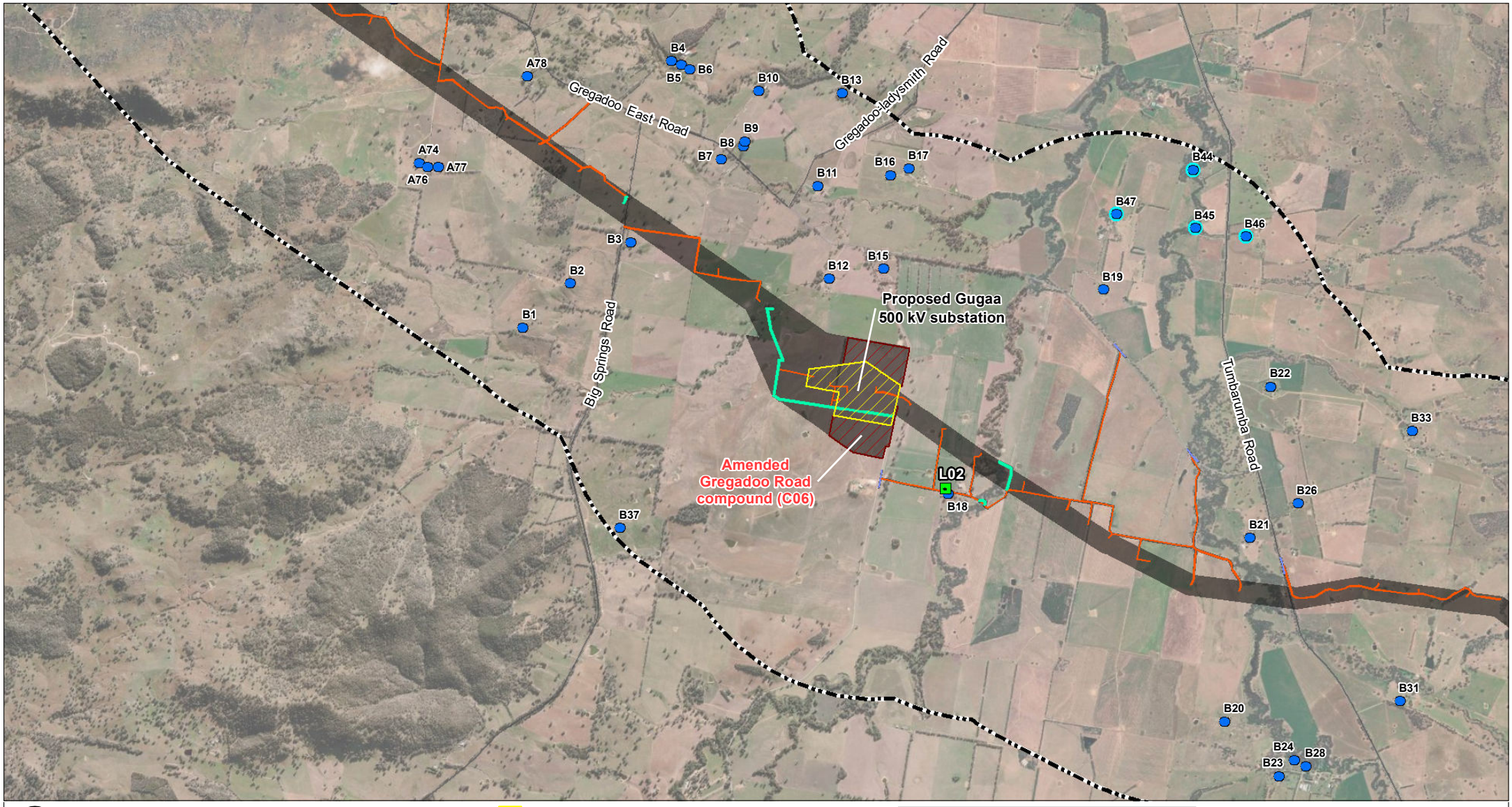

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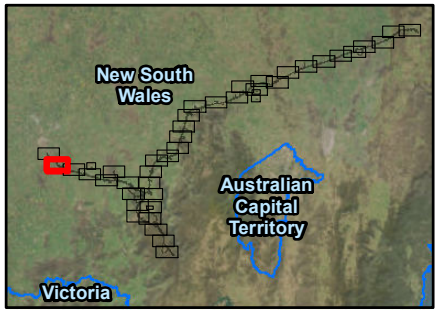

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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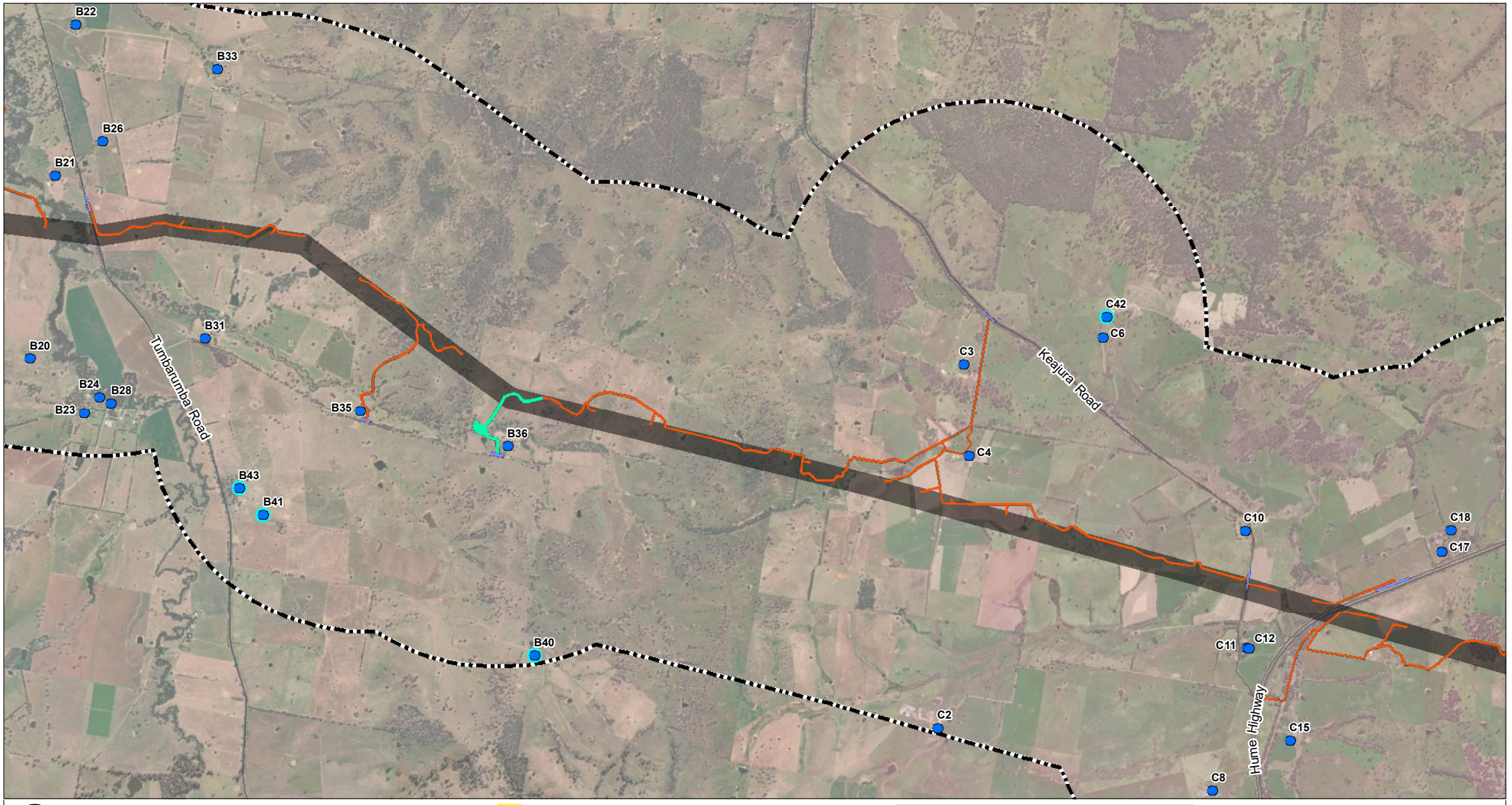

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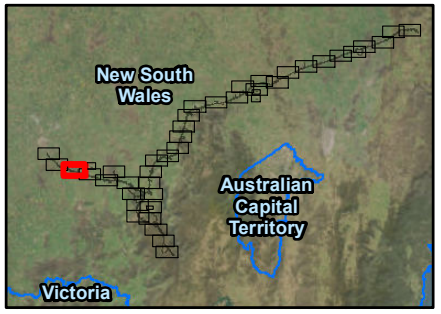

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NOISE AND VIBRATION IMPACT ASSESSMENT

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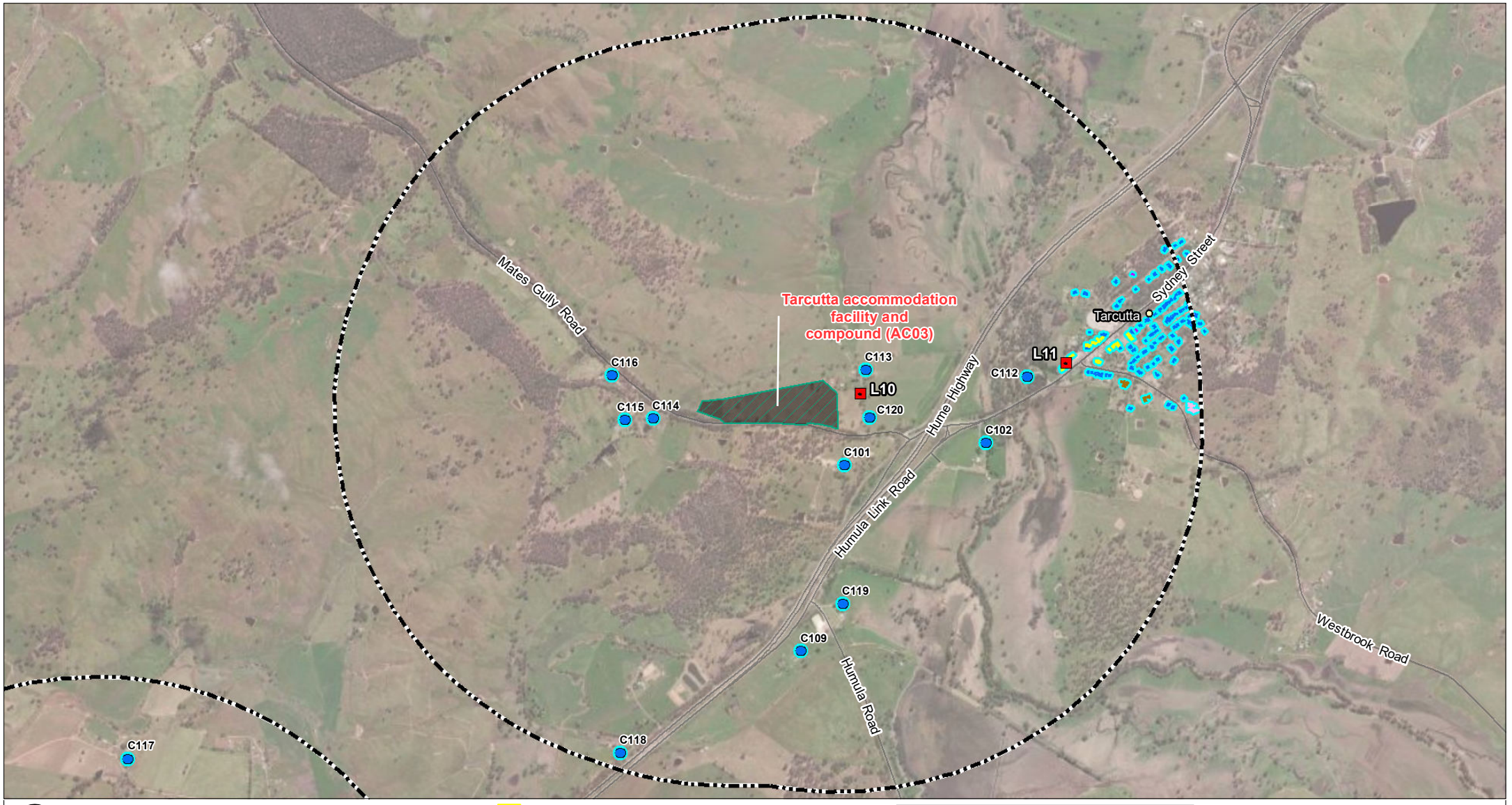

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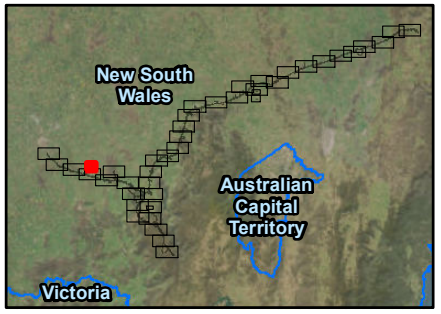

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

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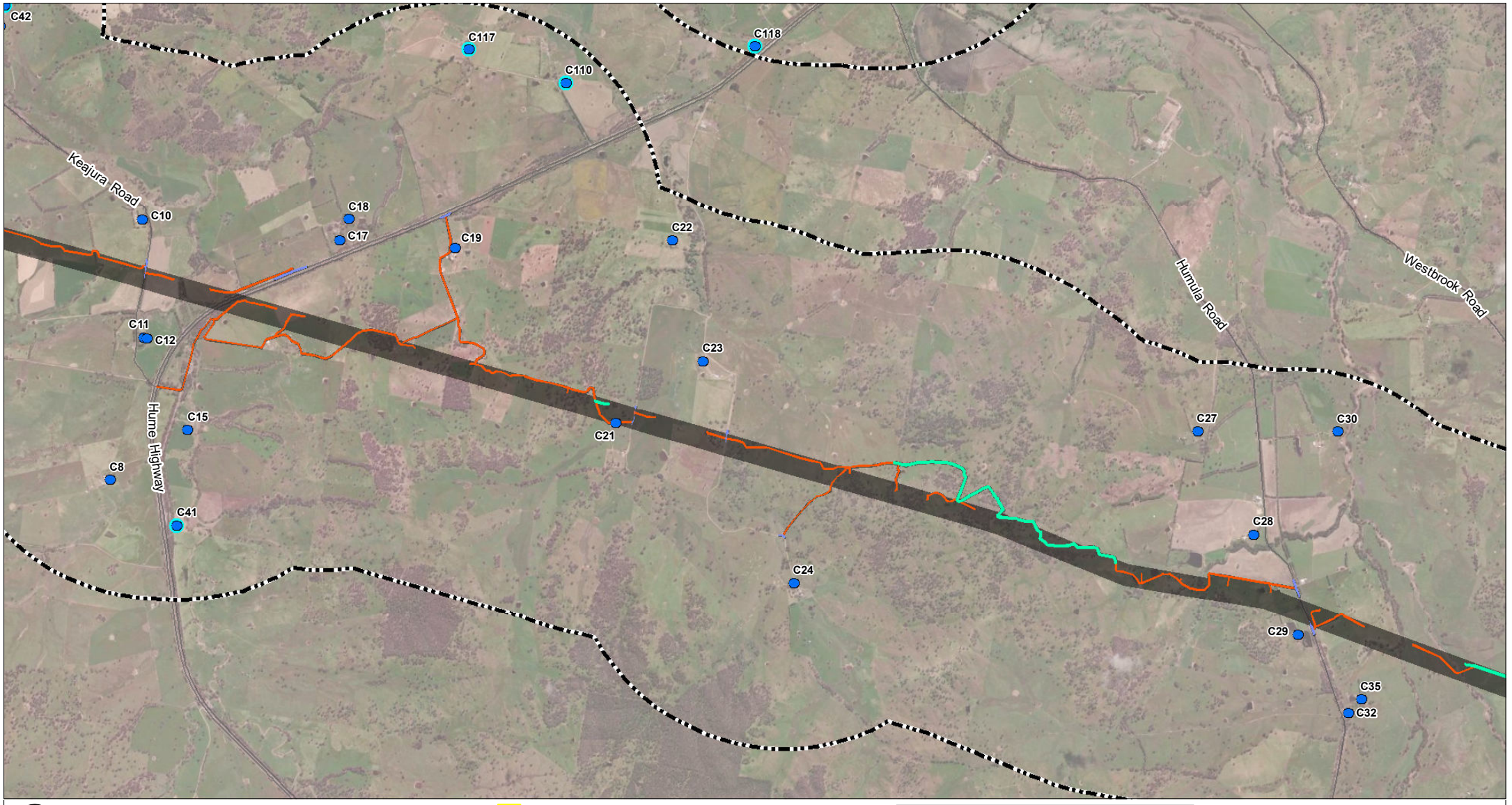

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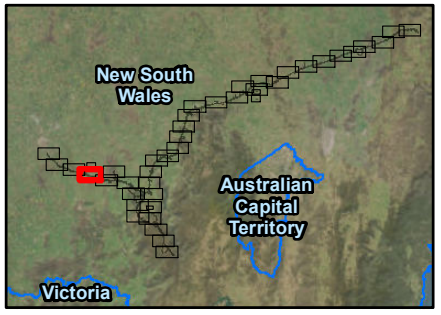

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

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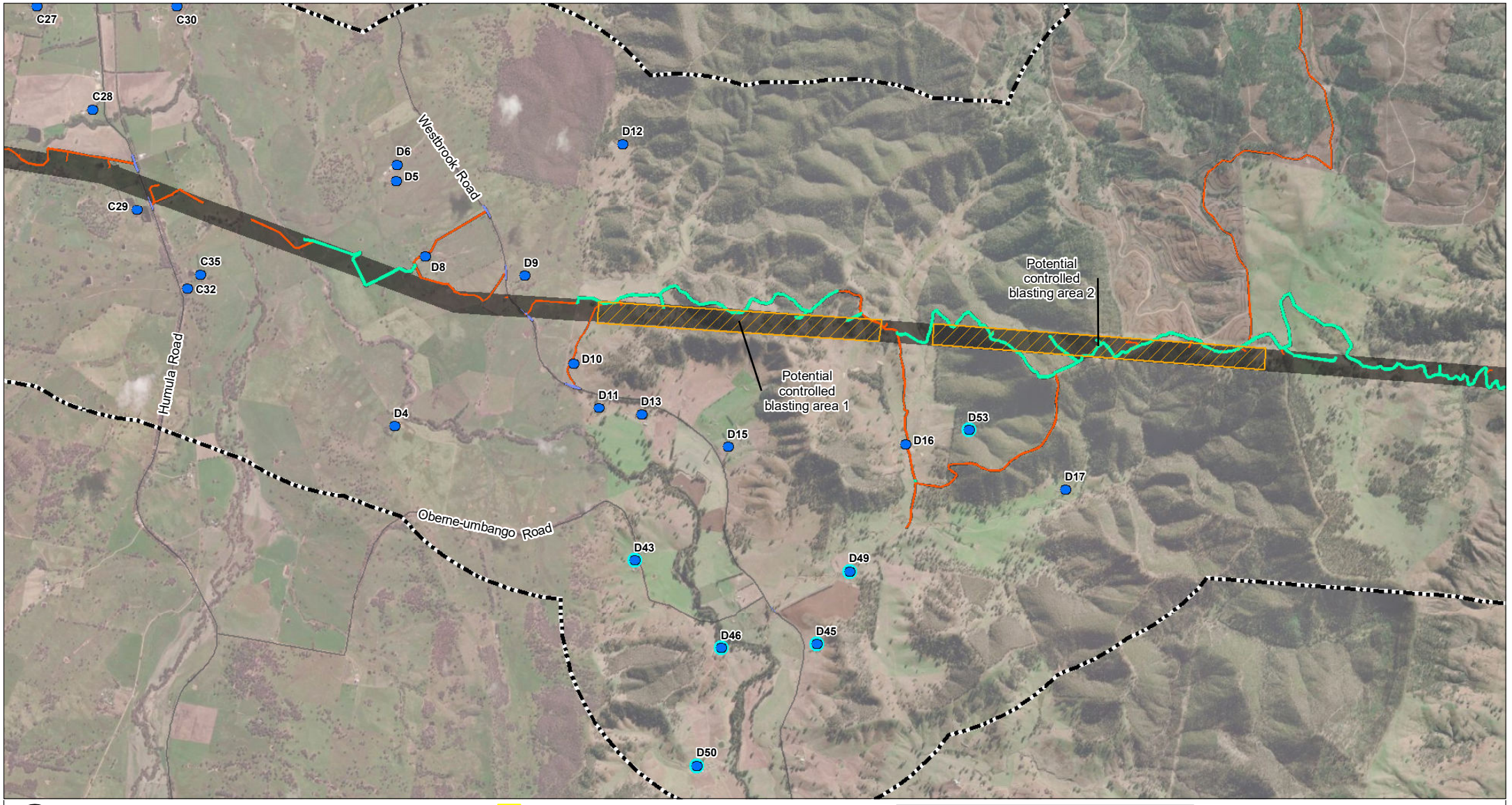

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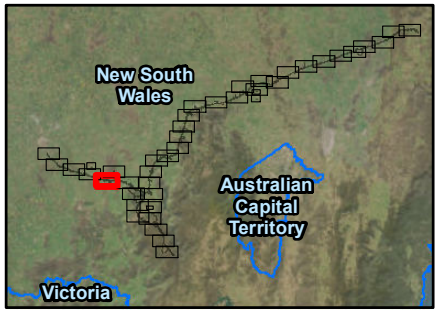

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NOISE AND VIBRATION IMPACT ASSESSMENT

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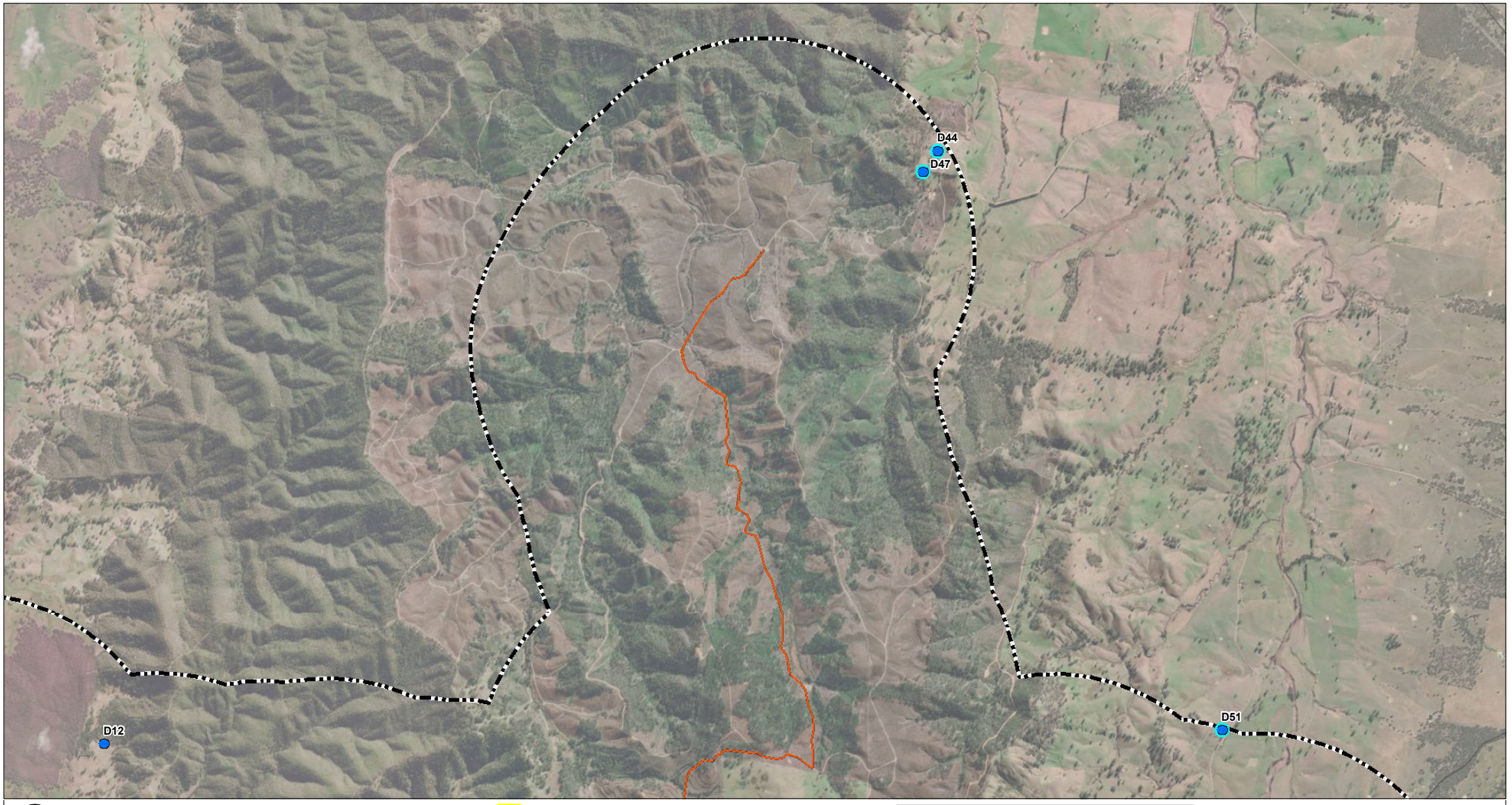

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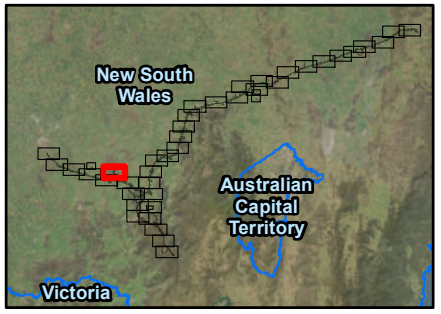

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

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ATTACHMENT B

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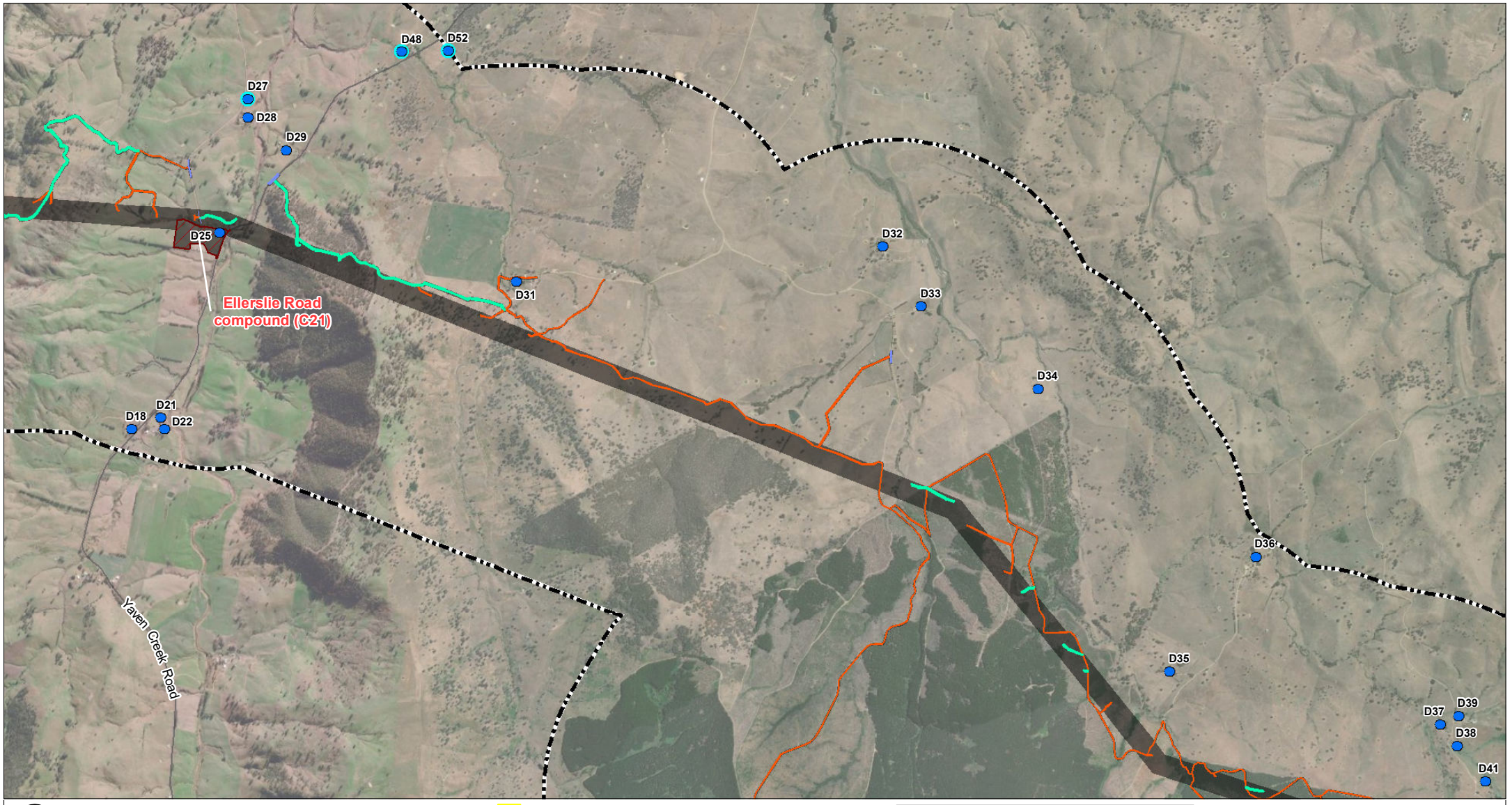

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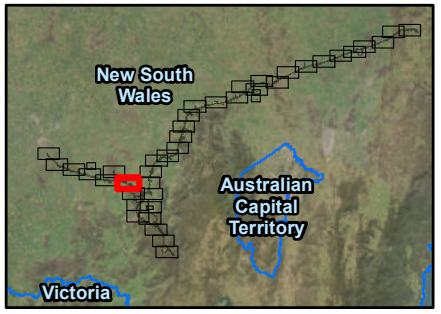

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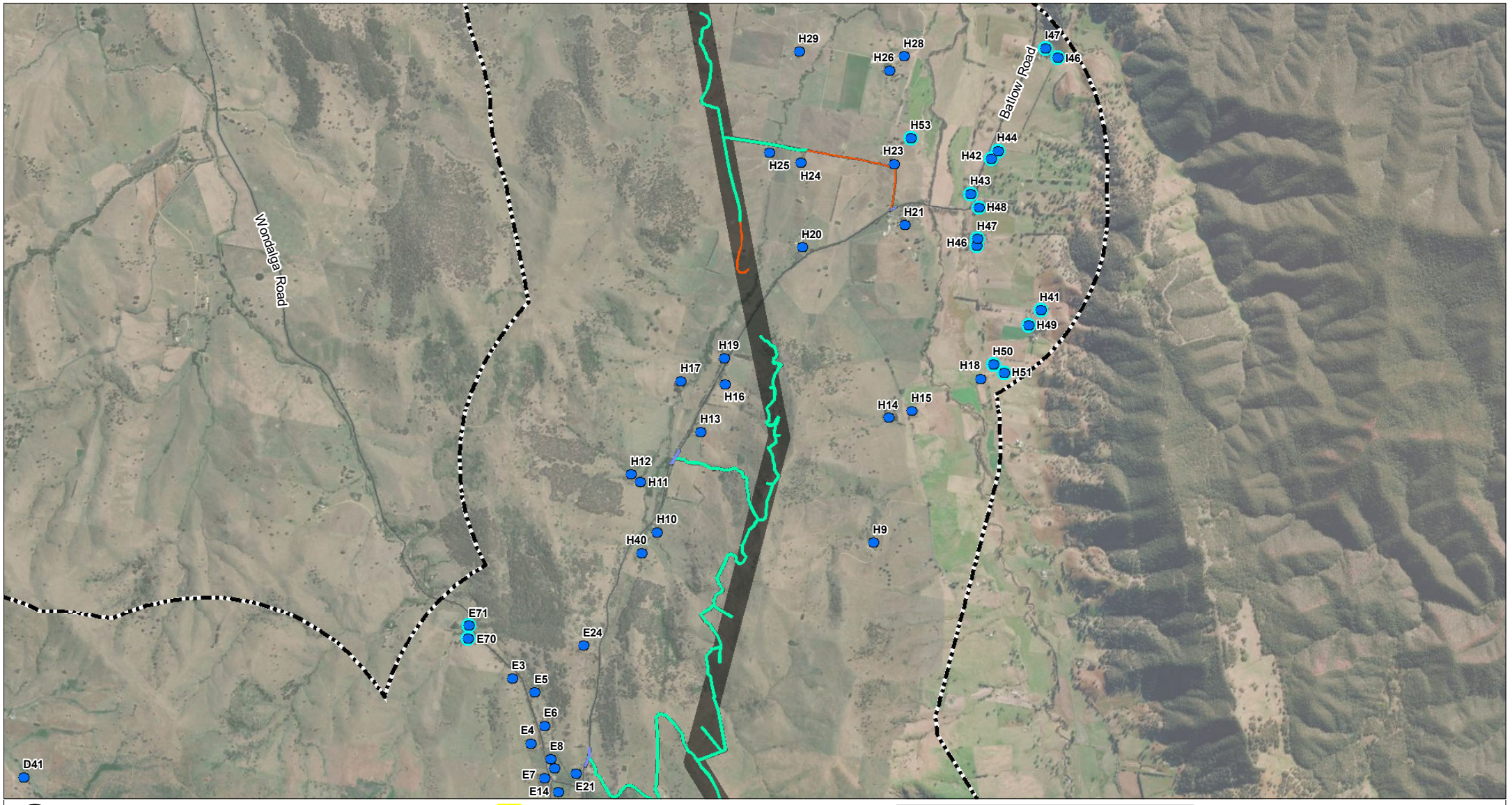

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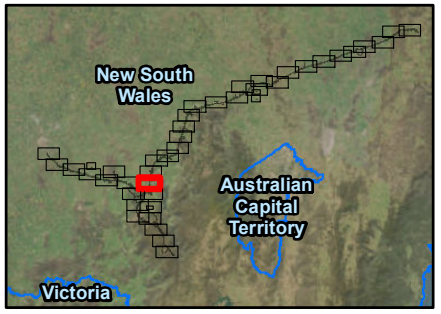
- Other (Place of Worship)



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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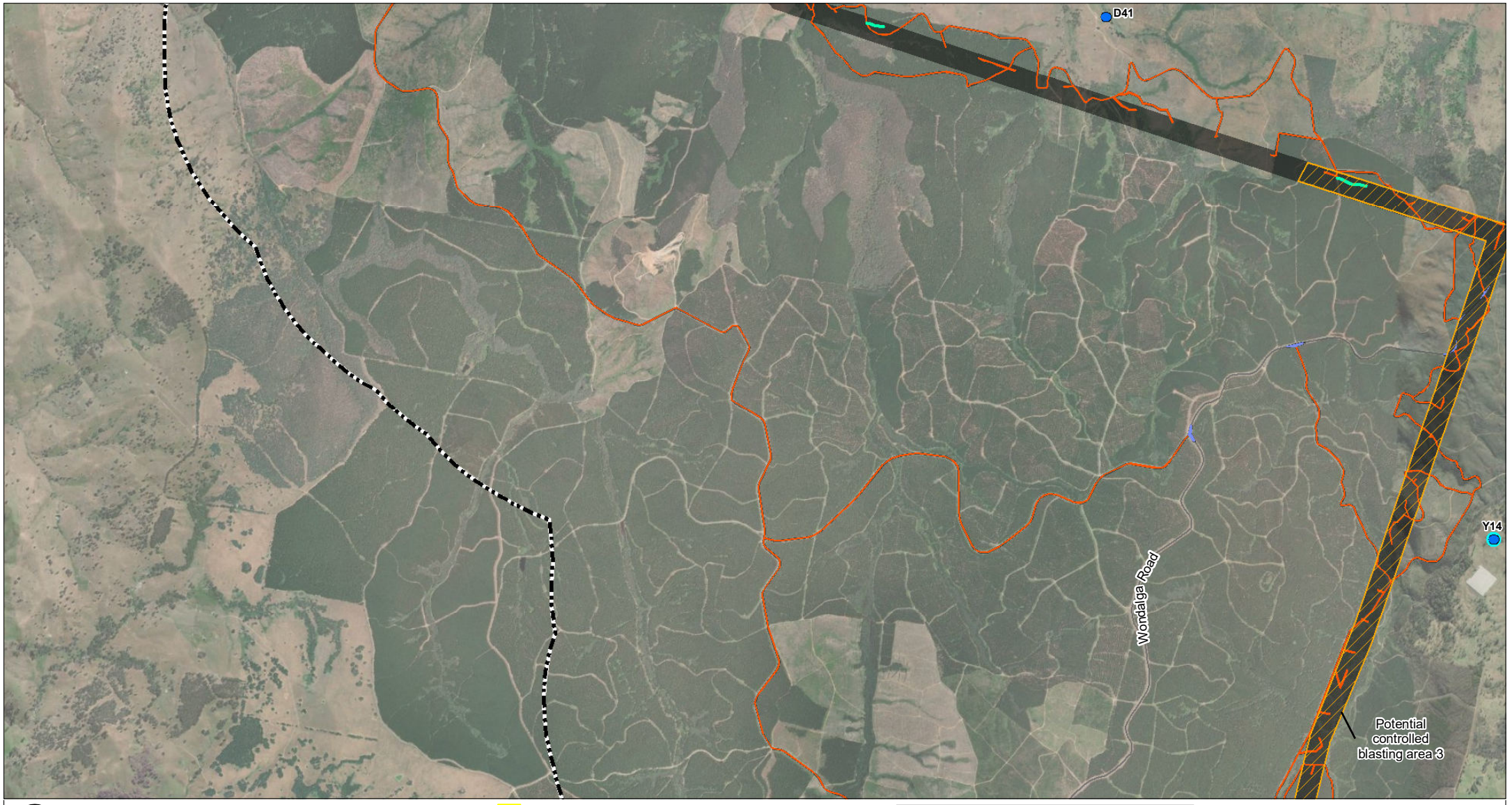
ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd



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Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
- New monitoring location
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Receiver Points

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- Other (Educational)
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Receiver Buildings

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- Other (Medical)
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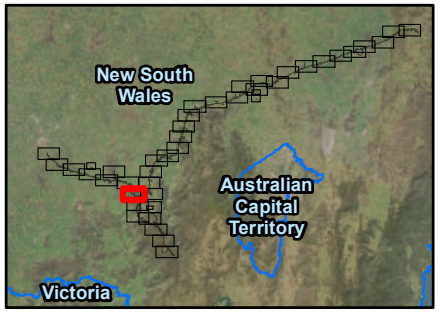

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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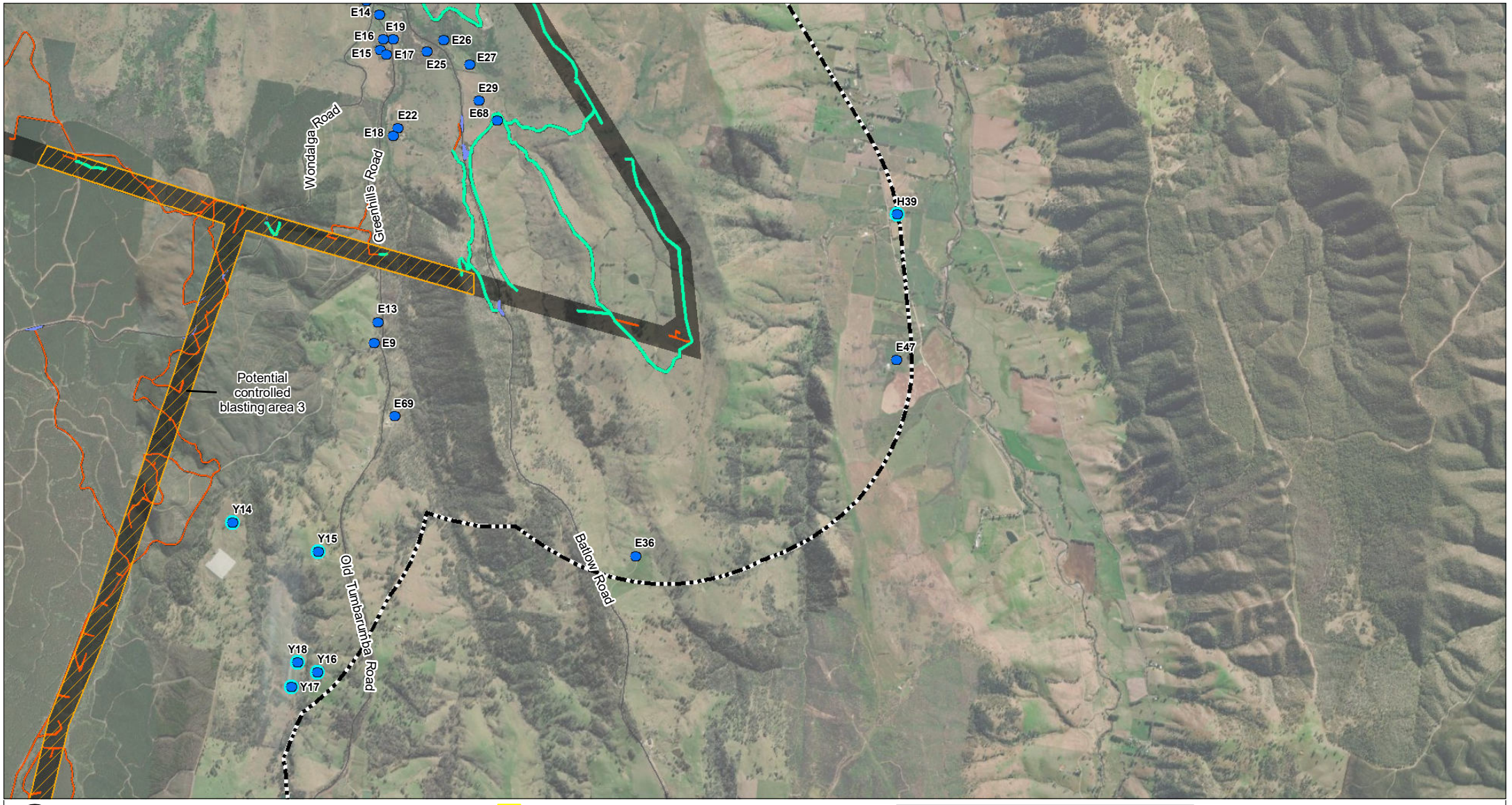

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Scale:	1:50,000 at A4
Project Number:	610.30622
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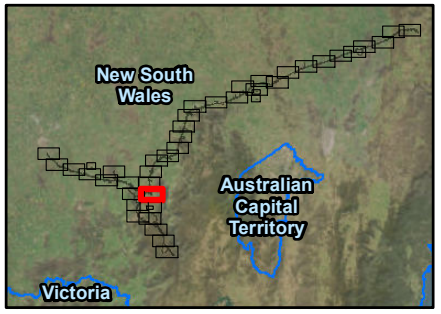

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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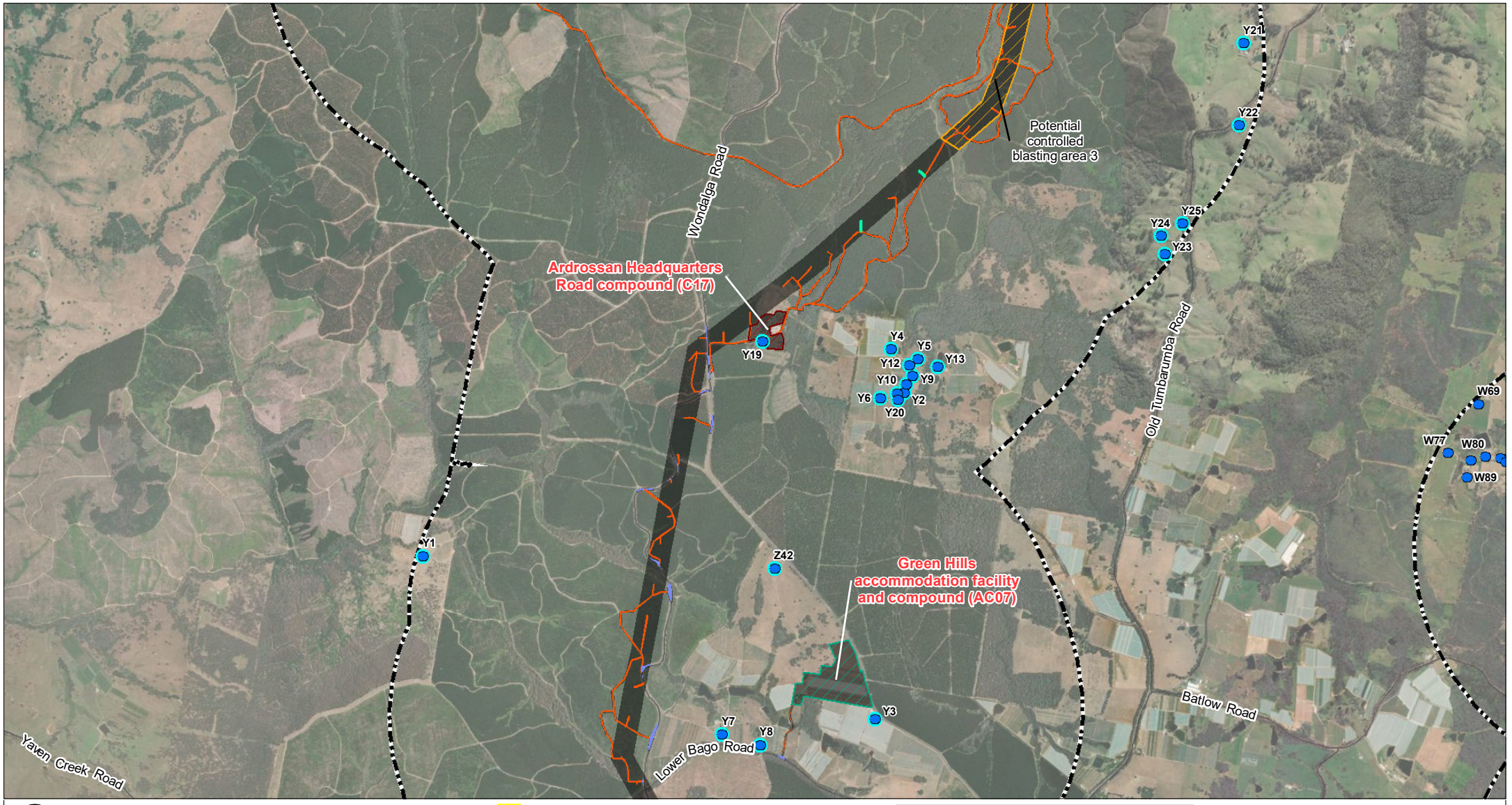

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Scale:	1:50,000 at A4
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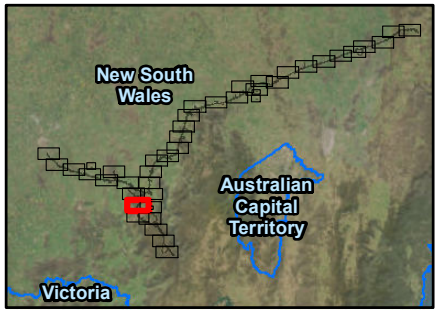

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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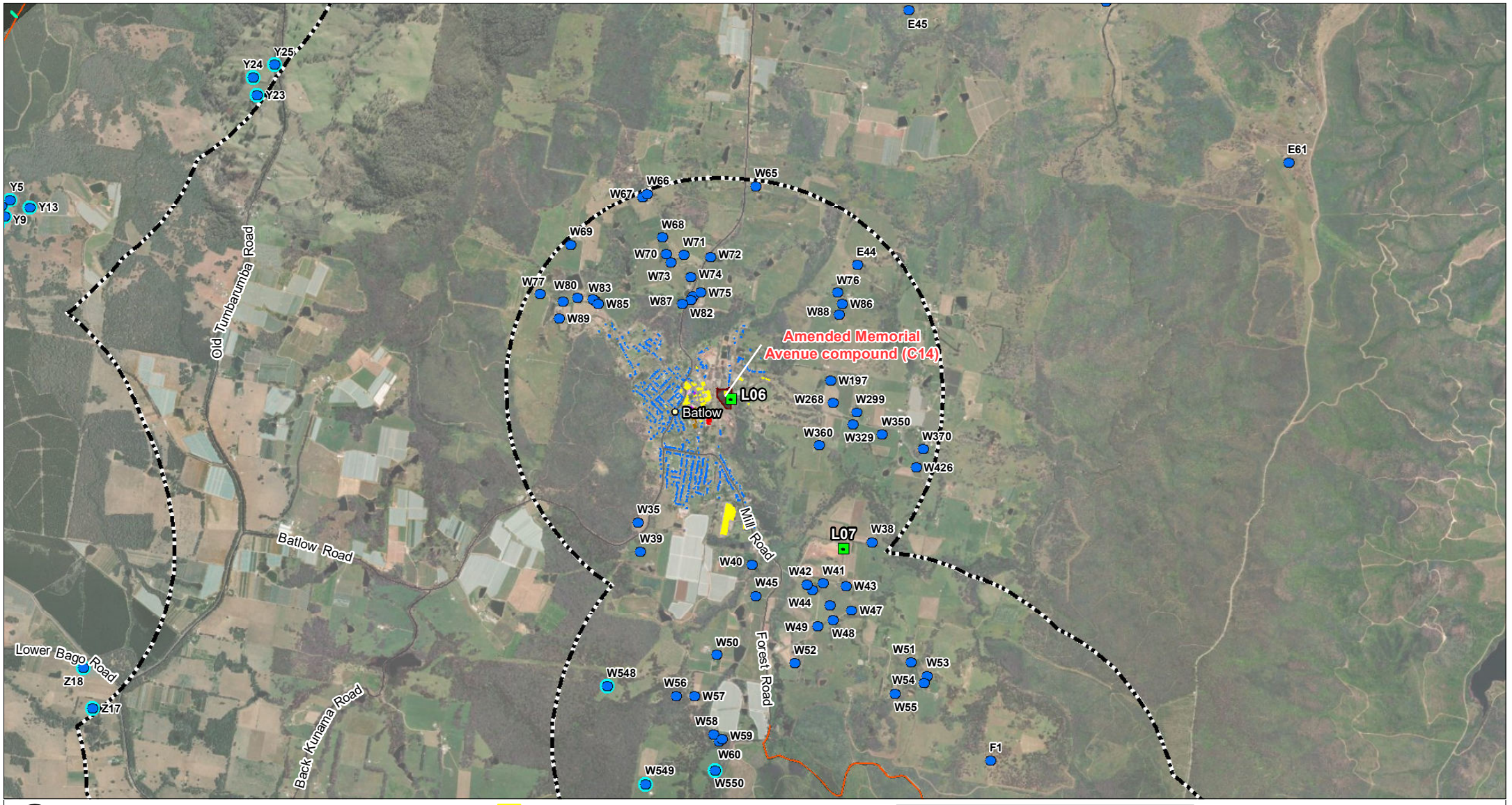

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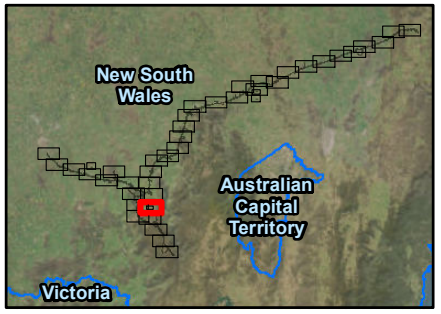

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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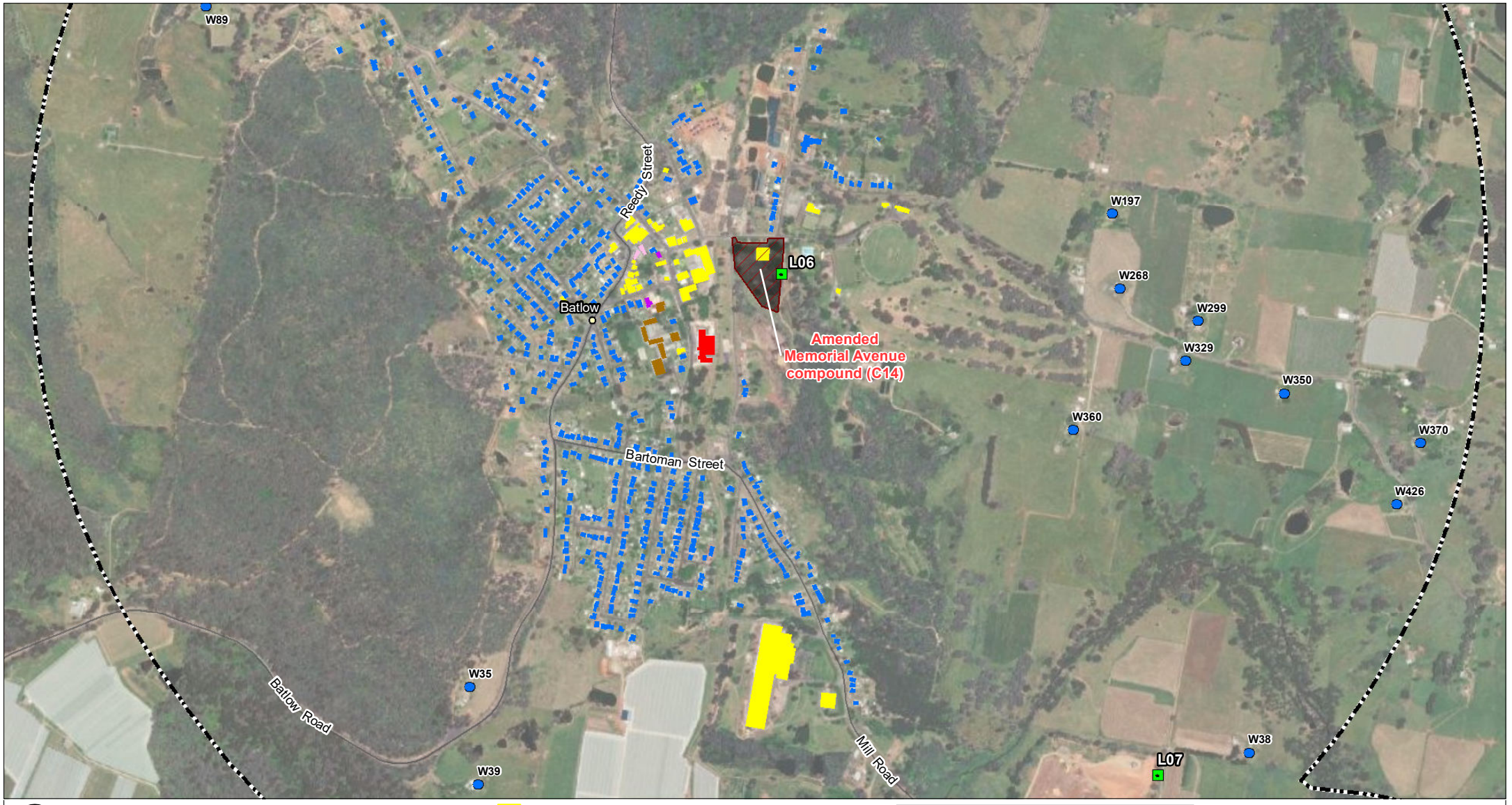

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Project Number:	610.30622
Date:	06-Mar-2024
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SLR

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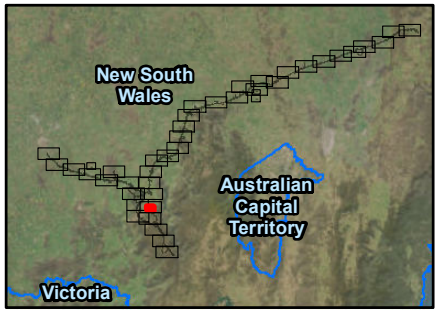

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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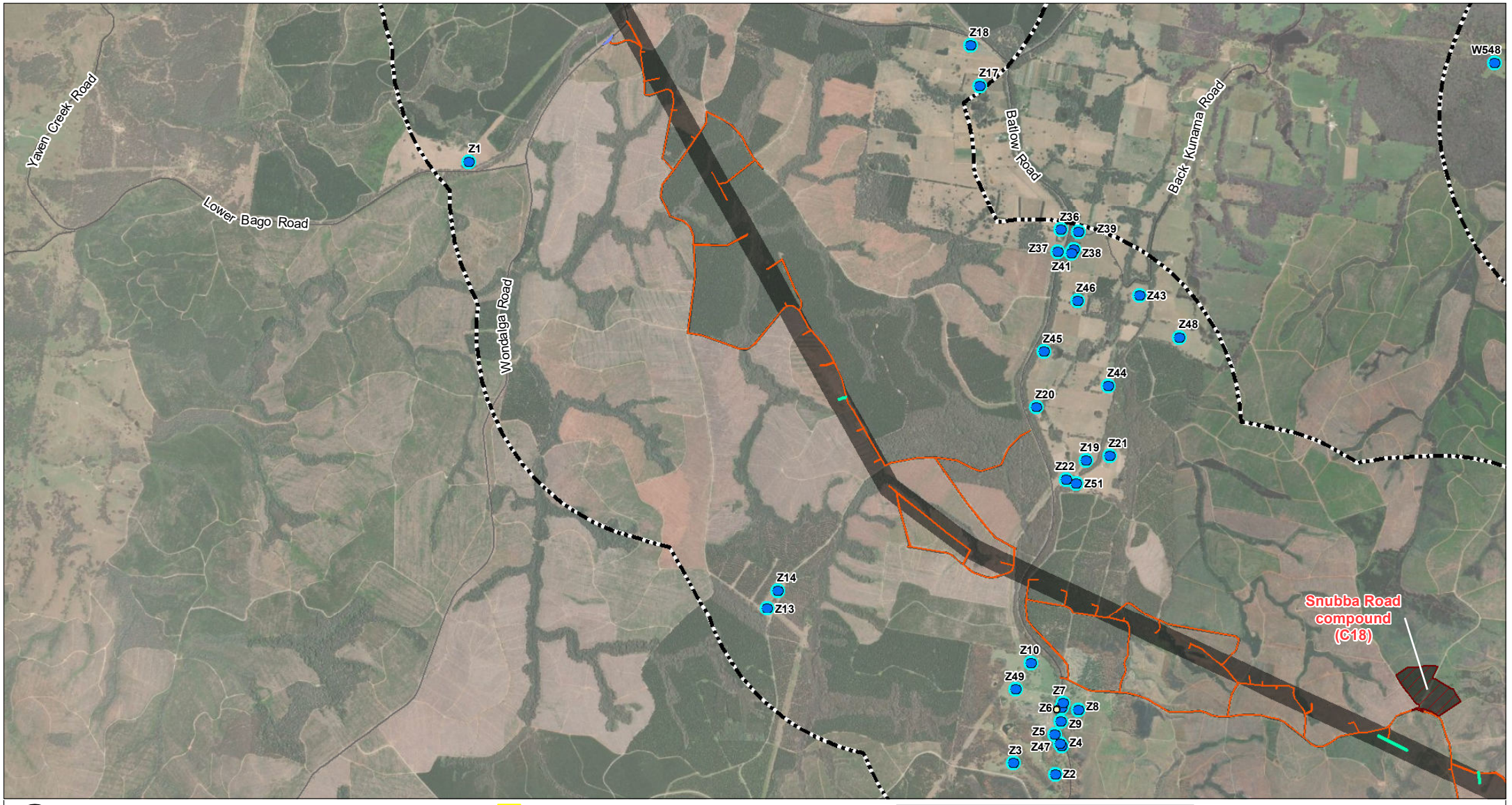

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Coordinate System:	GDA 1994 MGA Zone 55
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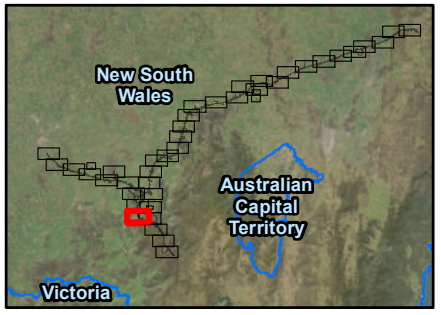

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 15 OF 44

ATTACHMENT B

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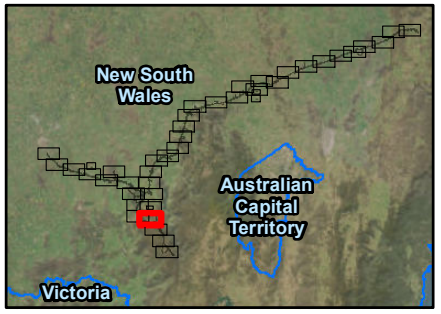

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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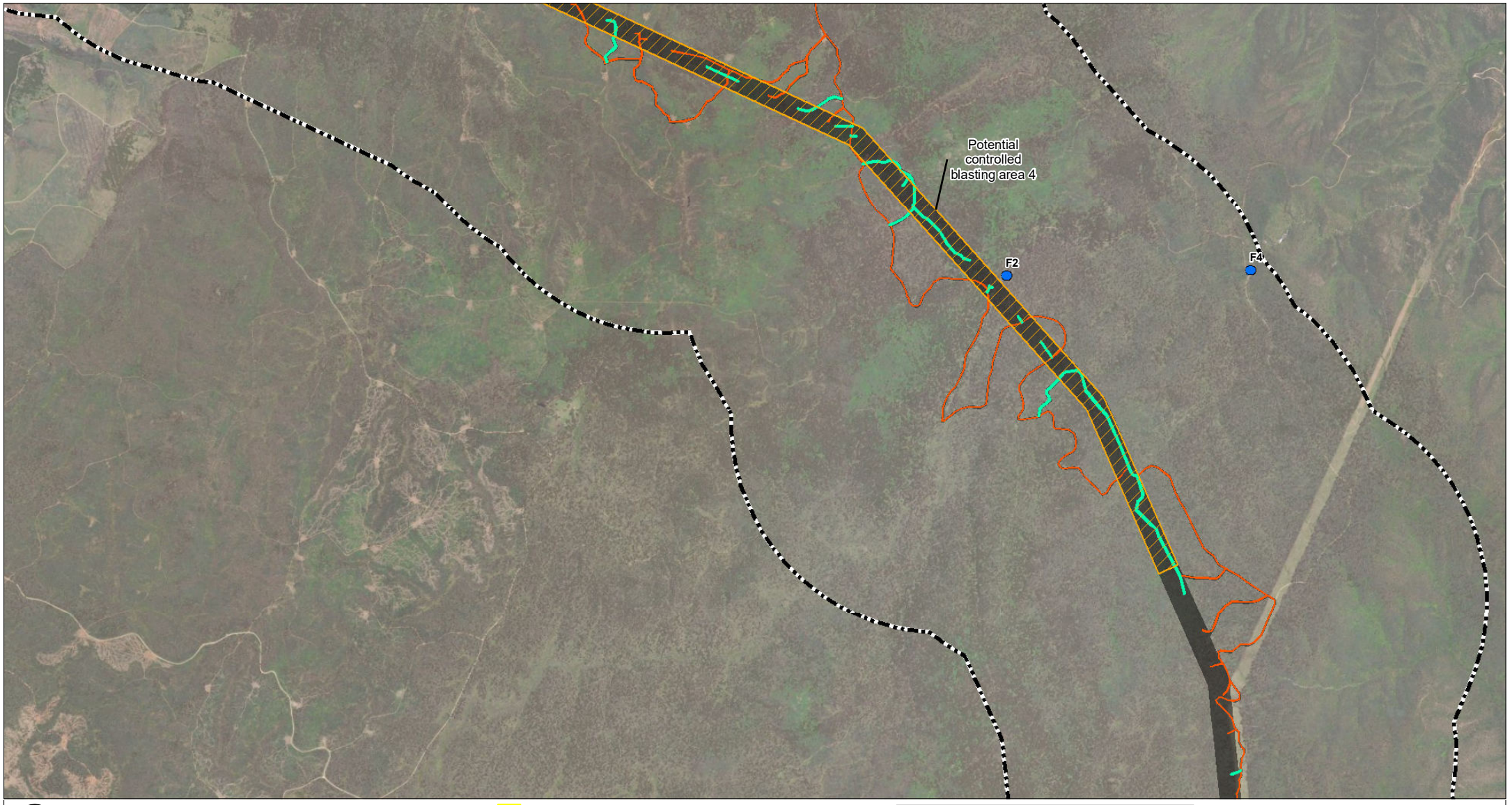

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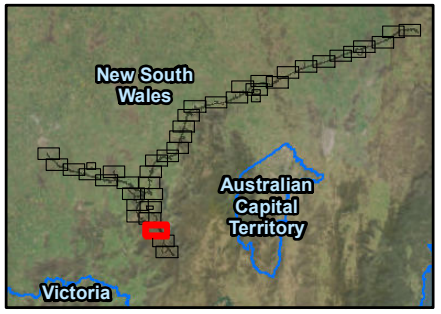

HUMELINK
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 17 OF 44

ATTACHMENT B

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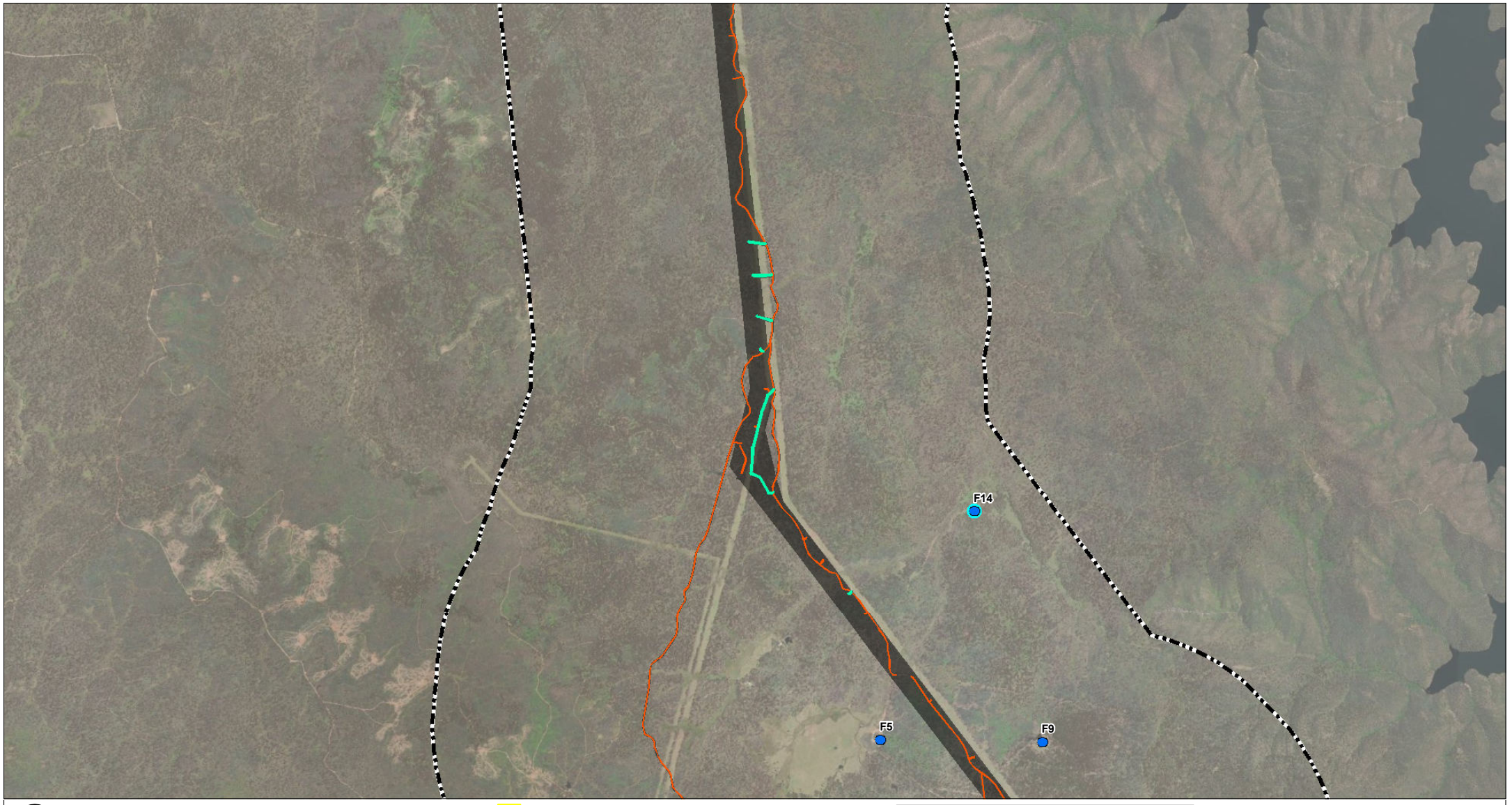

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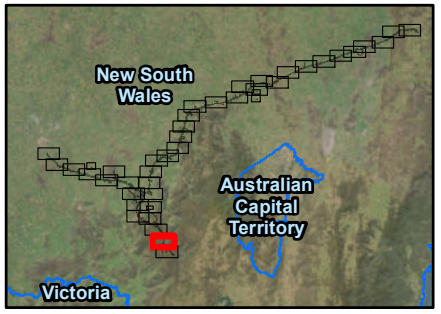

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 18 OF 44

ATTACHMENT B

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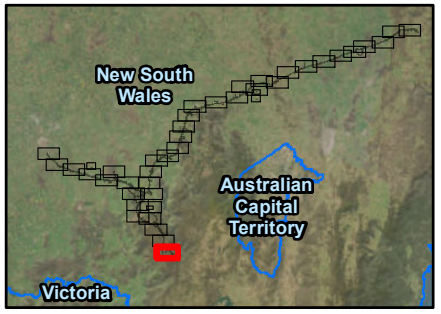

HUMELINK
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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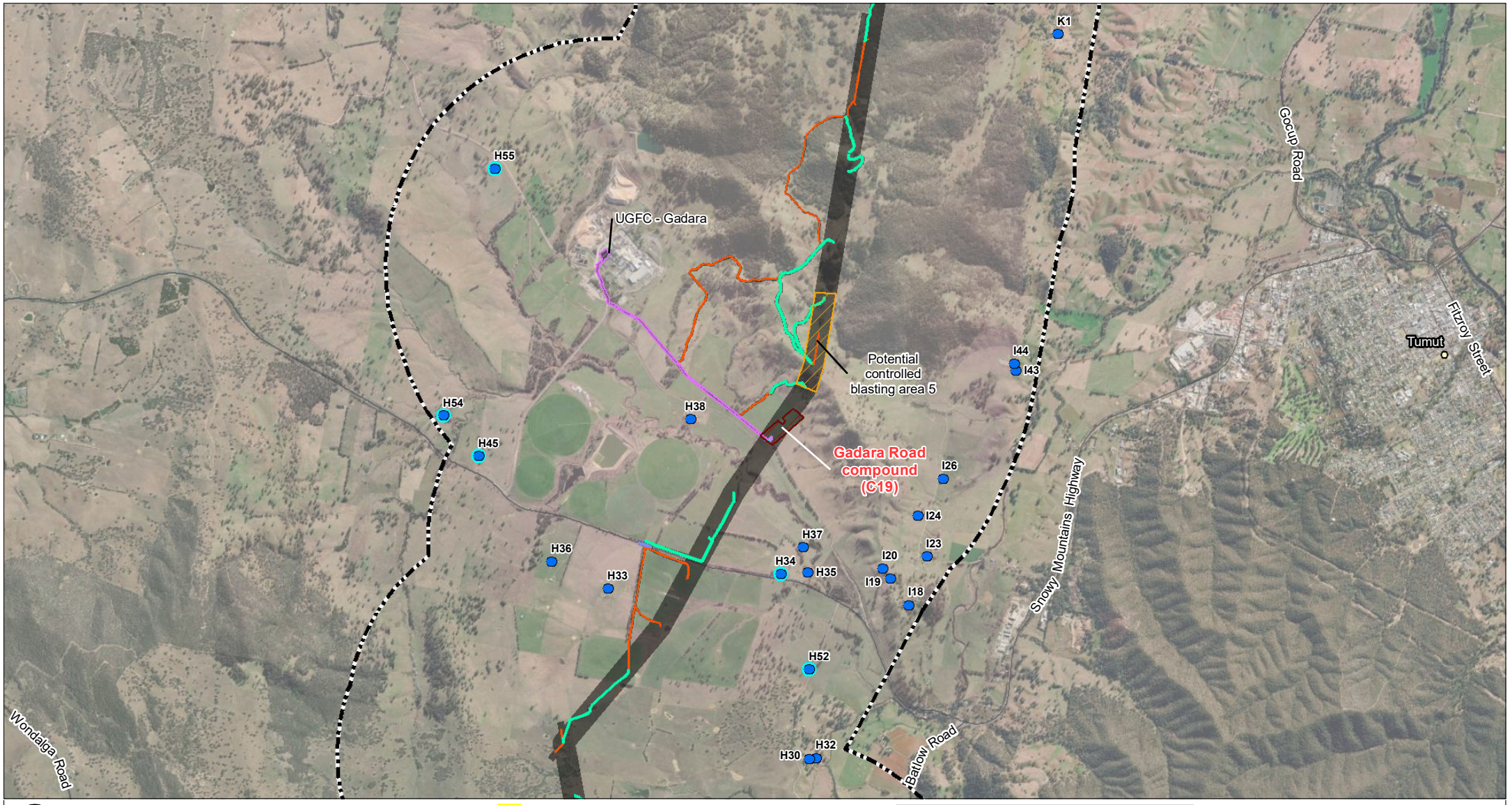

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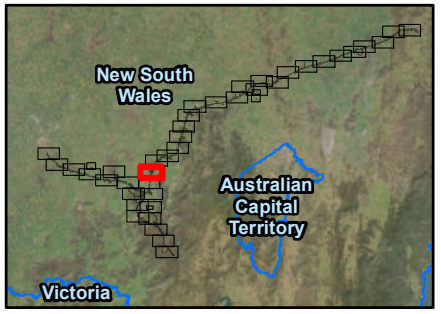

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 20 OF 44

ATTACHMENT B

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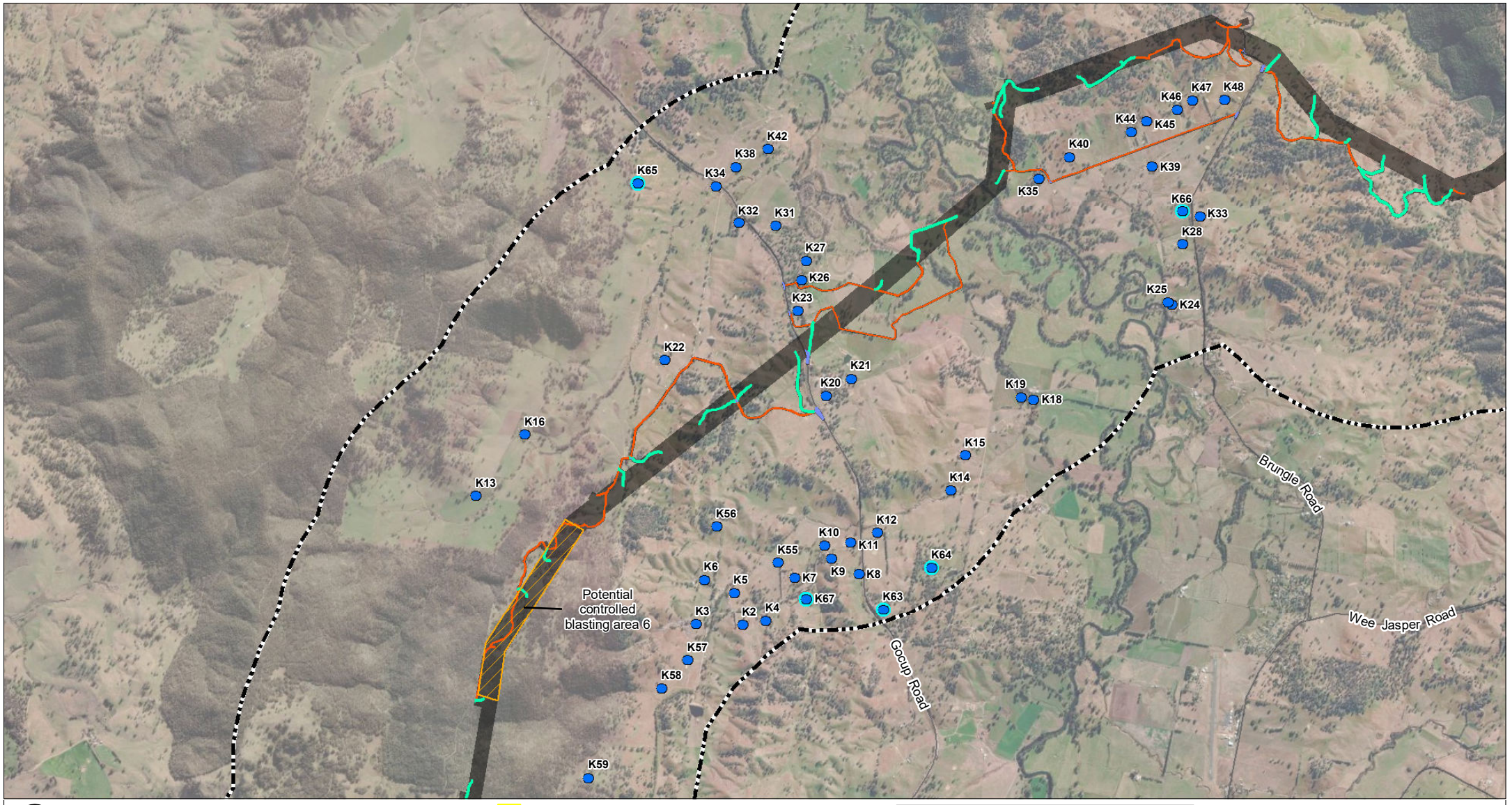

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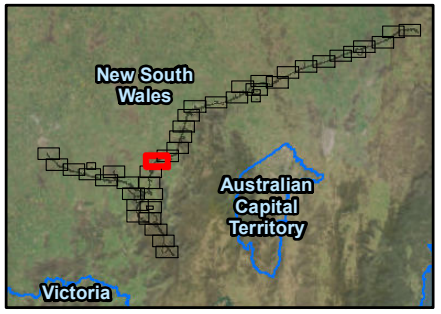

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 21 OF 44

ATTACHMENT B

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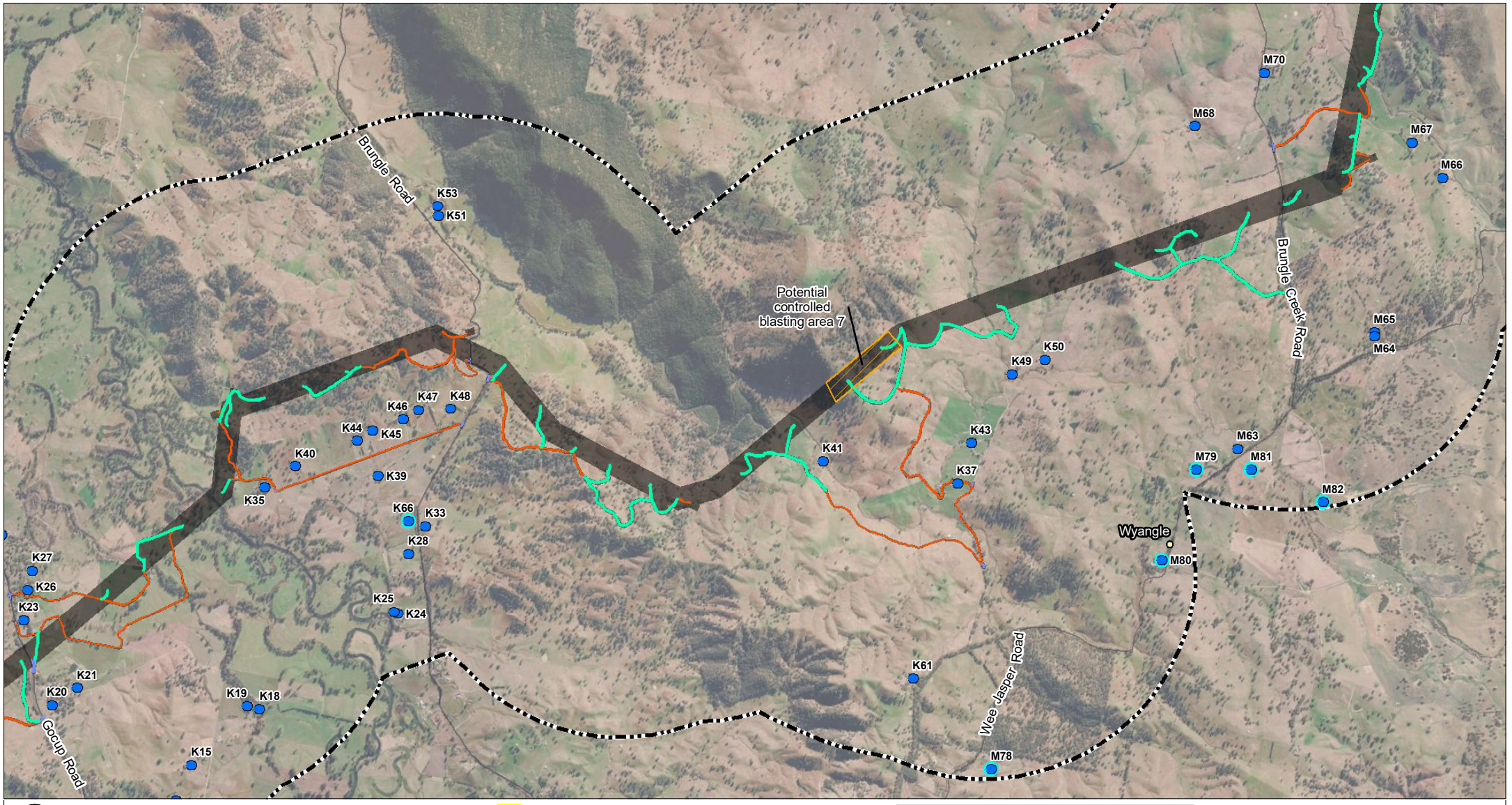

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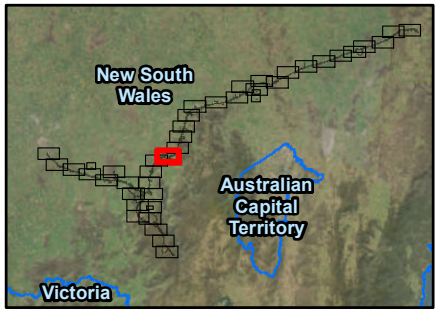

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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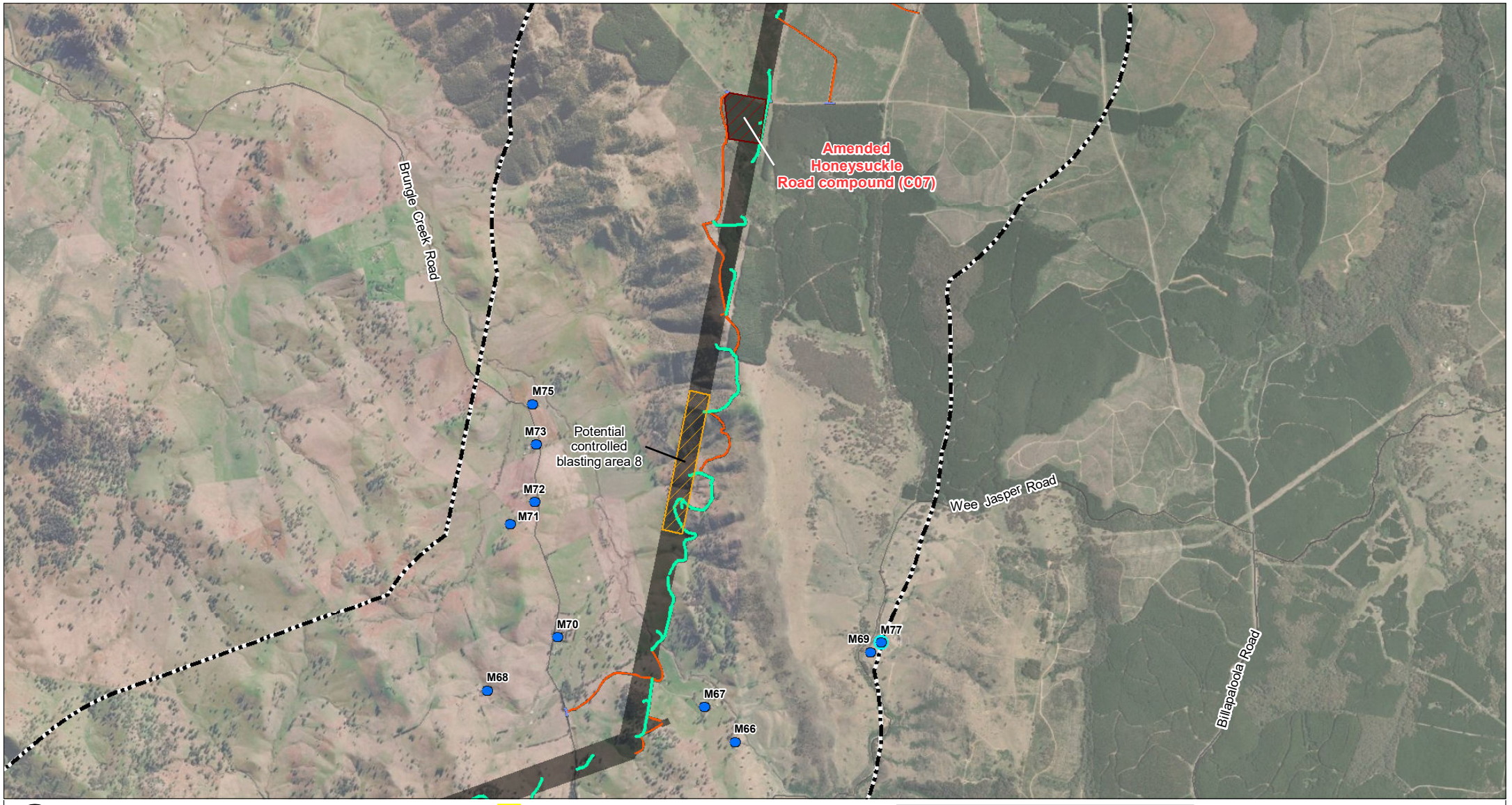

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Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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Receiver Buildings

- Residential
- Commercial
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- Other (Hotel)
- Other (Medical)
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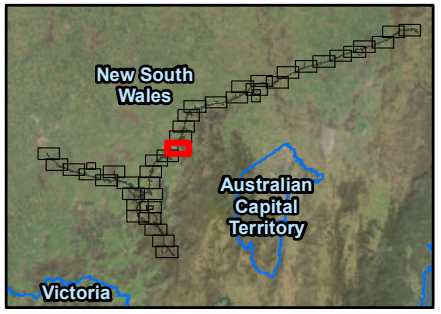

HUMELINK
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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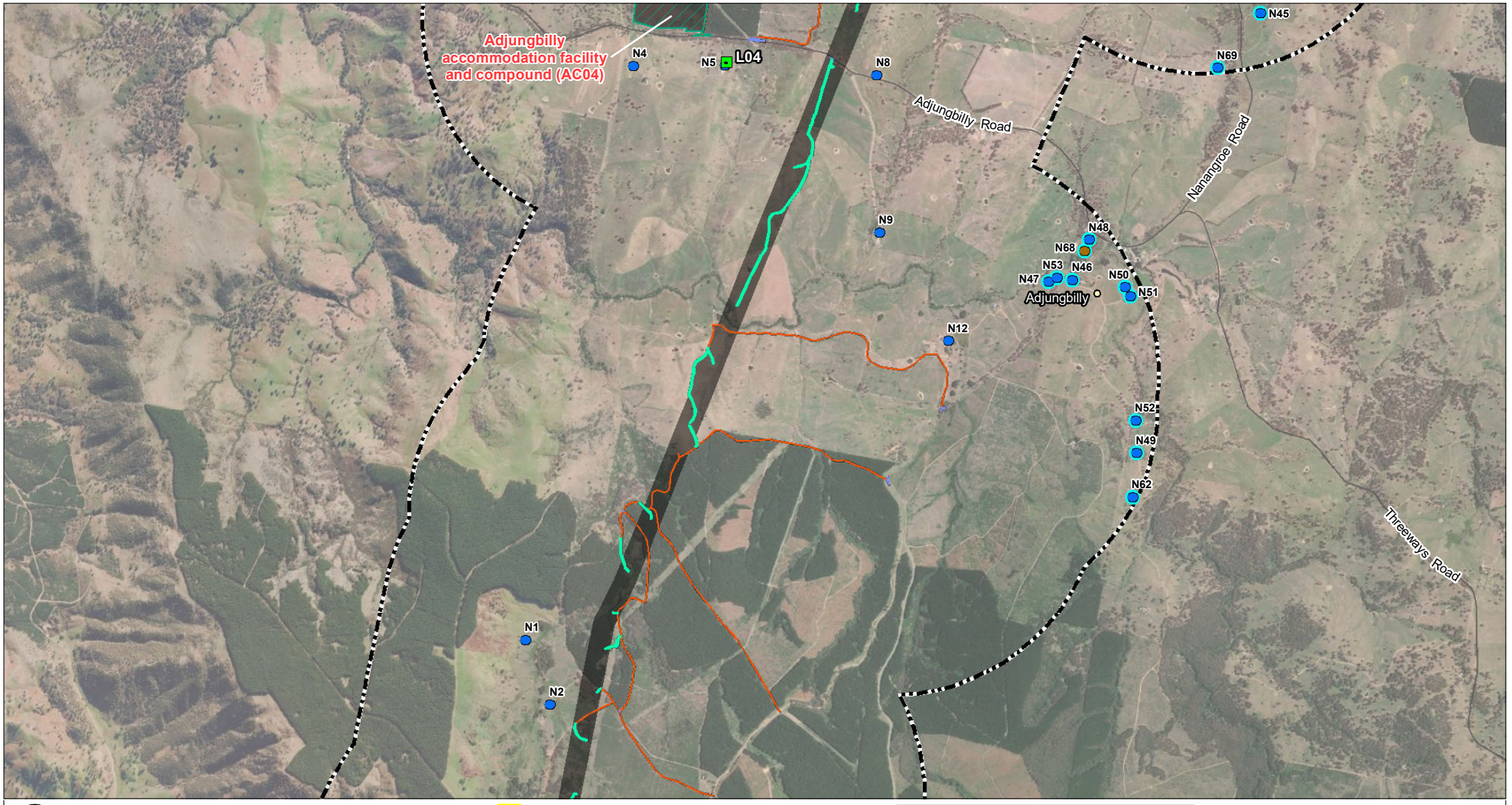

HUMELINK
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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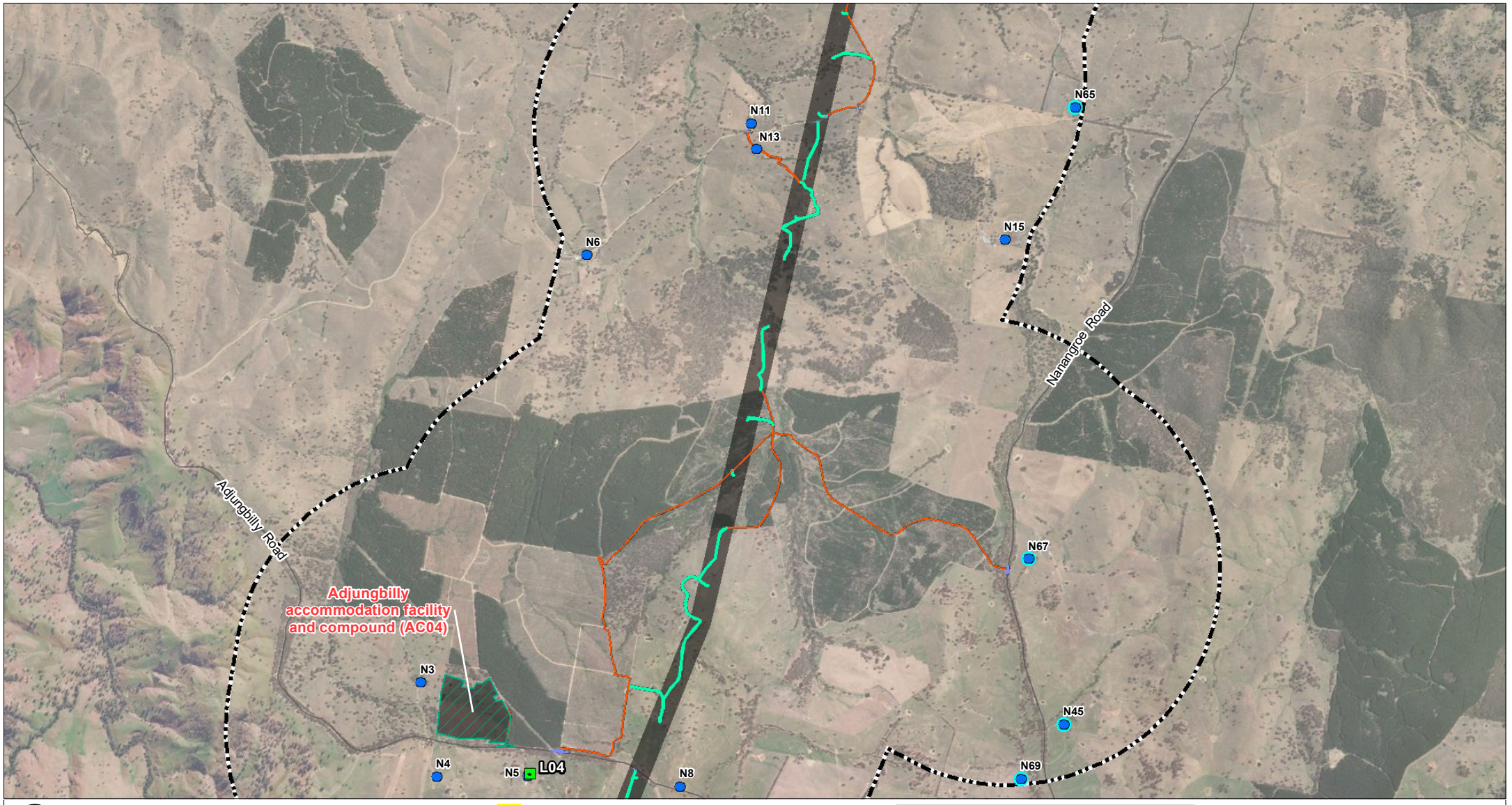

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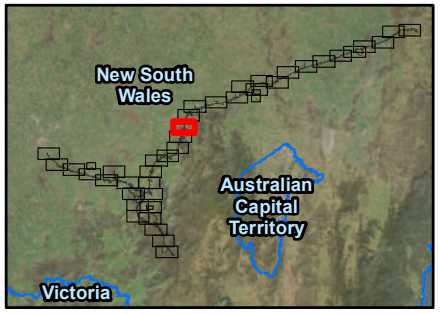

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd

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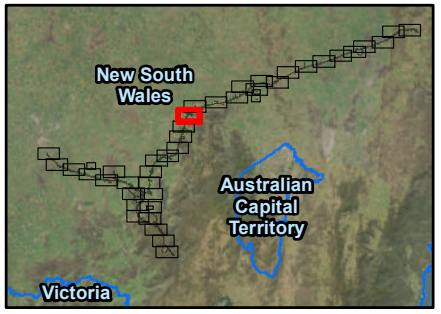

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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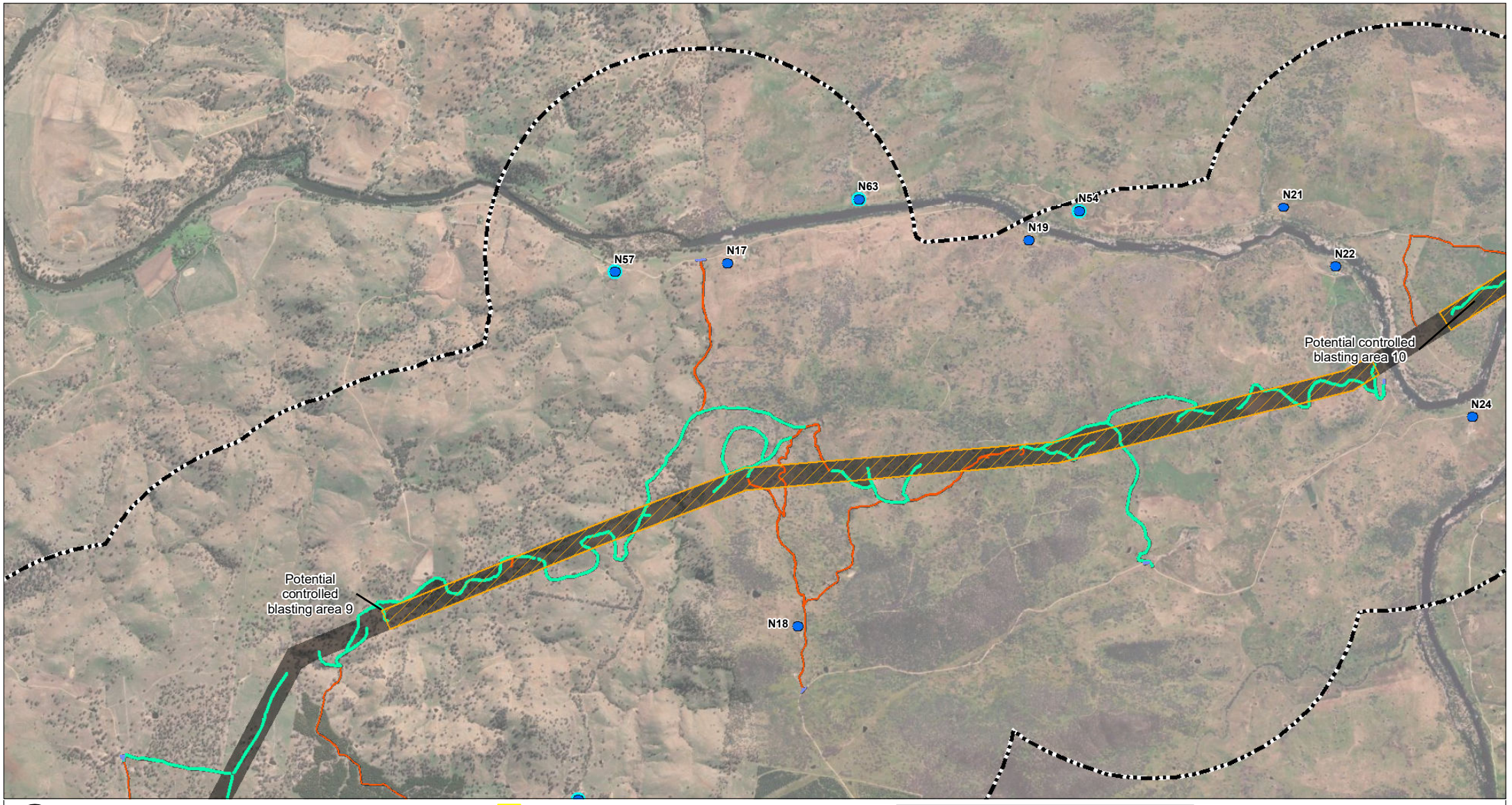

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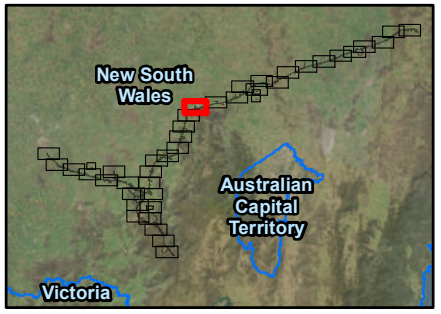

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 27 OF 44

ATTACHMENT B

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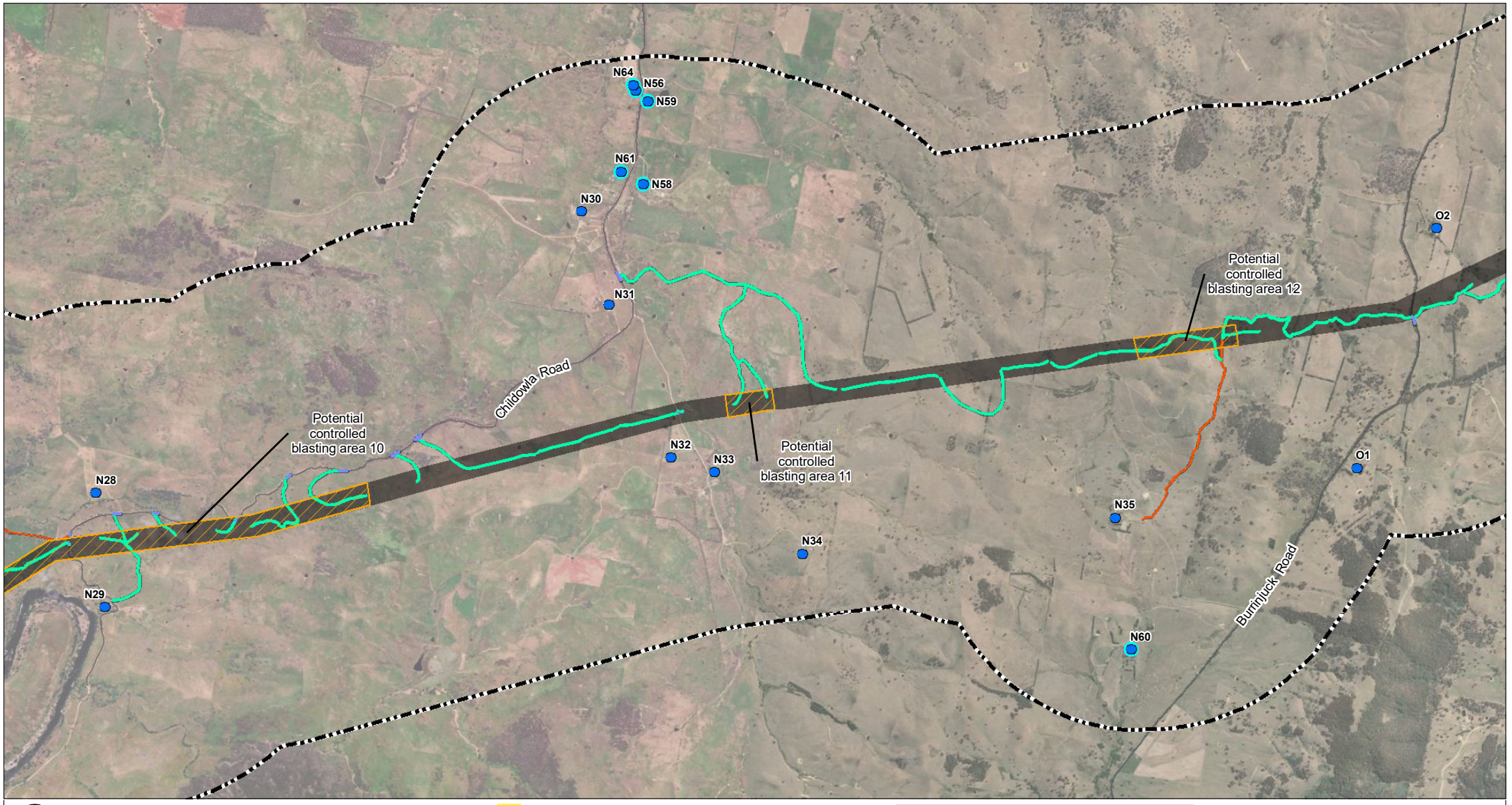

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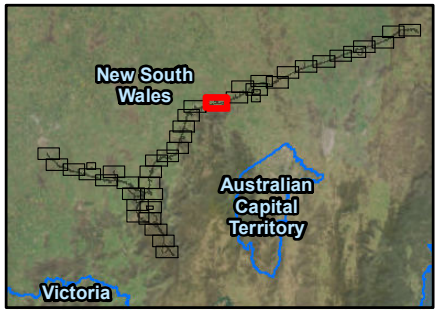
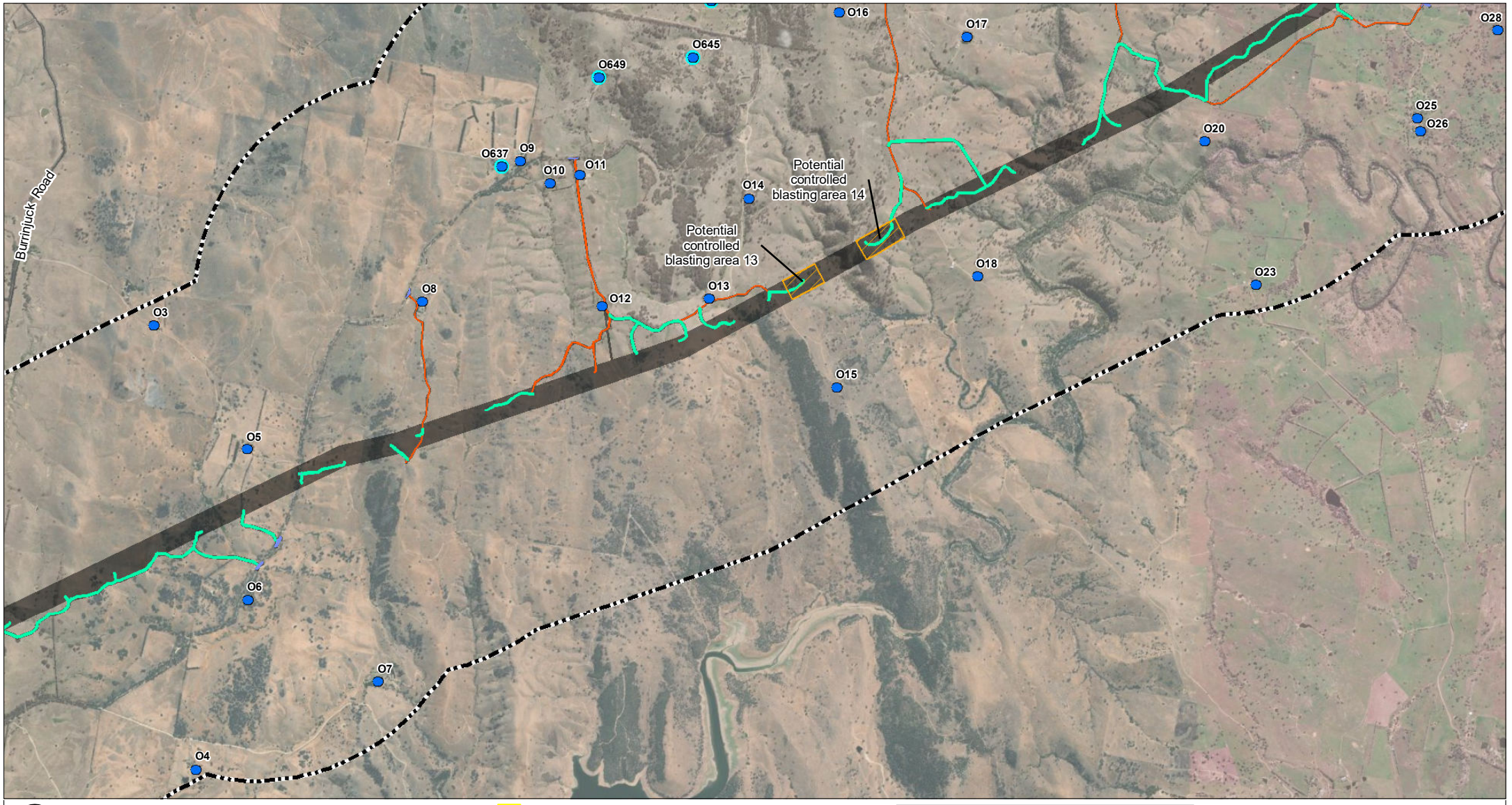


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 28 OF 44

ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd



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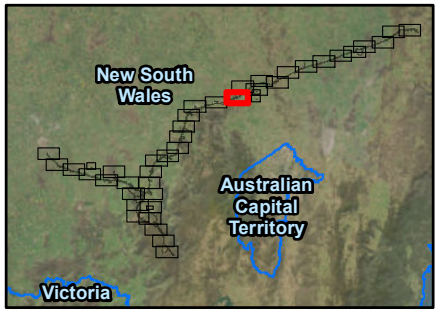
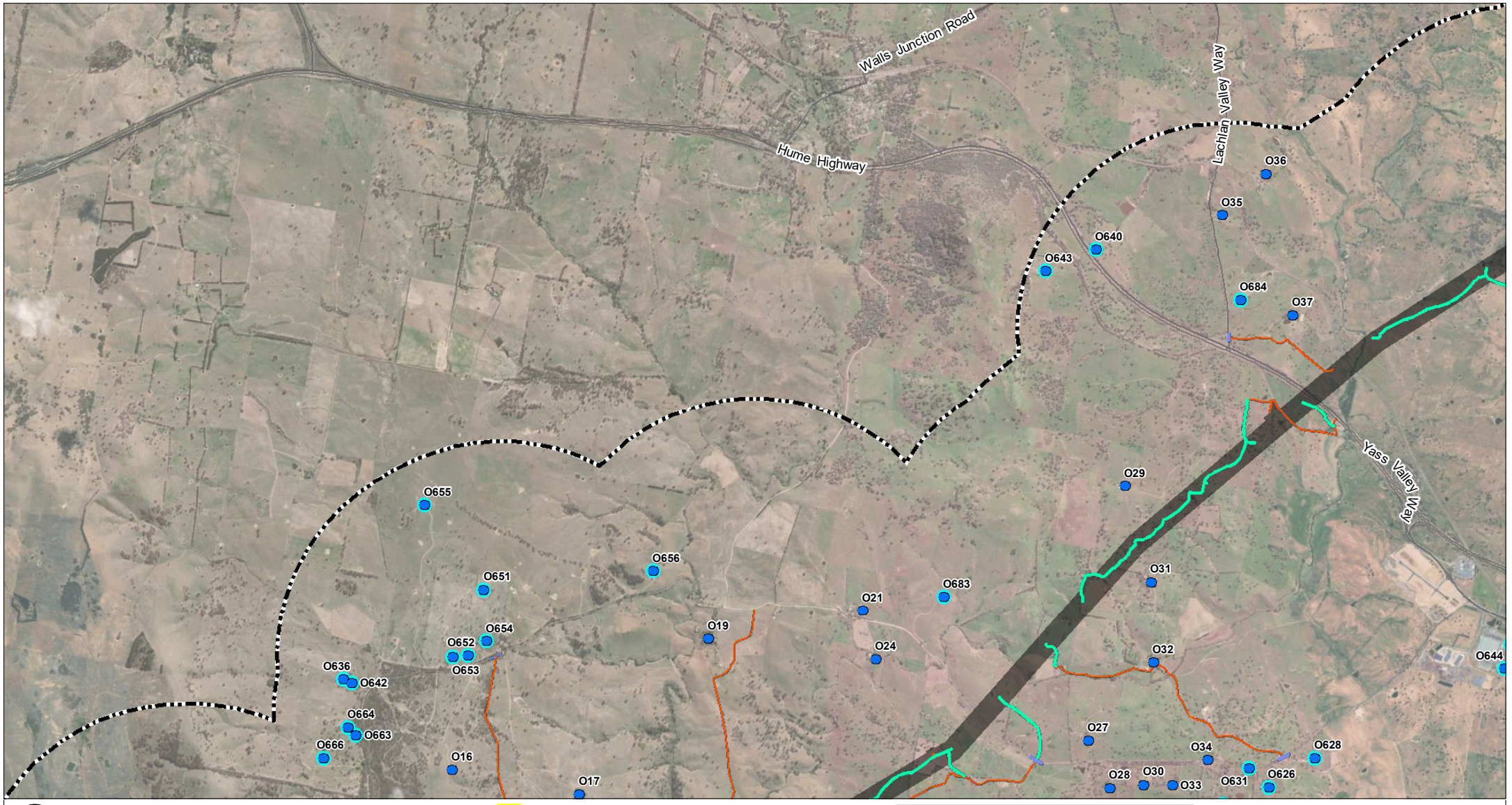


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 29 OF 44

ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd



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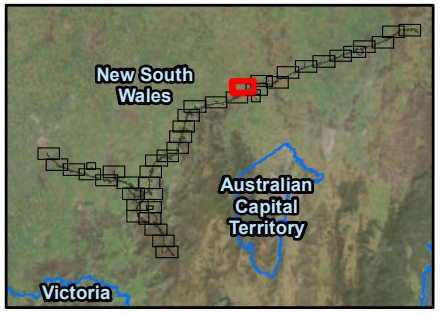
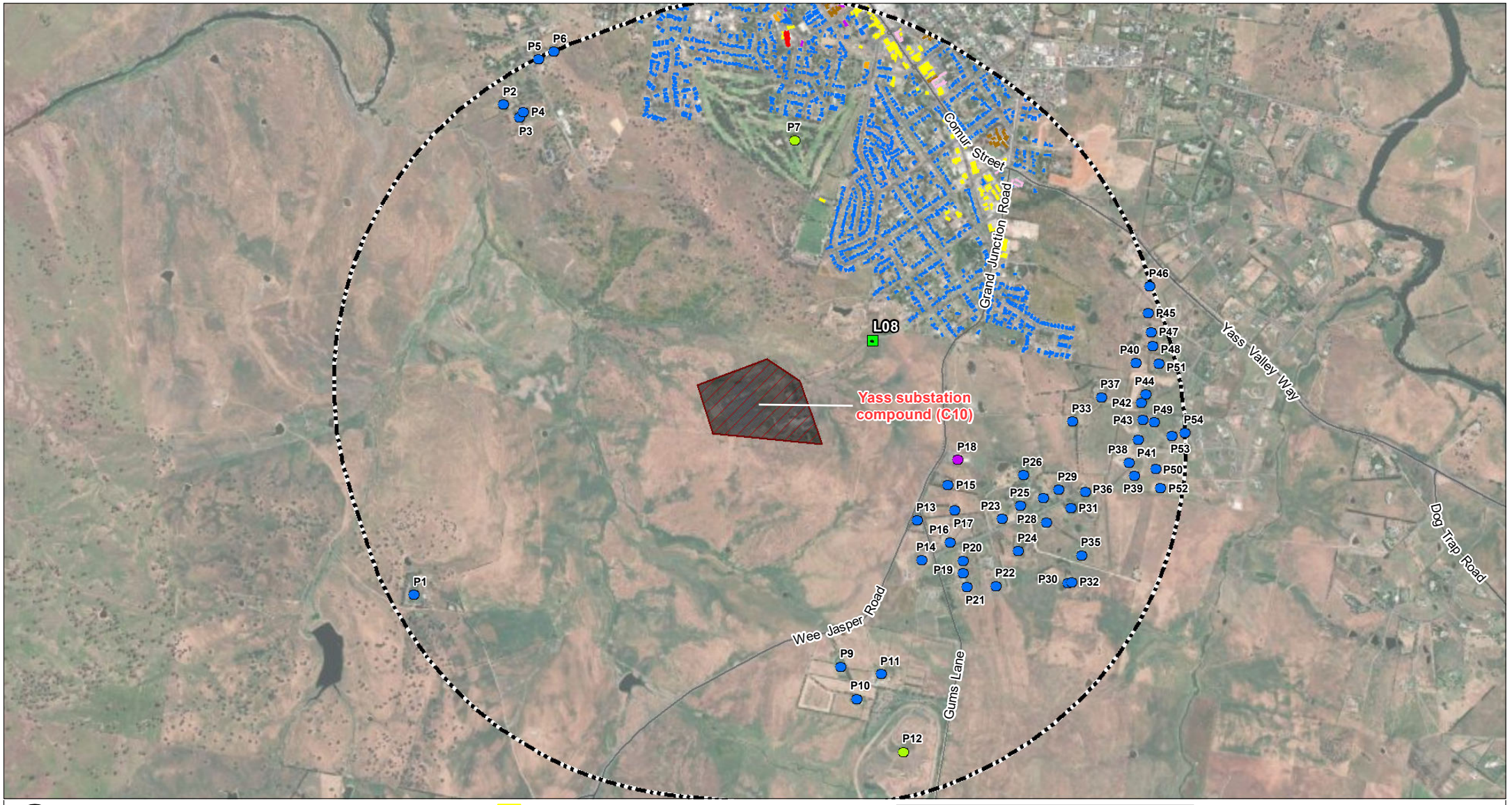


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 30 OF 44

ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd



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Project Number:	610.30622
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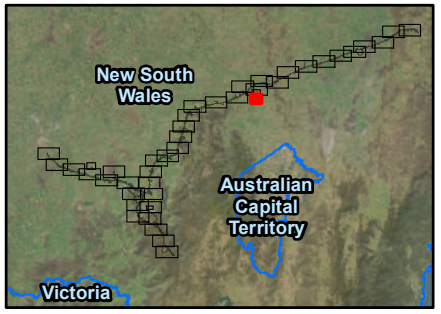

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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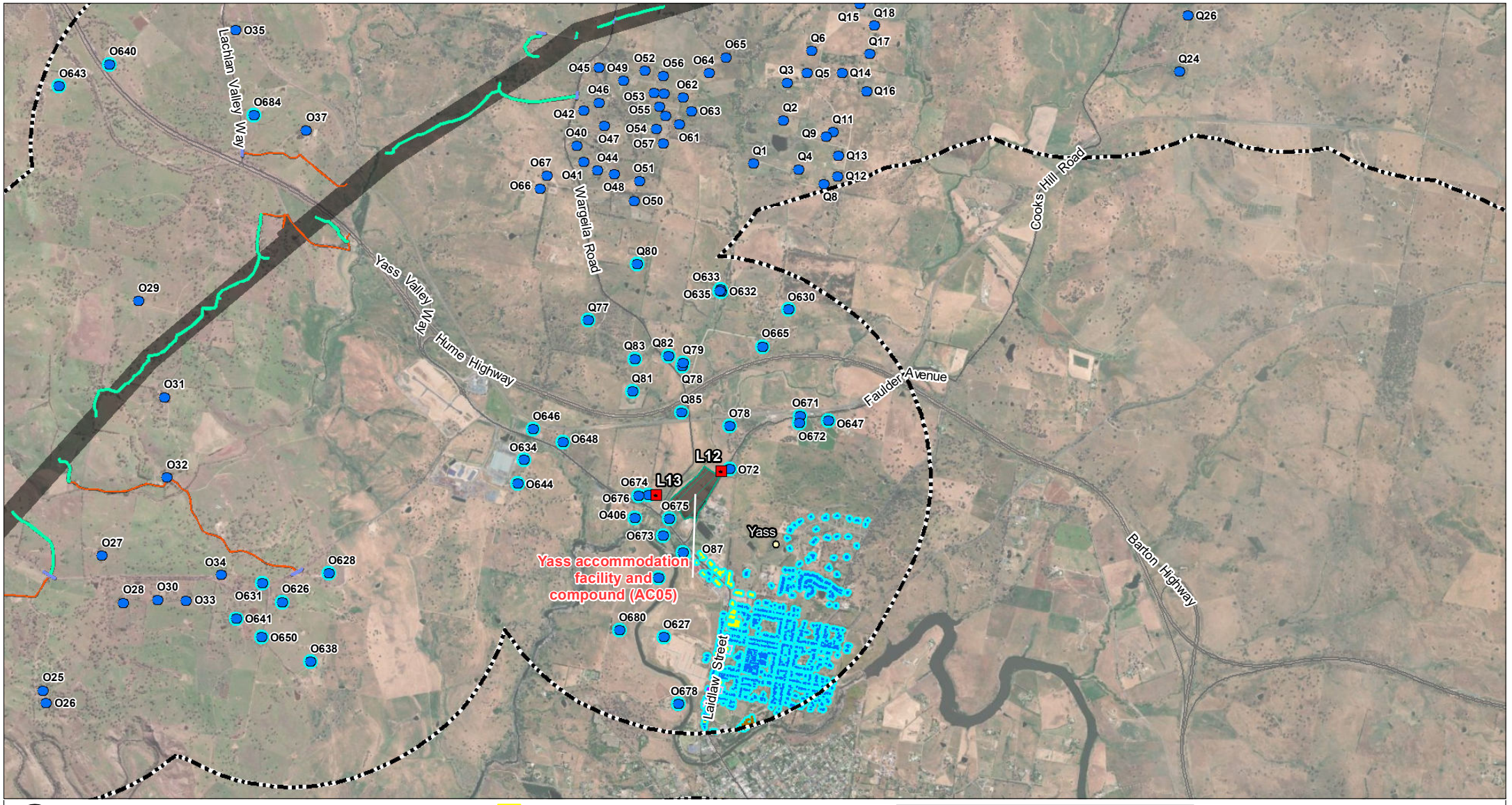

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HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP

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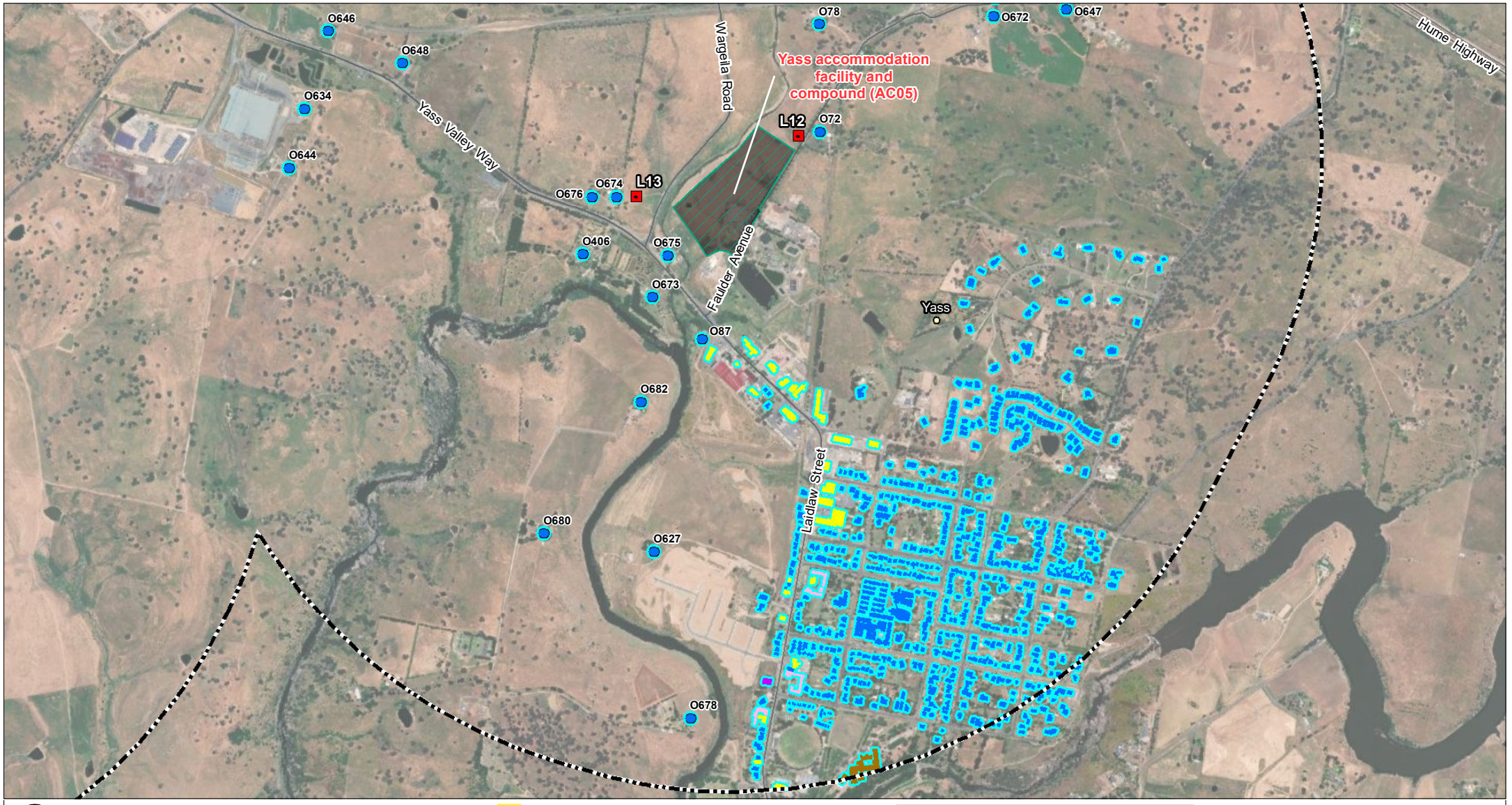

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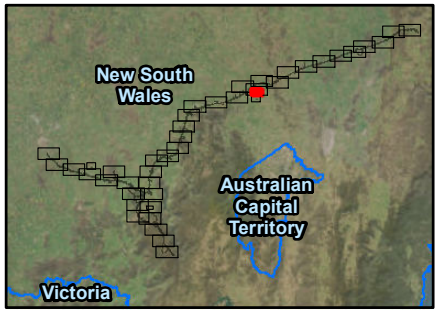

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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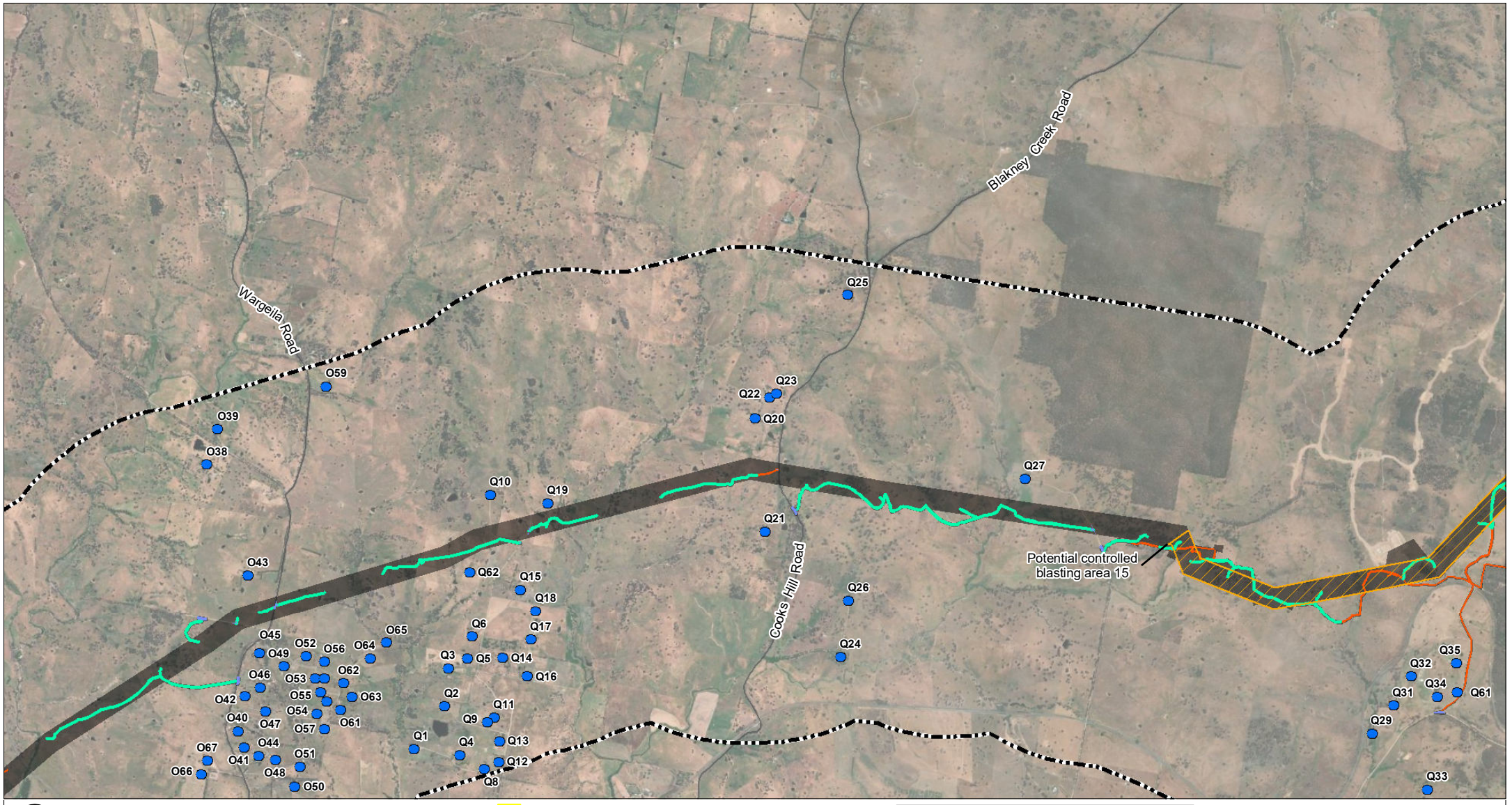
ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd


Blakney Creek Road
Wargella Road
Cooks Hill Road
Potential controlled blasting area 15
Q25
Q23
Q22
Q20
O59
O39
O38
Q10
Q19
Q27
Q21
O43
Q62
Q15
Q18
Q26
Q6
Q17
O45
O52
O56
O64
O65
O49
Q3
Q5
Q14
Q24
O46
O53
O62
Q16
O42
O55
O63
Q2
Q11
O40
O54
Q9
O47
O61
O57
Q1
Q4
Q13
O67
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Q61
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Q33
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New South Wales
Australian Capital Territory
Victoria
SLR
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NOISE AND VIBRATION
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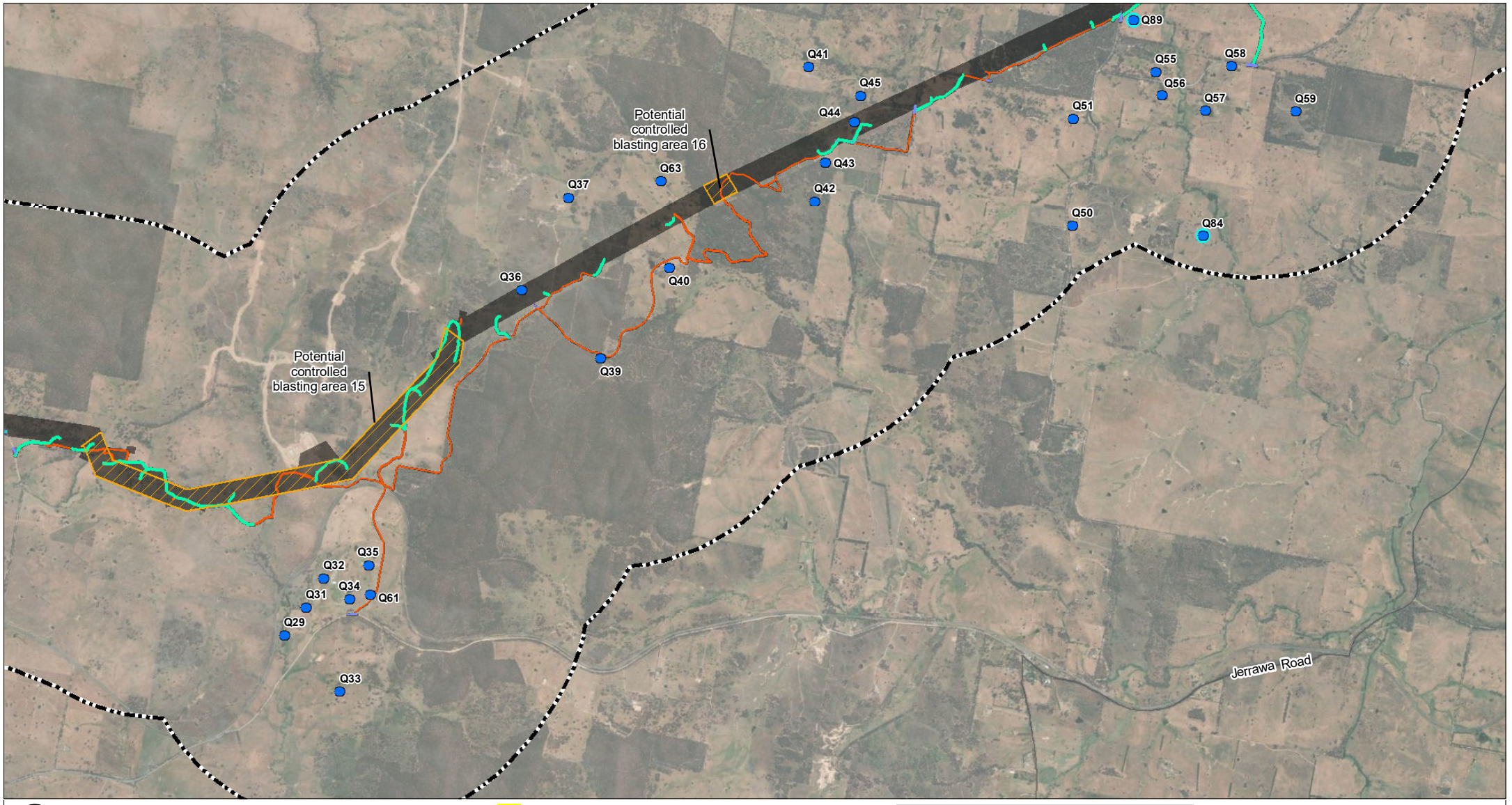
\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd



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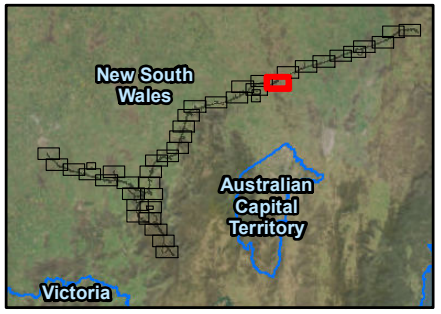

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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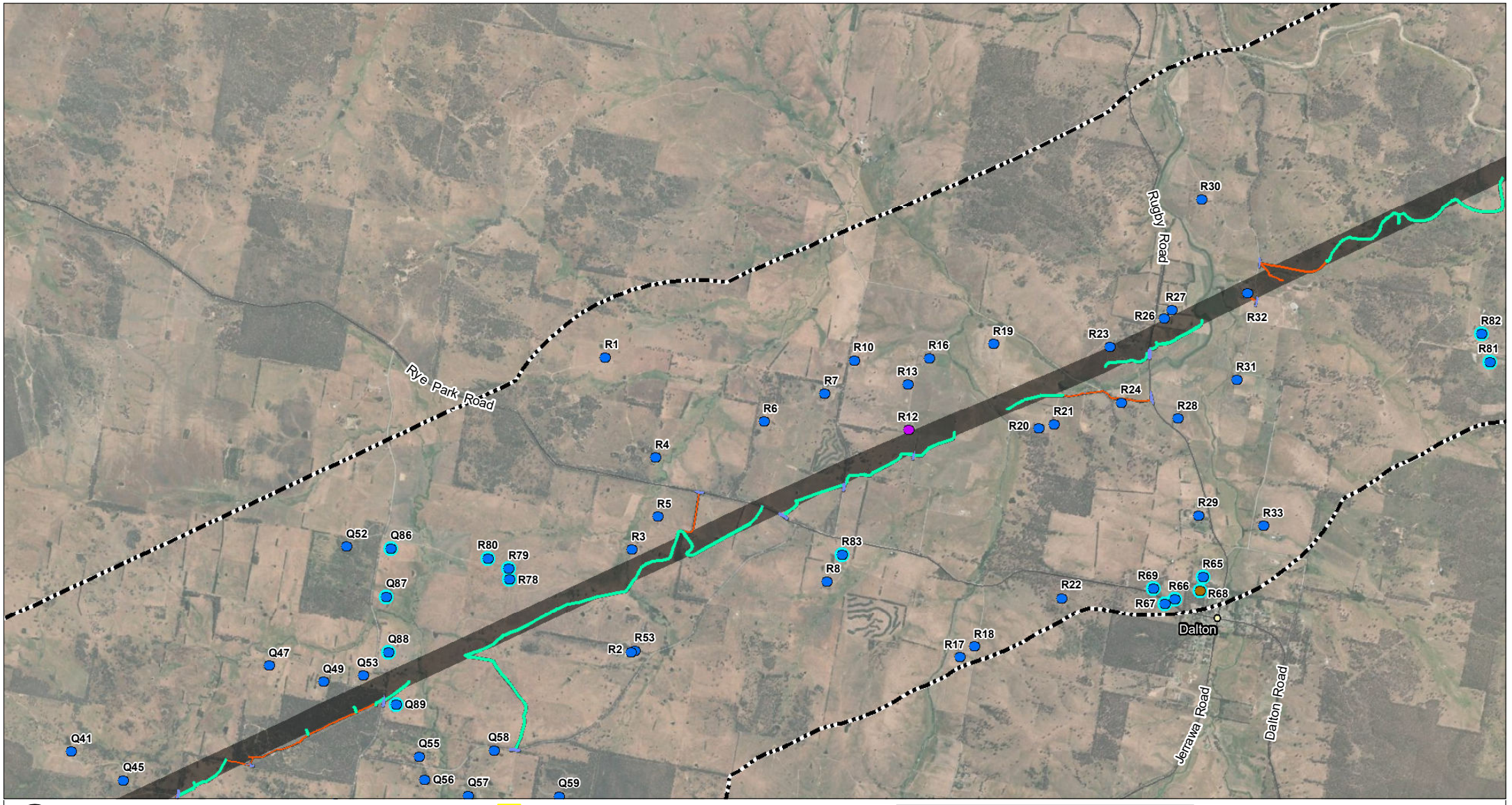
ATTACHMENT B

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Project and Receiver Map DDP.mxd



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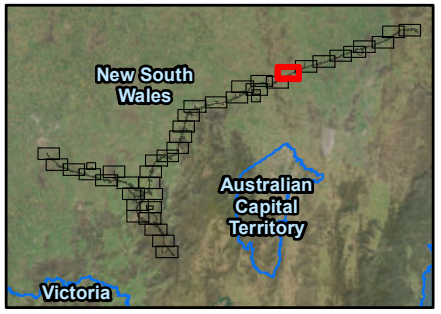

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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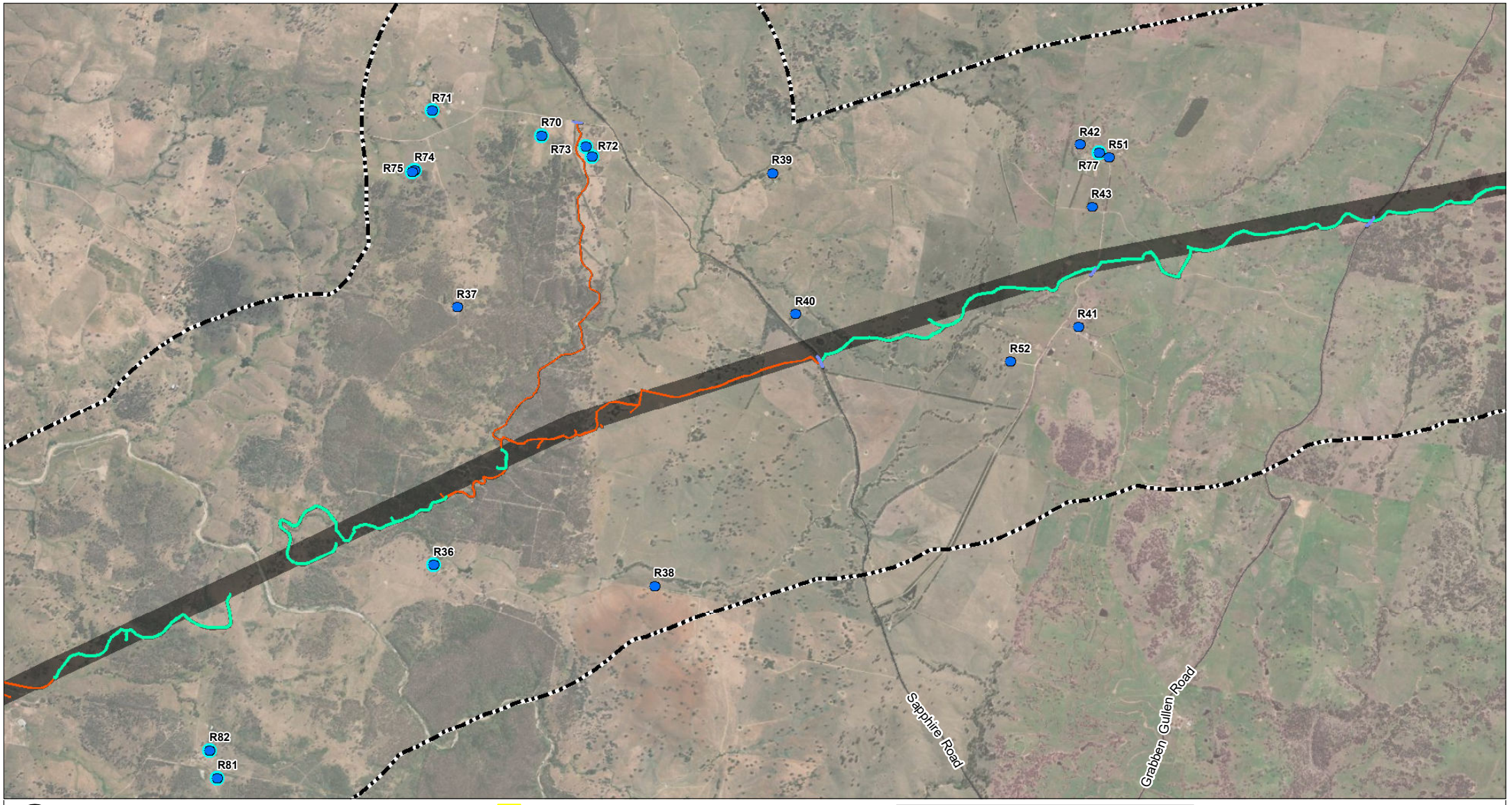

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Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
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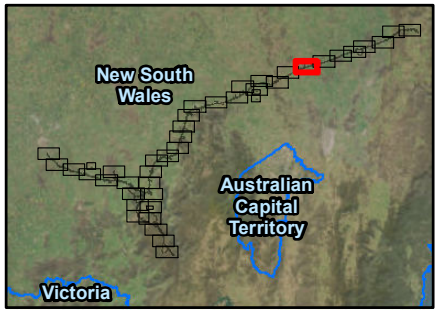

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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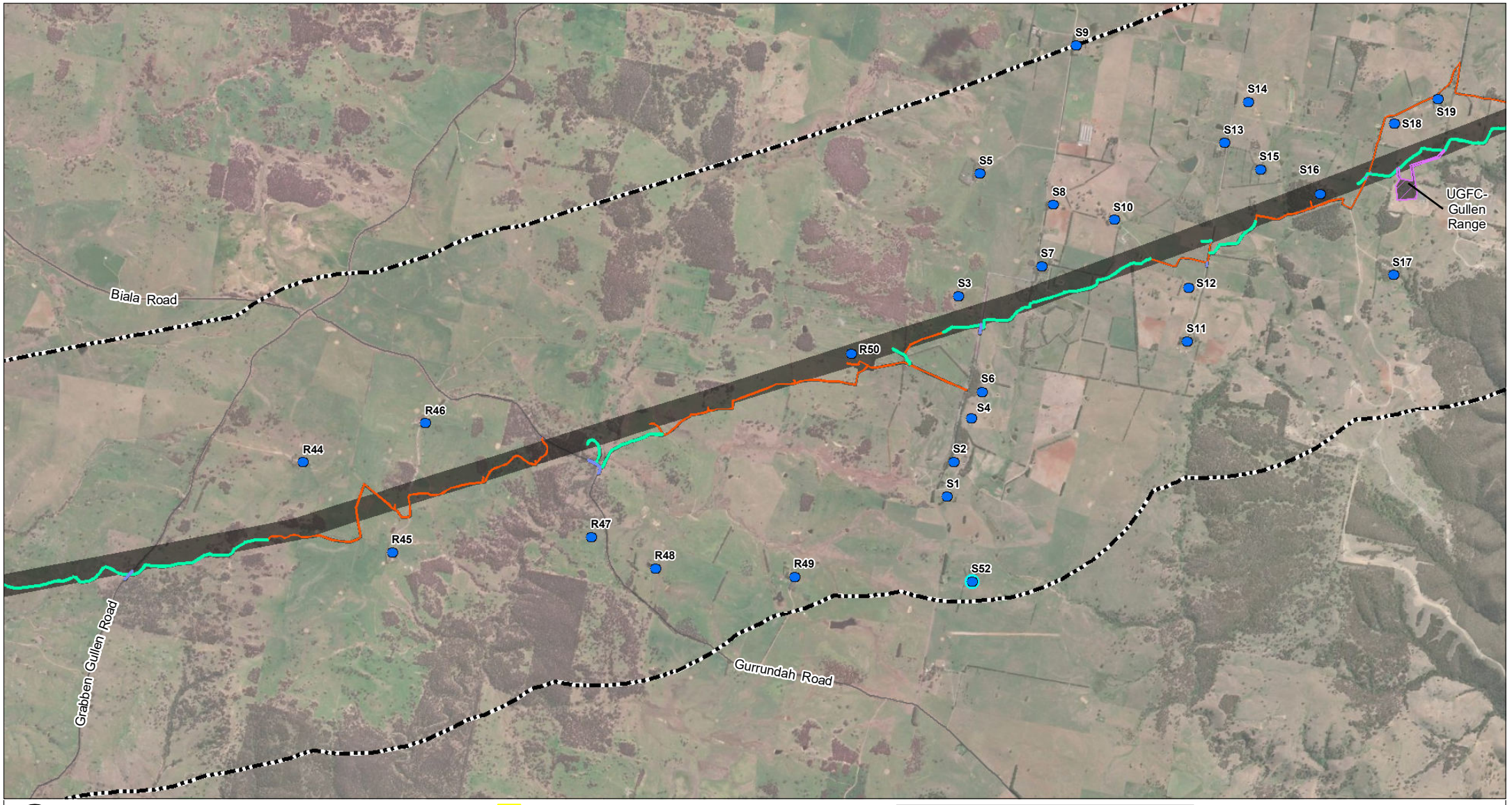

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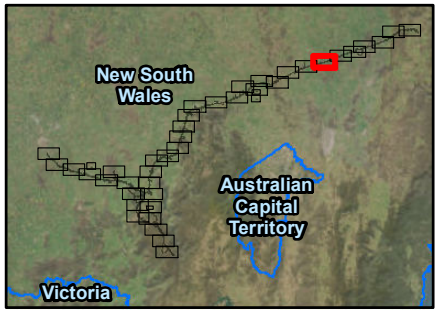

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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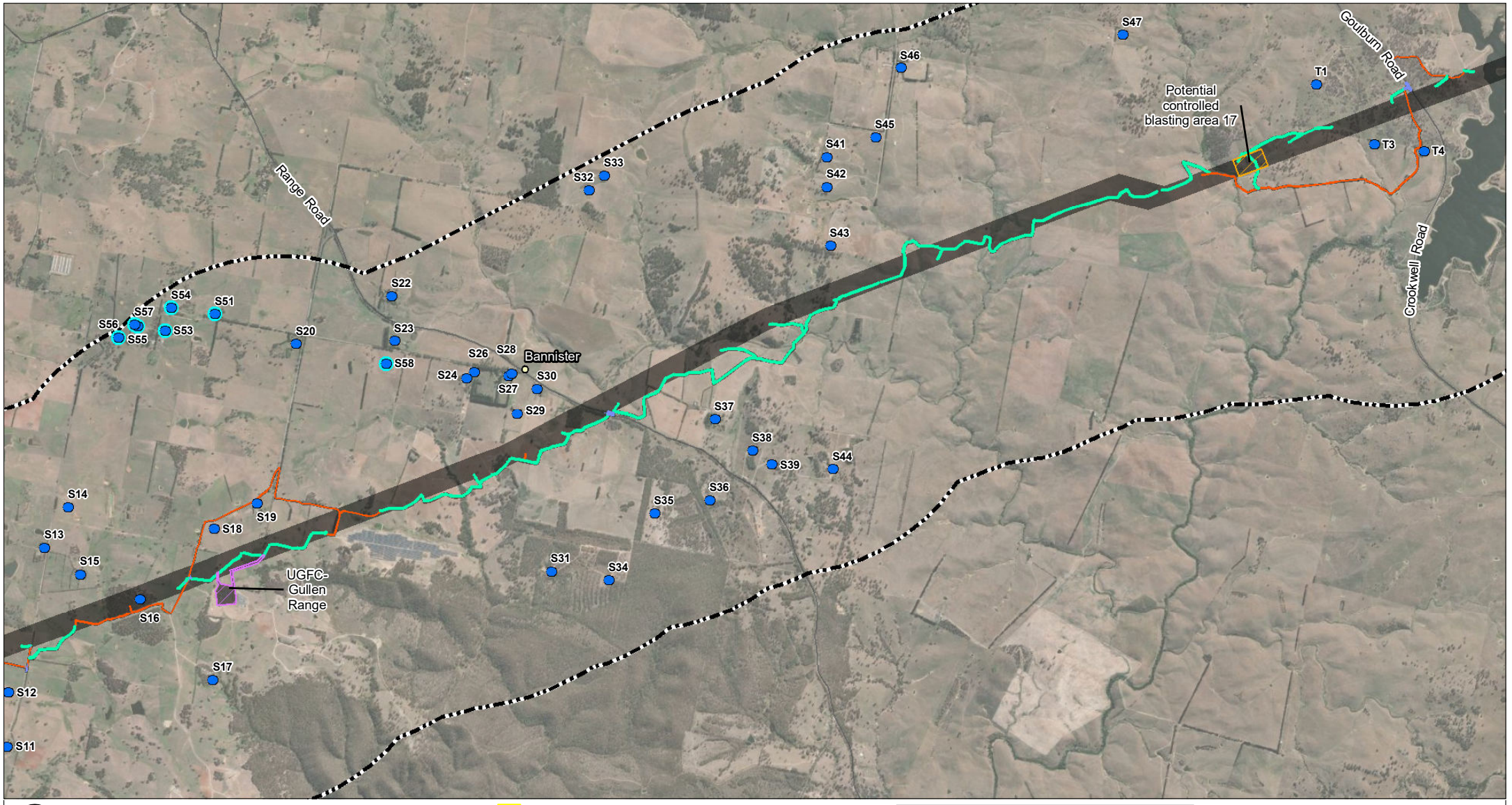

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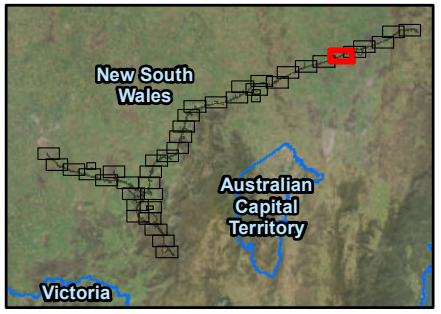

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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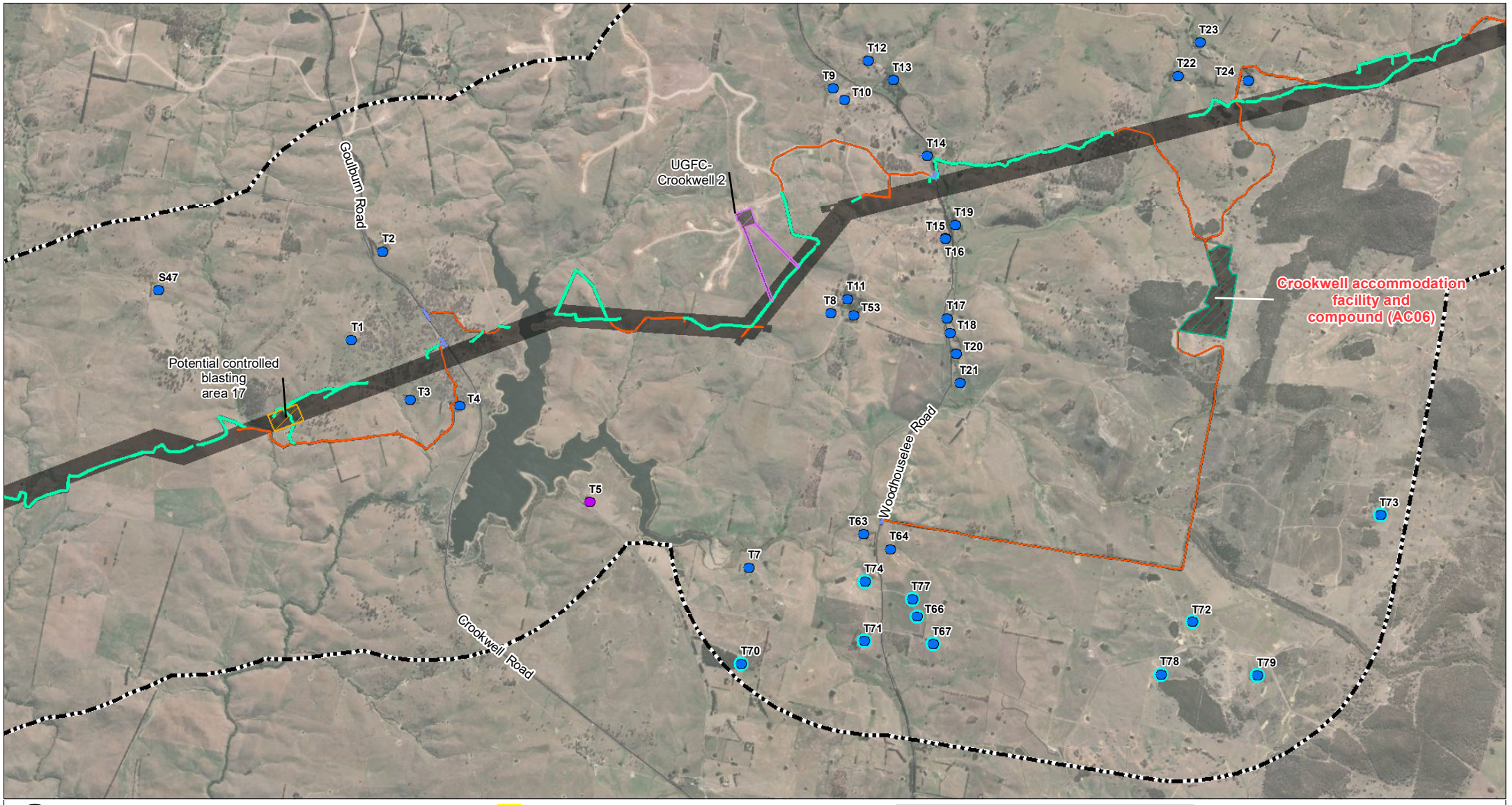

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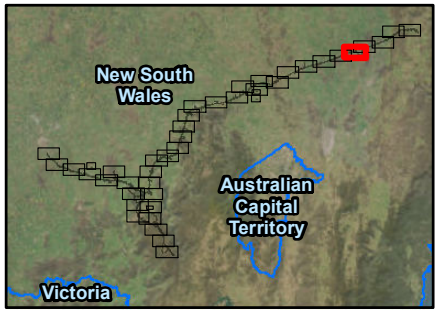

HUMELINK
NOISE AND VIBRATION
IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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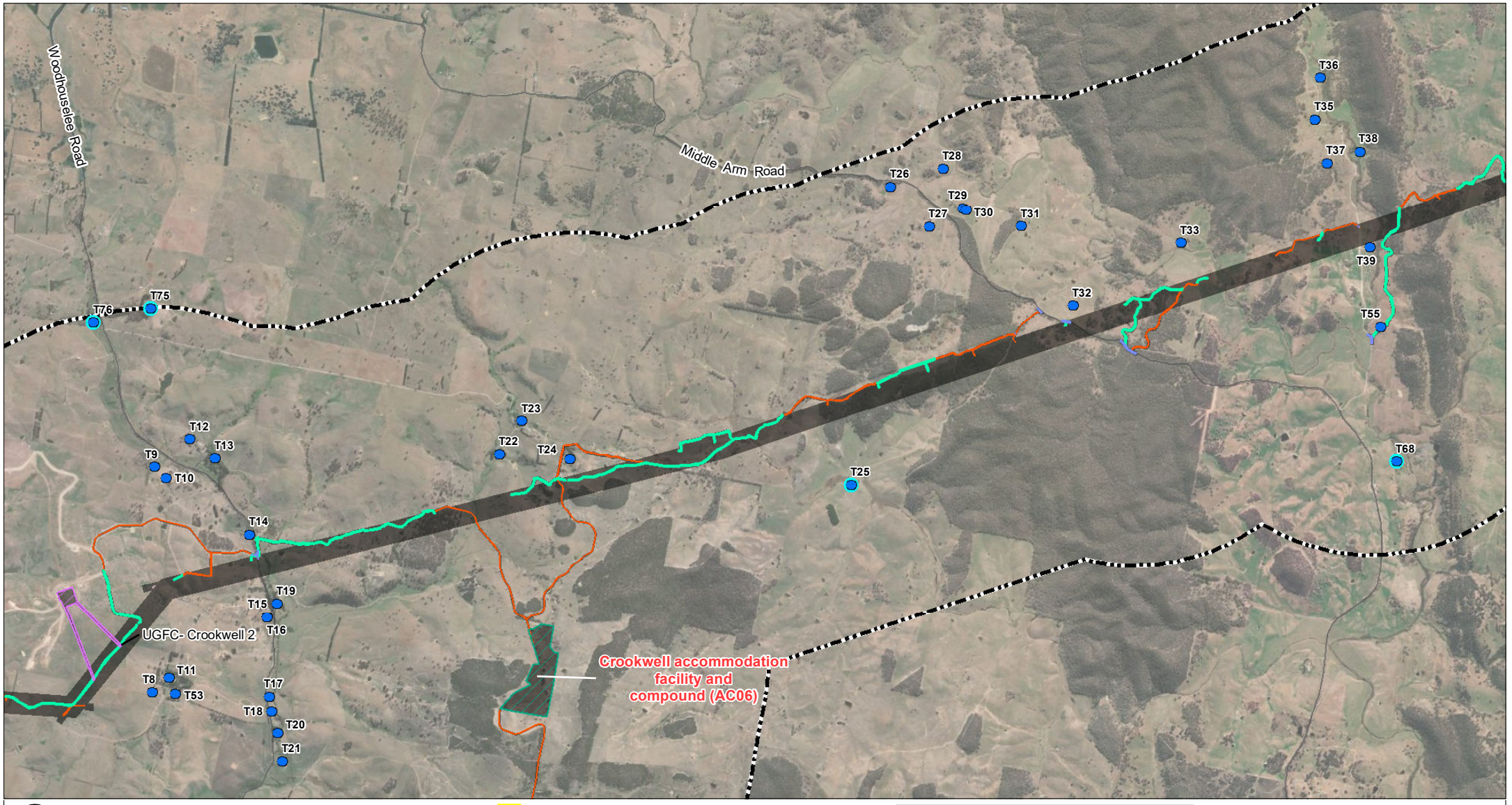

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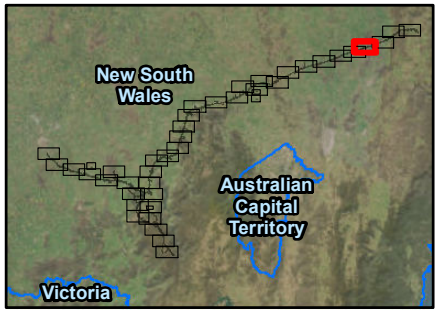

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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ATTACHMENT B

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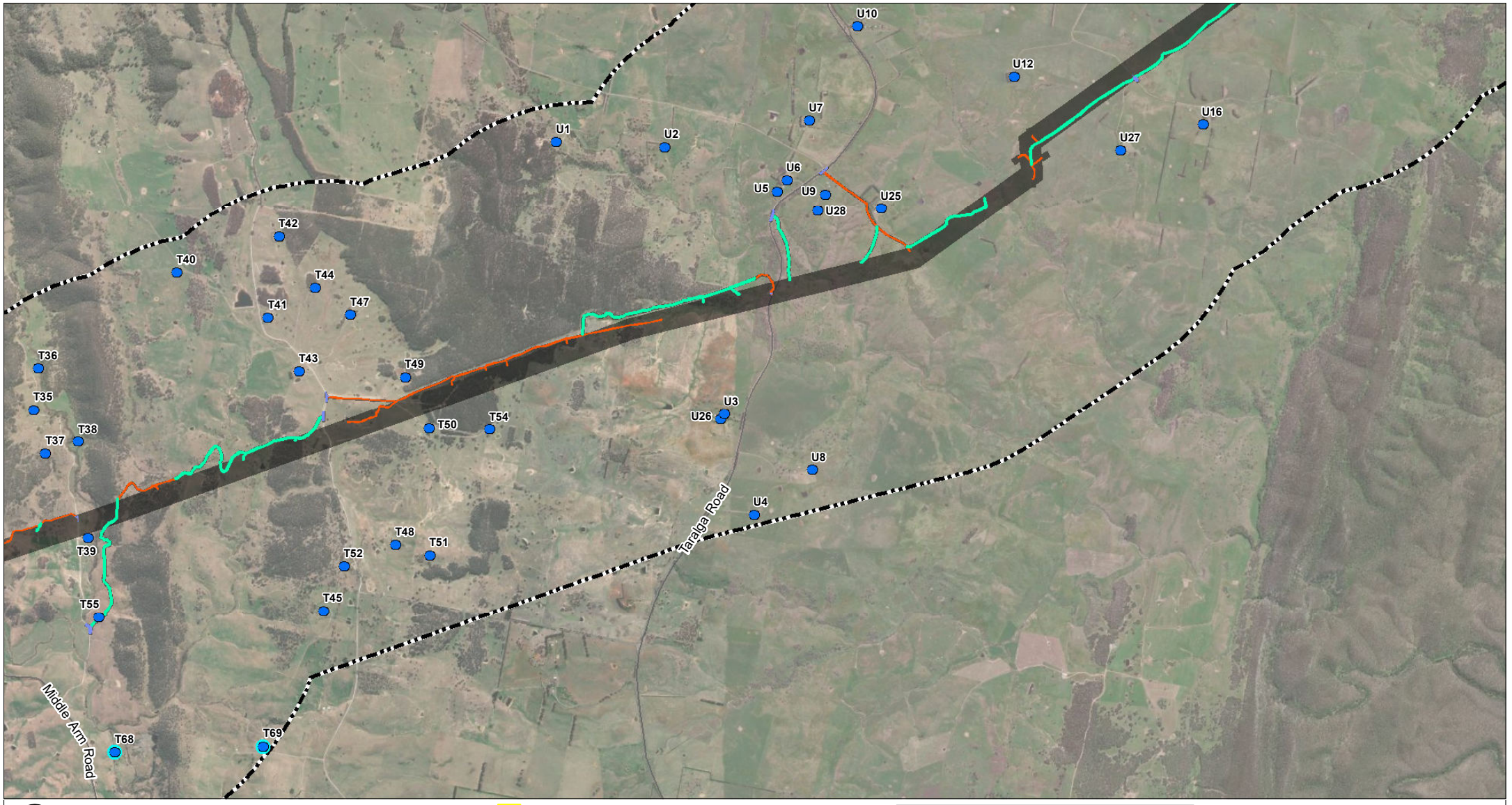

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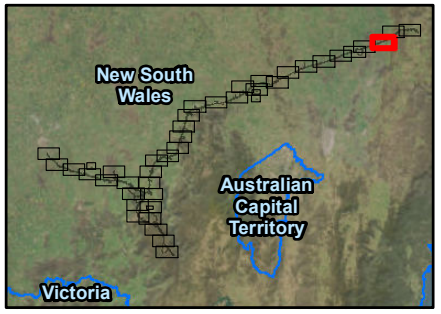

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
PAGE 42 OF 44

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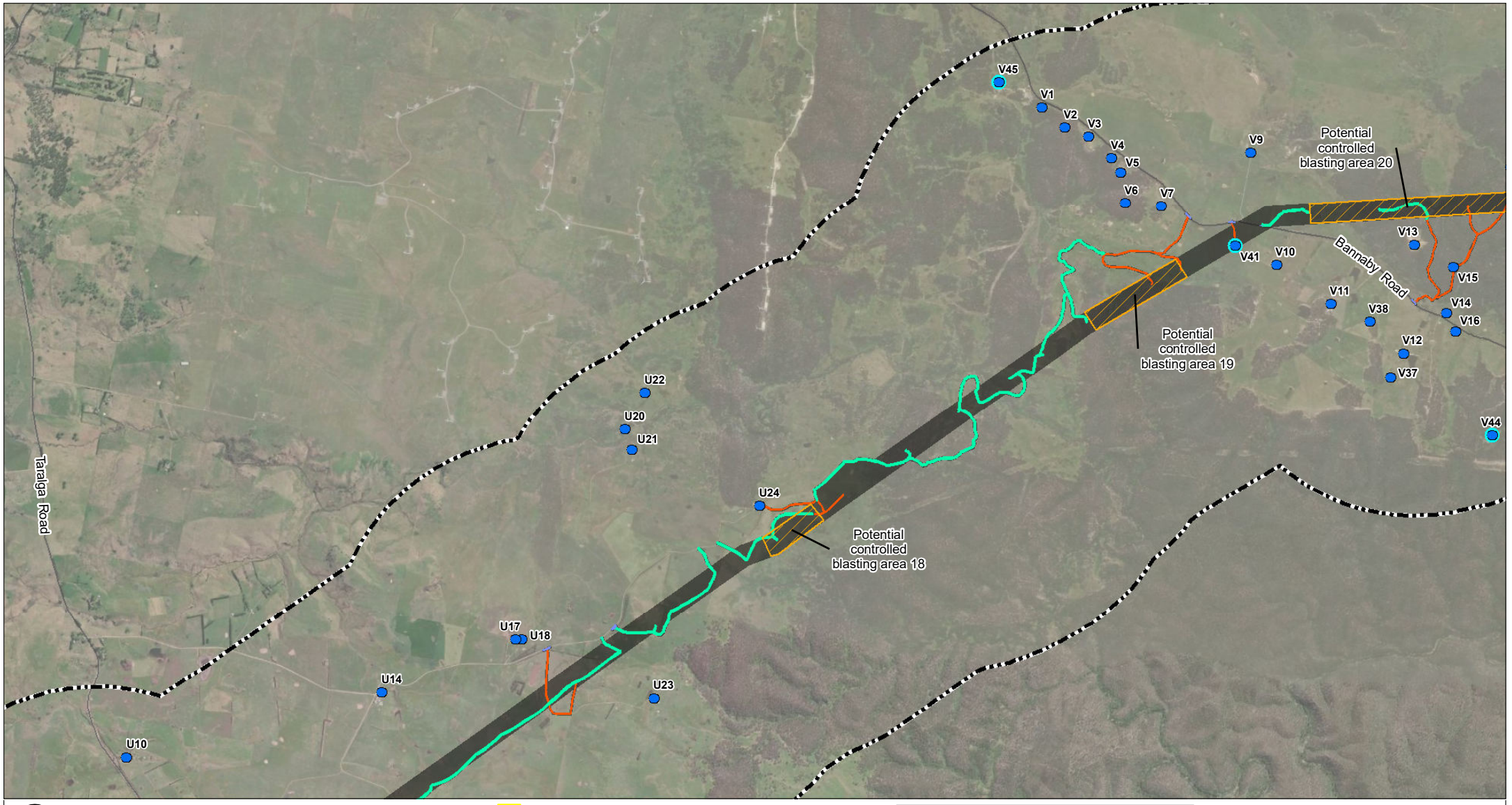

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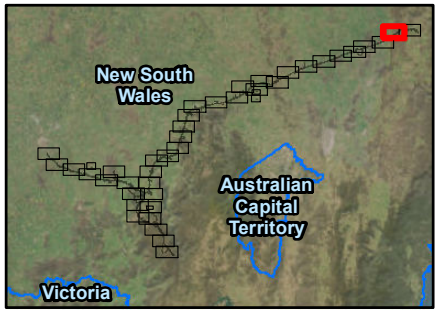

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

PROJECT AND RECEIVER MAP
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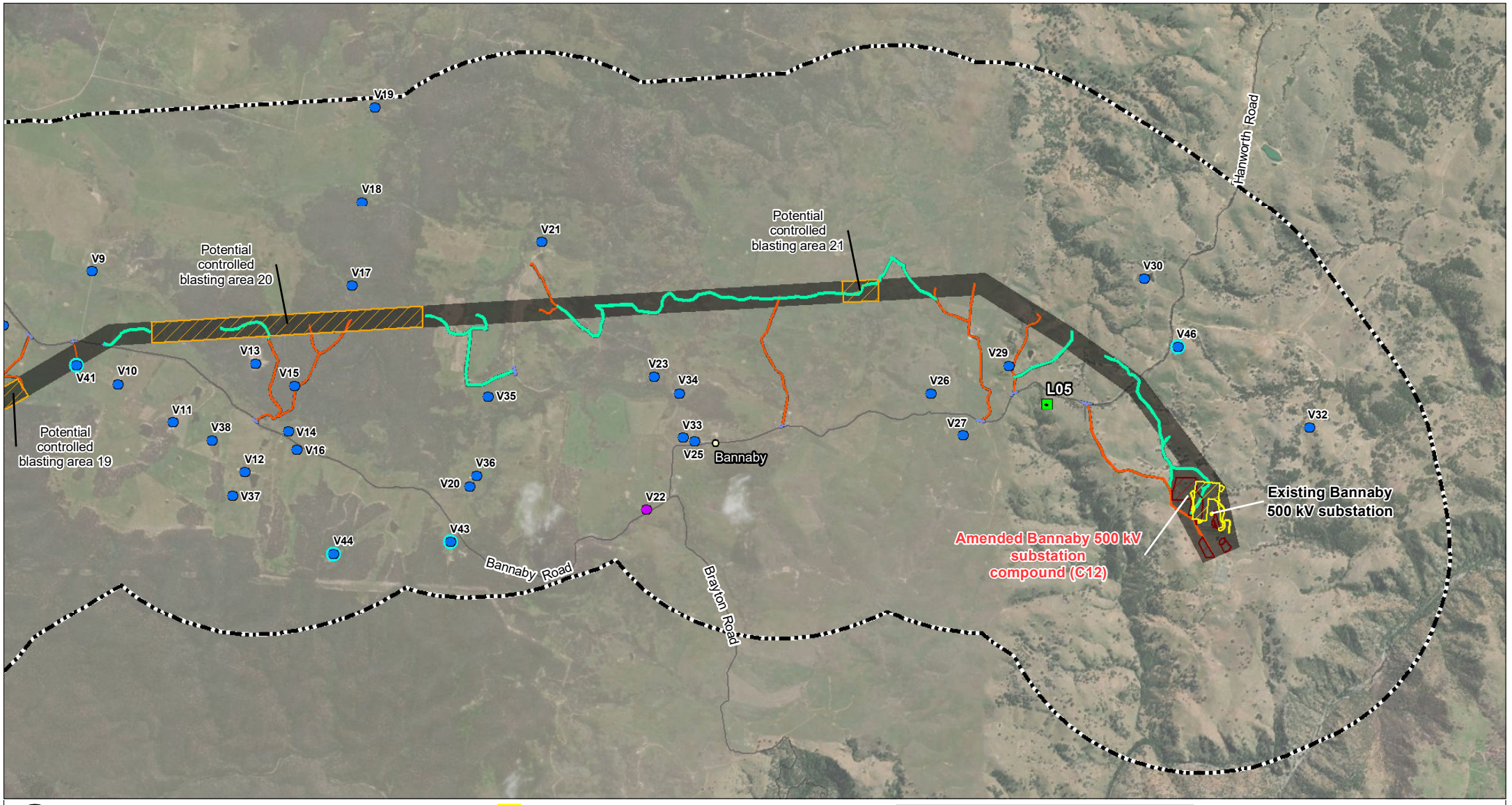

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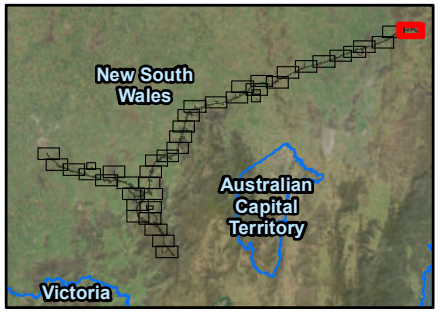

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NOISE AND VIBRATION IMPACT ASSESSMENT

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Attachment C Construction scenarios and equipment

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

Equipment lists and sound power levels

Equipment		Total sound power level (dBA)	Backhoe	Chainsaw[1]	Concrete pump	Concrete truck	Concrete vibrator	Crane – Fixed	Crane – Franna	Crane – Truck mounted	Dozer	Elevated work platform	Excavator - 10t	Excavator - 20t	Excavator - 40t	Excavator - Breaker	Front end loader	Generator – Attenuated	Grader	Grinder[1]	Hand tools	Light vehicle	Mobile jaw crusher[1]	Mobile screener	Puller / Tensioner	Roller – Smooth drum	Roller - Vibratory	Skid steer loader	Telehandler	Truck	Truck - Dump	Truck - Flatbed	Vacuum and oil pumps	Water cart	Winch
Sound power level[2] (dBA)			111	119	109	109	113	113	98	108	116	98	100	105	115	123	112	92	113	110	104	103	123	115	103	107	109	107	98	108	110	103	109	107	103
Estimated on-time in any 15-minute period			15	15	15	15	15	7.5	7.5	7.5	7.5	3	7.5	7.5	7.5	7.5	15	15	15	7.5	15	5	15	15	15	15	15	15	7.5	7.5	5	7.5	15	15	15
ID	**Construction scenario**																																		
	Substations																																		
W.001	Site establishment	109							X					X							X									X				
W.002	Earthwork and vegetation clearance	122									X				X	X											X				X			
W.003	Civil and building work	114			X	X			X	X			X							X										X				
W.004	Installation of high voltage equipment and associated structures	113								X		X								X										X			X	
W.005	Pre commissioning activities	104										X									X														
W.006	Site clean-up and landscaping	112							X	X											X							X		X				
W.007	Tie-in work	105							X			X									X														
	Transmission lines																																		
W.008	Site establishment and deliveries	119		X					X	X			X																	X				
W.009a	Access tracks – New	122									X				X	X			X								X				X			
W.009b	Access tracks – Upgrade	117									X			X					X								X				X			
W.010	Earthwork and clearing	122									X				X	X											X							
W.011	Brake and winch sites	115									X													X			X							

	Equipment	Total sound power level (dBA)	Backhoe	Chainsaw[1]	Concrete pump	Concrete truck	Concrete vibrator	Crane – Fixed	Crane – Franna	Crane – Truck mounted	Dozer	Elevated work platform	Excavator - 10t	Excavator - 20t	Excavator - 40t	Excavator - Breaker	Front end loader	Generator – Attenuated	Grader	Grinder[1]	Hand tools	Light vehicle	Mobile jaw crusher[1]	Mobile screener	Puller / Tensioner	Roller – Smooth drum	Roller - Vibratory	Skid steer loader	Telehandler	Truck	Truck - Dump	Truck - Flatbed	Vacuum and oil pumps	Water cart	Winch
W.012	Construction of structures	114			X	X			X	X		X								X									X					
W.013	Overhead stringing of conductors and earth wires	108								X																								X
W.014	Decommissioning and rehabilitation	115							X	X									X		X						X		X					
W.015	Crushing	124													X		X						X	X					X					
W.016	Underground fibre cable connection	112												X							X					X			X	X				
	Construction compounds																																		
W.016	Site establishment	121	X		X		X	X	X		X	X	X	X					X							X		X			X	X		X	
W.017	Compound operation	116			X	X	X							X				X				X							X	X					
	Worker accommodation facility																																		
W.018	Site establishment	121			X		X			X	X	X		X					X							X		X					X	
W.019	Facility operation	106																X				X							X					
Note 1:	Equipment classed as ‘annoying’ in the ICNG.																																		
Note 2:	Sound power level data is taken from the TfNSW Construction Noise and Vibration Guideline, TfNSW Construction Noise and Vibration Strategy, AS 2436-2010, DEFRA Noise Database, and SLR historical measurements.																																		

Attachment D Construction traffic

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

Traffic volumes and predicted road traffic noise increase

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Abbots Lane	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	15	30	131	145	4	2	3.3
Angels Lane	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	25	30	161	178	4	2	3.3
Ashfords Road	Wagga Wagga	Local road	Sealed	80	25	4	259	41	29	5	10	15	110	121	3	1	4.2
Big Springs Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	20	30	219	243	6	3	4.2
Boiling Down Road	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	5	10	44	49	1	1	3.3
Burkinshaws Lane	Wagga Wagga	Local road	Unsealed	60	8	1	87	14	9	1	5	15	58	64	2	1	3.2
Byes Lane	Wagga Wagga	Local road	Unsealed	60	8	1	87	14	9	1	15	20	102	113	3	1	3.2
Centenary Avenue	Wagga Wagga	Local road	Sealed	80	84	13	863	137	95	15	15	35	292	324	8	4	4.2
Comatawa Road	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	10	20	175	194	5	2	3.3
Coreinbob Road	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	25	35	175	194	5	2	3.3
Coreinbob Siding Road	Wagga Wagga	Local road	Unsealed	60	25	4	259	41	29	5	25	35	175	194	5	2	3.3
Gregadoo East Road	Wagga Wagga	Local road	Sealed	80	84	13	863	137	95	15	40	50	394	437	11	5	4.2
Gregadoo-Ladysmith Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	20	35	241	267	7	3	4.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Hume Highway (between Humula Road and Comatawa Road)	Wagga Wagga	National road	Sealed	100	69	35	1,837	929	511	258	35	45	467	518	13	6	2.8
Humula Link Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	5	15	117	130	3	2	4.2
Humula Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	5	15	117	130	3	2	4.2
Ivydale Road	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	10	10	88	98	2	1	3.3
Keajura Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	15	30	131	145	4	2	4.2
Kyeamba Street	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	15	30	131	145	4	2	4.2
Livingstone Gully Road	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	20	30	219	243	6	3	3.3
Mates Gully Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	40	40	467	518	13	6	4.2
Mcallisters Trail	Wagga Wagga	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Prices Road	Wagga Wagga	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Stewarts Road	Wagga Wagga	Local road	Sealed	80	8	1	87	14	9	1	15	30	131	145	4	2	4.1
Toonga Settlement Road	Wagga Wagga	Local road	Unsealed	60	17	3	173	27	19	3	5	15	58	64	2	1	3.3
Trewalla Road	Wagga Wagga	Local road	Unsealed	60	8	1	87	14	9	1	25	35	175	194	5	2	3.2
Tumbarumba Road	Wagga Wagga	Regional road	Sealed	100	43	6	642	88	70	10	35	40	329	364	9	4	7.4
Tywong Street	Wagga Wagga	Local road	Sealed	80	17	3	173	27	19	3	15	30	131	145	4	2	4.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Westbrook Road	Wagga Wagga	Local road	Sealed	80	42	7	432	68	47	7	25	45	409	454	11	5	4.2
Wilds Road	Wagga Wagga	Local road	Unsealed	60	8	1	87	14	9	1	10	20	175	194	5	2	3.2
Adelong Creek Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	25	40	285	316	8	4	3.2
Adelong Road	Snowy Valley	State road	Sealed	100	213	51	2,839	678	393	94	20	20	117	130	3	2	1.0
Ardrossan Headquarters Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	20	20	234	259	6	3	3.3
Ash Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	10	15	73	81	2	1	3.3
Back Camp Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	20	20	234	259	6	3	3.3
Back Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	15	58	64	2	1	3.3
Back Nacki Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	10	10	58	64	2	1	3.3
Back Kunama Road	Snowy Valley	Local road	Unsealed	60	25	4	259	41	29	5	10	15	110	121	3	1	3.3
Bago Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	25	175	194	5	2	3.3
Bago Forest Way	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	20	154	170	4	2	3.3
Barneys Highway	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	44	49	1	1	3.2
Bartoman Street	Snowy Valley	Local road	Sealed	80	42	7	432	68	47	7	5	10	66	73	2	1	4.2
Batlow Road	Snowy Valley	State road	Sealed	100	53	13	1,023	244	126	30	25	35	350	388	10	5	4.9

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Bb Feeder Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Booths Access Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	44	49	1	1	3.2
Booths Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Bradleys Drive	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	15	110	121	3	1	3.2
Bridge Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	20	131	145	4	2	3.2
Browns Forest Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	44	49	1	1	3.3
Browns Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	15	25	175	194	5	2	3.2
Brungle Creek Road	Snowy Valley	Local road	Unsealed	60	25	4	259	41	29	5	15	15	88	98	2	1	3.3
Brungle Road	Snowy Valley	Local road	Sealed	80	42	7	432	68	47	7	15	15	88	98	2	1	4.2
Buddong Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Bullongra Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	10	15	110	121	3	1	3.3
Carrs Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	30	204	226	6	3	3.2
Central Logging Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	10	15	110	121	3	1	3.3
Cockatoo Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	15	10	73	81	2	1	3.2
Dunns Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	10	20	88	98	2	1	3.3
East Bago Powerline Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	20	20	175	194	5	2	3.2
Ellerslie Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	20	154	170	4	2	3.3
Elliott Way	Snowy Valley	Regional road	Sealed	100	43	6	483	66	53	7	10	15	110	121	3	1	4.8
Ernies Way	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	25	175	194	5	2	3.2
Forest Road	Snowy Valley	Local road	Sealed	80	42	7	432	68	47	7	5	5	44	49	1	1	4.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Gadara Lane	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	20	15	154	170	4	2	3.3
Gadara Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	25	15	117	130	3	2	3.3
Gilmore Mill Road	Snowy Valley	Local road	Sealed	80	17	3	173	27	19	3	20	25	198	219	5	3	4.2
Gocup Road (west Of Tumut)	Snowy Valley	State road	Sealed	100	53	13	1,143	273	158	38	15	15	88	98	2	1	1.7
Green Hills Access Road	Snowy Valley	Local road	Sealed	80	17	3	173	27	19	3	20	30	292	324	8	4	4.2
Green Hills Forest Way	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	66	73	2	1	3.3
Greenhills Road	Snowy Valley	Local road	Sealed	80	42	7	432	68	47	7	15	25	117	130	3	2	4.2
Honeysuckle Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	30	20	219	243	6	3	3.2
Hugel Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	15	73	81	2	1	3.2
Kileys Creek Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Kileys Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Kopsens Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	20	154	170	4	2	3.3
Kunama Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	20	35	321	356	9	4	3.3
Kurrajong Avenue	Snowy Valley	Local road	Sealed	80	17	3	173	27	19	3	10	10	88	98	2	1	4.2
Lower Bago Road	Snowy Valley	Local road	Sealed	80	42	7	432	68	47	7	20	40	350	388	10	5	4.2
Meadow Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Memorial Avenue	Snowy Valley	Local road	Sealed	80	25	4	259	41	29	5	10	10	88	98	2	1	4.2
Mill Road	Snowy Valley	Local road	Sealed	80	25	4	259	41	29	5	5	5	44	49	1	1	4.2
Millers Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	15	20	102	113	3	1	3.2
Monterey Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	15	88	98	2	1	3.3
Mount Pleasant Creek Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
New Maragle Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	20	88	98	2	1	3.2
Nacki Creek Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Northern Boundary Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	44	49	1	1	3.3
Nursery Access Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	35	175	194	5	2	3.3
Oberne Ellerslie Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	66	73	2	1	3.2
Old Telegraph Track	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	20	35	241	267	7	3	3.2
Old Tumbarumba Road	Snowy Valley	Local road	Sealed	80	25	4	259	41	29	5	10	15	73	81	2	1	4.2
Old Western Boundary Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
One Tree Hill Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	66	73	2	1	3.2
Palmer Street	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	66	73	2	1	3.3

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Perkins Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	15	58	64	2	1	3.3
Pierces Boundary Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Pipe Dump Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	44	49	1	1	3.3
Powerline Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	15	73	81	2	1	3.2
Powerline Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Prickle Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	15	73	81	2	1	3.2
Red Hill Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	40	25	285	316	8	4	3.3
Right Arm Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Roaches Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Rocky Gully Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	20	15	102	113	3	1	3.2
Rosehill Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Sargood Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	44	49	1	1	3.2
Scotties Hut Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Sharps Creek Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	44	49	1	1	3.3
Sharps Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	15	20	102	113	3	1	3.2
Shedleys Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	15	58	64	2	1	3.2
Sixty Five Feeder Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Snowy Mountains Highway (west of Batlow Road)	Snowy Valley	State road	Sealed	100	99	24	1,784	426	313	75	20	25	198	219	5	3	2.3
Snubba Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	20	154	170	4	2	3.3
Spyglass Trail	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Stockmans Creek Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Stud Horse Feeder Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	44	49	1	1	3.3
Webbs Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	10	73	81	2	1	3.3
Wee Jasper Road (north-east of Tumut)	Snowy Valley	Regional road	Unsealed	80	60	8	1,188	162	158	22	15	15	131	145	4	2	2.4
West Branch Feeder	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	20	35	161	178	4	2	3.3
West Gilmore Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	10	15	73	81	2	1	3.3
Westwood Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	20	102	113	3	1	3.3
Wilsons Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Wiltys Road	Snowy Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Wondalga Road	Snowy Valley	Regional road	Sealed	100	26	4	509	70	98	13	20	30	219	243	6	3	6.8
Yarrawonga Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	44	49	1	1	3.2
Yaven Creek Road	Snowy Valley	Local road	Sealed	80	25	4	259	41	29	5	15	20	154	170	4	2	4.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Yellowin Access Road	Snowy Valley	Local road	Sealed	80	17	3	173	27	19	3	5	5	44	49	1	1	4.2
Adjungbilly Road	Cootamundra-Gundagai	Local road	Sealed	80	17	3	173	27	19	3	60	15	438	486	12	6	4.2
Bundarbo Road	Cootamundra-Gundagai	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Fernhill Road	Cootamundra-Gundagai	Local road	Unsealed	60	8	1	87	14	9	1	35	20	321	356	9	4	3.2
Honeysuckle Road	Cootamundra-Gundagai	Local road	Unsealed	60	17	3	173	27	19	3	30	20	219	243	6	3	3.3
Maryvale Road	Cootamundra-Gundagai	Local road	Unsealed	60	8	1	87	14	9	1	10	15	73	81	2	1	3.2
Nanangroe Road	Cootamundra-Gundagai	Local road	Unsealed	60	25	4	259	41	29	5	15	20	102	113	3	1	3.3
Parsons Creek Road	Cootamundra-Gundagai	Local road	Unsealed	60	17	3	173	27	19	3	10	10	117	130	3	2	3.3
Red Hill Road	Cootamundra-Gundagai	Local road	Unsealed	60	17	3	173	27	19	3	40	25	285	316	8	4	3.3
Red Strip Road	Cootamundra-Gundagai	Local road	Unsealed	60	8	1	87	14	9	1	35	20	241	267	7	3	3.2
Sawmill Creek Road	Cootamundra-Gundagai	Local road	Unsealed	60	8	1	87	14	9	1	15	10	110	121	3	1	3.2
Nanangroe Road	Cootamundra-Gundagai	Local road	Unsealed	60	25	4	259	41	29	5	15	20	102	113	3	1	3.3
Bango Lane	Yass Valley	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Black Range Road	Yass Valley	Local road	Unsealed	60	25	4	259	41	29	5	35	25	350	388	10	5	3.3

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Blakney Creek Road South	Yass Valley	Local road	Sealed	80	25	4	259	41	29	5	25	15	117	130	3	2	4.2
Buggali Road	Yass Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	58	64	2	1	3.2
Burrinjuck Road	Yass Valley	Regional road	Sealed	100	26	4	290	40	31	4	15	10	73	81	2	1	5.1
Bushs Road	Yass Valley	Local road	Unsealed	60	17	3	173	27	19	3	15	10	73	81	2	1	3.3
Childowla Road	Yass Valley	Local road	Sealed	80	17	3	173	27	19	3	25	30	161	178	4	2	4.2
Comour Street	Yass Valley	Regional road	Sealed	100	302	41	3,382	463	366	50	5	20	73	81	2	1	0.8
Cooks Hill Road	Yass Valley	Local road	Sealed	80	25	4	259	41	29	5	30	25	321	356	9	4	4.2
Coolalie Road	Yass Valley	Local road	Unsealed	60	17	3	173	27	19	3	30	25	321	356	9	4	3.3
Days Road	Yass Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Fagan Drive	Yass Valley	Local road	Sealed	80	17	3	173	27	19	3	20	15	102	113	3	1	4.2
Fairy Hole Road	Yass Valley	Local road	Unsealed	60	17	3	173	27	19	3	5	10	88	98	2	1	3.3
Faulder Avenue	Yass Valley	Local road	Unsealed	60	25	4	259	41	29	5	60	10	409	454	11	5	3.3
Glebe Street	Yass Valley	Local road	Sealed	80	17	3	173	27	19	3	40	30	409	454	11	5	4.2
Grand Junction Road	Yass Valley	Local road	Sealed	80	59	9	604	96	66	11	10	20	88	98	2	1	4.2
Hovell Street	Yass Valley	Local road	Sealed	80	42	7	432	68	47	7	40	10	292	324	8	4	4.2
Hume Highway (between Burley Griffin Way and Burrinjuck Road)	Yass Valley	National road	Sealed	100	168	85	1,645	832	407	206	35	45	467	518	13	6	3.0

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Hume Highway (between Yass Valley Way and Barton Highway)	Yass Valley	National road	Sealed	100	143	72	3,899	1,972	731	369	35	45	467	518	13	6	1.5
Hume Highway (between Yass Valley Way and Lachlan Valley Way)	Yass Valley	National road	Sealed	100	272	137	6,787	3,433	1,015	513	35	45	467	518	13	6	0.9
Illalong Road	Yass Valley	Local road	Sealed	80	25	4	259	41	29	5	20	15	102	113	3	1	4.2
Laidlaw Street	Yass Valley	Regional road	Sealed	100	302	41	3,382	463	366	50	10	20	88	98	2	1	0.9
Mcintosh Lane	Yass Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Orion Street	Yass Valley	Local road	Sealed	80	42	7	432	68	47	7	40	30	409	454	11	5	4.2
Perry Street	Yass Valley	Local road	Sealed	80	25	4	259	41	29	5	10	20	88	98	2	1	4.2
Pollux Street	Yass Valley	Local road	Sealed	80	42	7	432	68	47	7	40	10	292	324	8	4	4.2
Reddall Street	Yass Valley	Local road	Sealed	80	17	3	173	27	19	3	40	15	321	356	9	4	4.2
Talmo Road	Yass Valley	Local road	Unsealed	60	17	3	173	27	19	3	20	15	102	113	3	1	3.3
Wargeila Road	Yass Valley	Local road	Sealed	80	25	4	259	41	29	5	20	10	175	194	5	2	4.2
Warroo Road	Yass Valley	Local road	Sealed	80	84	13	863	137	95	15	10	20	88	98	2	1	4.2
Yass Valley Way	Yass Valley	Regional road	Sealed	100	276	38	4,187	573	457	62	40	30	409	454	11	5	2.7
Adavale Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	15	5	58	64	2	1	3.2
Back Arm Road	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Bannaby Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	25	15	117	130	3	2	4.2
Bannister Lane	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Blakney Creek North Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	10	10	58	64	2	1	4.2
Blakney Creek Road South	Upper Lachlan	Local road	Sealed	80	25	4	259	41	29	5	25	15	117	130	3	2	4.2
Blakney Creek South Road	Upper Lachlan	Local road	Sealed	80	8	1	87	14	9	1	25	15	117	130	3	2	4.1
Britannia Street	Upper Lachlan	Regional road	Sealed	100	17	2	193	26	21	3	5	5	29	32	1	0	3.7
Brown Street	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	10	5	44	49	1	1	3.3
Bulleys Crossing	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	10	10	58	64	2	1	3.3
Bunnaby Street	Upper Lachlan	Regional road	Sealed	100	17	2	193	26	21	3	25	20	131	145	4	2	8.4
Butcher Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	20	15	102	113	3	1	3.2
Camp Street	Upper Lachlan	Regional road	Sealed	100	17	2	193	26	21	3	5	5	29	32	1	0	3.7
Carnells Lane	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	5	44	49	1	1	3.2
Carrabungla Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	20	10	88	98	2	1	3.2
Castle Hill Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	5	44	49	1	1	3.2
Chapel Street	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	10	5	44	49	1	1	4.2
Church Street	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	10	5	44	49	1	1	4.2
Clancys Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	20	15	102	113	3	1	3.2
Colyer Street	Upper Lachlan	Local road	Sealed	80	42	7	432	68	47	7	5	5	29	32	1	0	4.2
Coolalie Road	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	30	25	321	356	9	4	3.3
Crookwell Road	Upper Lachlan	State road	Sealed	100	76	18	852	204	116	28	40	20	175	194	5	2	3.6
Cullerin Road	Upper Lachlan	Local road	Sealed	80	25	4	259	41	29	5	15	10	73	81	2	1	4.2
Dawes Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Felled Timber Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Flacknell Creek Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Goulburn Road	Upper Lachlan	State road	Sealed	100	76	18	852	204	116	28	35	25	175	194	5	2	3.6
Grabben Gullen Road (north of Cullerin Road)	Upper Lachlan	Regional road	Sealed	100	17	2	350	48	43	6	20	15	102	113	3	1	5.5
Greendale Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Gundaroo Road	Upper Lachlan	Regional road	Sealed	100	43	6	483	66	53	7	15	10	73	81	2	1	3.7
Gunning Street	Upper Lachlan	Regional road	Sealed	100	26	4	290	40	31	4	10	5	44	49	1	1	3.7
Gurrundah Road	Upper Lachlan	Local road	Sealed	80	25	4	259	41	29	5	5	5	29	32	1	0	4.2
Hanworth Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	25	15	175	194	5	2	4.2
Harley Road	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Hillcrest Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	15	15	88	98	2	1	3.2
Hume Highway	Upper Lachlan	National road	Sealed	100	148	75	891	451	237	120	35	45	467	518	13	6	4.5
Hume Street	Upper Lachlan	Local road	Sealed	80	42	7	432	68	47	7	40	10	146	162	4	2	4.2
Jerrawa Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	10	10	58	64	2	1	4.2
Kialla Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	15	15	88	98	2	1	4.2
Lachlan Valley Way	Upper Lachlan	Regional road	Sealed	100	43	6	483	66	53	7	5	5	29	32	1	0	1.8
Laggan – Taralga Road	Upper Lachlan	Regional road	Sealed/ Unsealed	100	43	6	483	66	53	7	20	10	88	98	2	1	4.2
Loop Road	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	10	5	44	49	1	1	3.3

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Lower Greendale Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Macarthur Street	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	25	20	131	145	4	2	4.2
Mcdonald Street	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	5	5	29	32	1	0	4.2
Menzies Lane	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	15	15	88	98	2	1	3.2
Middle Arm Road	Upper Lachlan	Local road	Sealed	80	42	7	432	68	47	7	30	10	117	130	3	2	4.2
Mount Rae Road	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	20	10	88	98	2	1	3.3
Offleys Lane	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	15	10	73	81	2	1	3.2
Orchard Street	Upper Lachlan	Regional road	Sealed	100	43	6	483	66	53	7	25	20	131	145	4	2	5.3
Parsons Lane	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	5	5	29	32	1	0	4.2
Pejar Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	25	25	146	162	4	2	3.2
Prices Lane	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Range Road	Upper Lachlan	Local road	Sealed	80	42	7	432	68	47	7	15	15	88	98	2	1	4.2
Rhyanna Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	10	10	58	64	2	1	4.2
Robertson Lane	Upper Lachlan	Local road	Sealed	80	25	4	259	41	29	5	5	5	29	32	1	0	4.2
Roslyn Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	5	10	44	49	1	1	4.2
Rugby Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	10	5	44	49	1	1	4.2
Rye Park Road	Upper Lachlan	Regional road	Sealed	100	26	4	290	40	31	4	15	10	73	81	2	1	5.1
Sapphire Road	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	15	15	88	98	2	1	4.2

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Soldiers Settlement Road South	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Spicers Lane	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Stink Pot Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Storriers Lane	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Strathaird Lane	Upper Lachlan	Local road	Sealed	80	17	3	173	27	19	3	15	20	102	113	3	1	4.2
Taralga Road	Upper Lachlan	Regional road	Unsealed	80	43	6	483	66	53	7	15	15	88	98	2	1	3.4
Walsh Street	Upper Lachlan	Local road	Sealed	80	25	4	259	41	29	5	35	30	190	211	5	2	4.2
Walshs Road	Upper Lachlan	Local road	Unsealed	60	8	1	87	14	9	1	10	10	58	64	2	1	3.2
Woodhouselee Road	Upper Lachlan	Local road	Sealed	80	25	4	259	41	29	5	50	15	380	421	11	5	4.2
Yass Street	Upper Lachlan	Regional road	Sealed	100	43	6	483	66	53	7	15	10	73	81	2	1	3.7
Crookwell Road	Goulburn Mulwaree	State road	Sealed	100	114	27	1,602	383	160	38	40	20	175	194	5	2	2.2
Middle Arm Road	Goulburn Mulwaree	Local road	Sealed	80	84	13	863	137	95	15	30	10	117	130	3	2	4.2
Mount Pedlar Road	Goulburn Mulwaree	Local road	Unsealed	60	8	1	87	14	9	1	15	10	73	81	2	1	3.2
Rhyanna Road	Goulburn Mulwaree	Local road	Sealed	80	17	3	173	27	19	3	10	10	58	64	2	1	4.2
Woodhouselee Road	Goulburn Mulwaree	Local road	Sealed	80	25	4	259	41	29	5	50	15	380	421	11	5	4.2
Wombeys Feeder Road	Snowy Valley	Local road	Unsealed	60	8	1	43	7	5	1	5	5	29	32	1	0	2.0

Road name	LGA	Road classification	Pavement type	Assumed speed, km/h[1]	Existing						Construction						Worst-case road traffic noise increase, dB (all periods)[2]
					Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		Peak (1 hour)		Day (7am – 10pm)		Night (10pm – 7am)		
					LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	
Willigobung Middle Spur Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Audley Road	Hilltops	Local road	Sealed	80	25	4	259	41	29	5	5	5	29	32	1	0	4.2
Riverside Drive	Hilltops	Local road	Sealed	80	25	4	259	41	29	5	5	5	29	32	1	0	4.2
Bundarbo Road	Hilltops	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Paynes Road	Yass Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	5	29	32	1	0	3.2
Burley Griffin Way	Yass Valley	State road	Sealed	100	76	18	912	218	125	30	5	5	29	32	1	0	0.8
Veterans Road	Upper Lachlan	Local road	Sealed	80	8	1	87	14	9	1	15	10	73	81	2	1	4.1
Lade Vale Road	Upper Lachlan	Local road	Unsealed	60	17	3	173	27	19	3	5	5	29	32	1	0	3.3
Sailors Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Stantons Road	Snowy Valley	Local road	Unsealed	60	8	1	87	14	9	1	5	10	44	49	1	1	3.2
Hume Highway (north of Coolac)	Cootamundra-Gundagai	National road	Sealed	100	188	95	2,549	1,289	240	121	5	5	29	32	1	0	0.2
Hume Highway (Jugiong)	Hilltops	National road	Sealed	100	188	95	2,549	1,289	240	121	5	10	44	49	1	1	0.3

Note 1: Road speeds are assumed as 100 km/h for regional, state and national roads and as 80 km/h for local roads. Assumed speeds are reduced by 20 km/h for unsealed roads.

Note 2: The worst-case road traffic noise increase is the maximum increase of the day and night period for regional, state and national roads and the peak 1 hour for local roads (as per the NSW Road Noise Policy criteria).

Attachment E Revised audible noise report

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

HumeLink

Technical Report 19 – Revised Audible Noise & Radio Interference Report

Transgrid

March 2024

aurecon

Bringing ideas to life

Document control record

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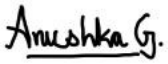
Approval			
Author signature		Approver signature	
Name	Anuska Gautam	Name	Dries Mouton
Title	Engineer	Title	Engineer

Executive summary

This revised report investigates the audible noise and radio interference expected to be produced by new 500 kV and 330 kV double circuit transmission lines constructed as part of the HumeLink project. The relevant standards and appropriate limits or targets are discussed, and computer modelling is reported. Potential project risks and practical mitigation methods are listed.

Contents

Figures

Tables

1 Introduction

1.1 General

Audible noise and radio interference are two of the design parameters for the design of the HumeLink 500 kV and 330 kV transmission lines. This assessment will look at different methods and weather cases to calculate audible noise and radio interference.

This report will inform Transgrid regarding risks for audible noise and radio interference.

1.2 References

Australian Standards

AS 1055:2018 Acoustics – Description and measurement of environmental noise

AS 2344:2016 Limits of electromagnetic interference from overhead a.c. powerlines and high voltage equipment installations in the frequency range 0.15 MHz to 3000 MHz

Guidelines

NSW EPA Noise Policy for Industry, 2017

Publications

Al-Faraj, M.A., Shwehdi, M.H, Farag, A.S (1997) Environmental Effect on High Voltage AC Transmission Lines Audible Noise IECEC-97 Proceedings, Thirty-Second Intersociety Energy Conversion Engineering Conference, 27 July – 1 August, Hawaii USA. IEEE Xplore.

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CIGRE (2004) Methods for Limiting Radio Interference from EHV OHL Insulator Sets. B2-302

CIGRE (1998) The Egyptian Experience for Electric & Magnetic Fields and Radio Noise with Compact and Traditional Towers. 22/33/36-09

EirGrid (2016), Evidence Based Environmental Studies Study 8: Noise, Literature review and evidence based field study on the noise effects of high voltage transmission development. Accessed 28 April 2022 at [https://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-Evidence-Based-Environmental-Study-8-Noise.pdf]

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EPRI AC Transmission Line Reference Book - 200kV and Above (The Red Book). Electric Power Research Institute.

IEEE, A Comparison of methods for calculating audible noise of high voltage transmission lines: A report prepared by a Task Force of the Corona and Field Effects Subcommittee. ISSN: 1558-1705 DOI: 10.1109/MPER.1982.5519926

IEEE, Audible Noise Calculation for Different Overhead Transmission Lines. ISBN: 978-1-5386-2910-9 DOI: 10.1109/UPEC.2018.8542082

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IEEE, Comparison of several methods for calculating power line electromagnetic interference levels and calibration with long term data. ISSN: 0885-8977-95 DOI: 10.1109/61.127097

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Straumann, U., Weber, H.J. (2010) Potential reduction of audible noise from new and aged overhead transmission line conductors by increasing their hydrophilicity, *CIGRE 2010*, B2-113, Paris

Transgrid. (2020). Transmission Line Design Manual for 220kV, 330kV and 500kV – Major New Build TLDM-MNB. Transgrid.

2 Input parameters

Input parameters were obtained from the following documents in addition to the relevant standards:

- HumeLink Preliminary Conductor Selection and Structure Selection Report.

2.1 Electrical

- Phase Conductor = Two conductor options are being considered namely ACSR Orange x 4 with 460 mm spacers and ACSR Pawpaw x 3 with 550 mm spacers (Non-Alpine).
- Phase Conductor = Two conductor options are being considered namely ACSR Orange x 4 with 460 mm spacers and ACSR Pawpaw x 3 with 550 mm spacers (Alpine).
- Double Circuits modelled as minimum reactance phasing, namely

  A C

  B B

  C A
- Shield Conductor = ACSR Lemon and OPGW B (Non-Alpine)
- Shield Conductor = 19/4.25 SC/AC and OPGW ASLH-Z(SA)bb 96 SMF (27SA 184) (Alpine)
- Voltage = 1.08 pu (540 kV or 354 kV)
- Current = 3,464 A at 120° C
- Maximum E-field = 9.1 kV/m
- Minimum ground clearance = *11 m (500 kV) or 8 m (330 kV)
- RI Frequency = 0.5 MHz.

Transmission lines produce approximately the same level of radio noise across frequencies up to 0.5 MHz, but this then drops off rapidly as the frequency increases above 0.5 MHz. Accordingly, 0.5 MHz is selected as a worst-case for study in the bands below VHF. 30 MHz is also examined in Section 4.4 below, as an indication of worst-case expected RI noise in the VHF (30 MHz - 300 MHz) and UHF (300 MHz – 3 GHz) bands.

**Minimum ground clearance will produce worst-case results and are therefore used as a conservative approach in this study. Accordingly, actual noise or RF results measured on site will likely be below the calculated levels.*

2.2 Geometry

2.2.1 Existing 330 kV single circuit horizontal tower (alpine and non-alpine)

The following geometry is used to model lines running in parallel to new 500 kV lines, for the purpose of calculating cumulative noise. The specific example follows the geometry of the SA type tower of Line 66, Lower Tumut to Murray.

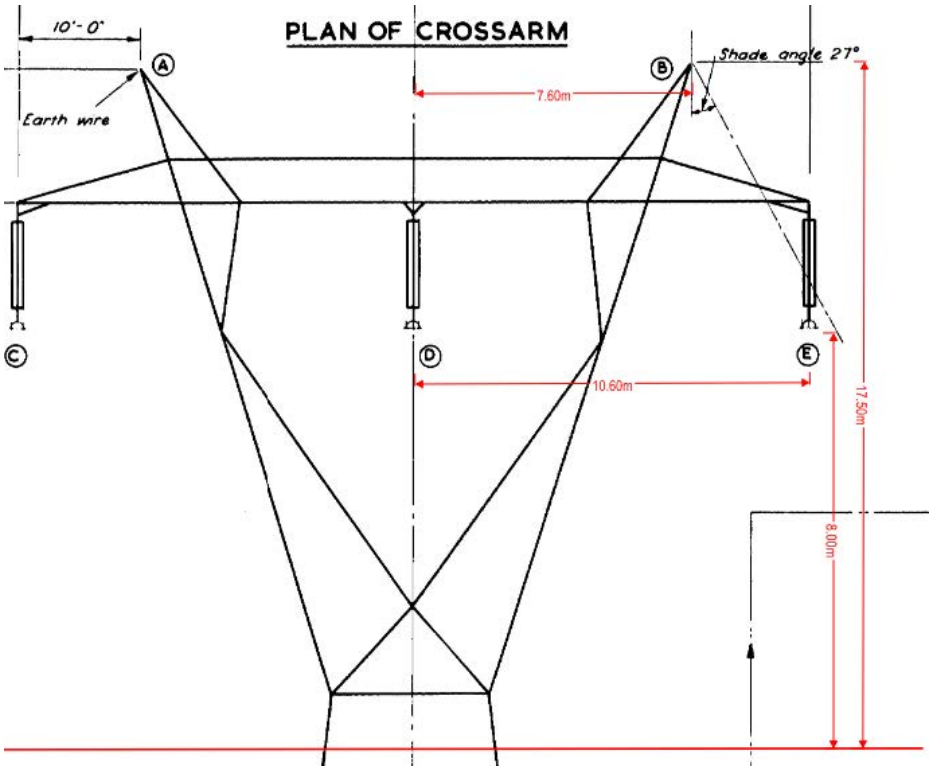
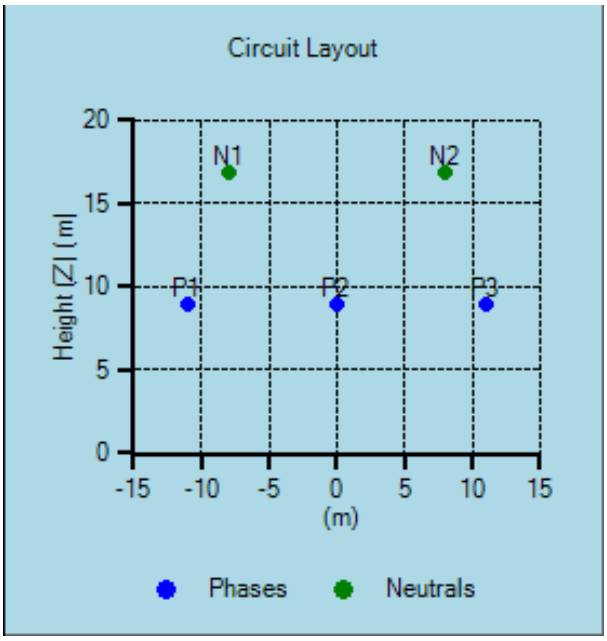


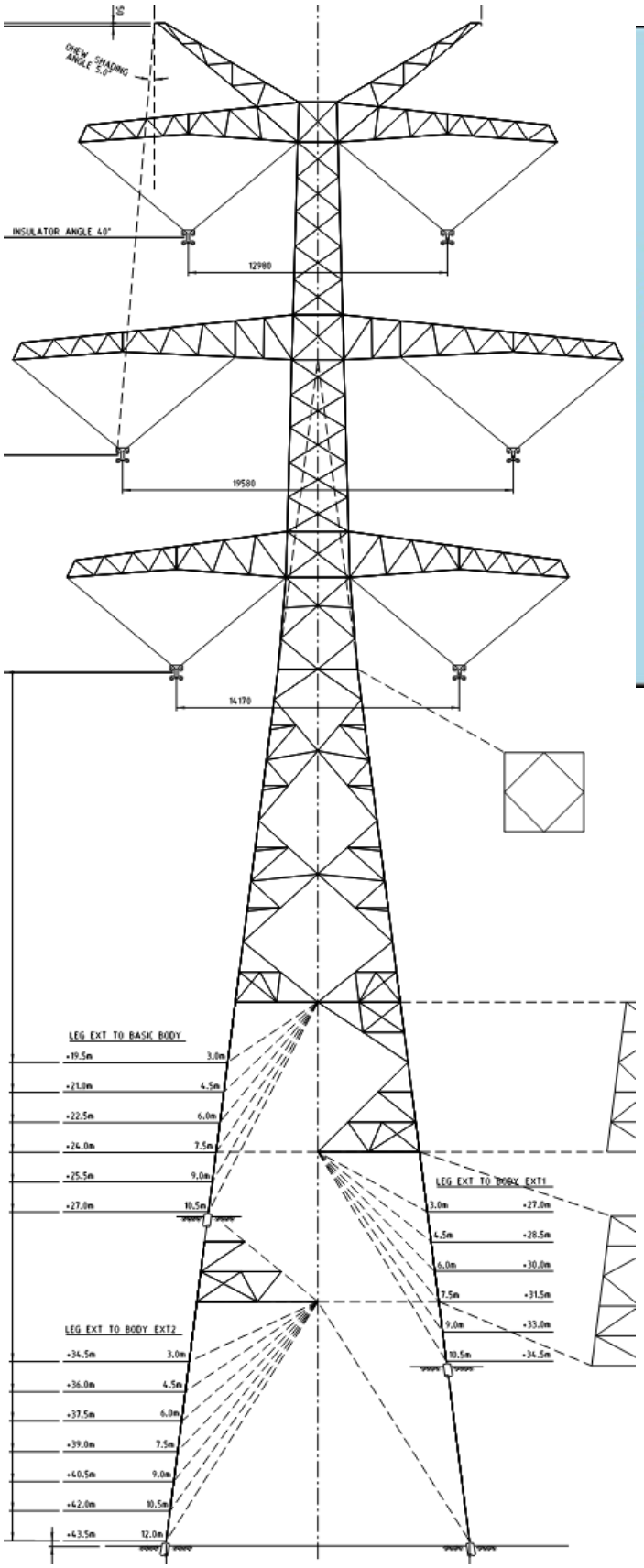
Figure 2-1: 330 kV single circuit tower geometry (SA)

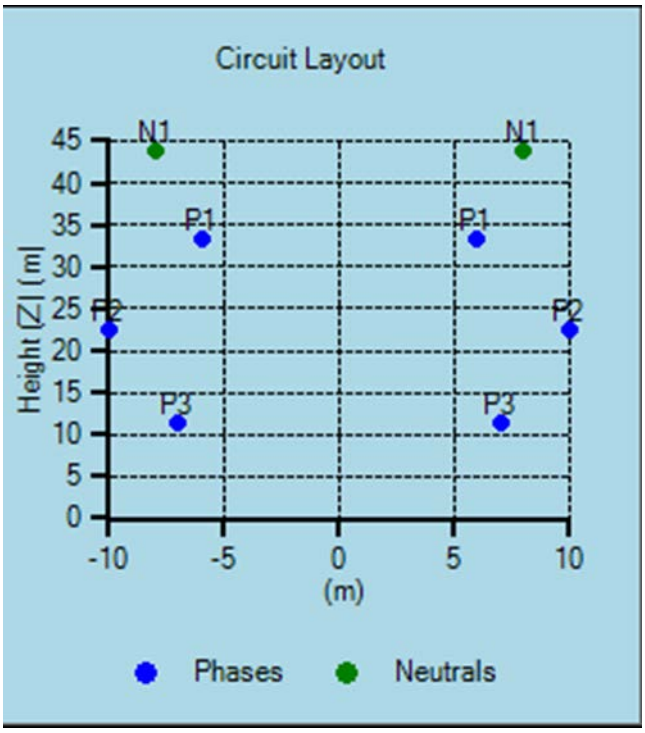


- **Phase separation = 10.6 m**
- **Shield wire separation = 15.2 m**
- **Ground Clearance midspan = 8 m (conservative worst-case)**

Figure 2-2: 330 kV single circuit tower geometry (CDEGS)

2.2.2 HumeLink 500 kV alpine double circuit vertical tower (VSL)

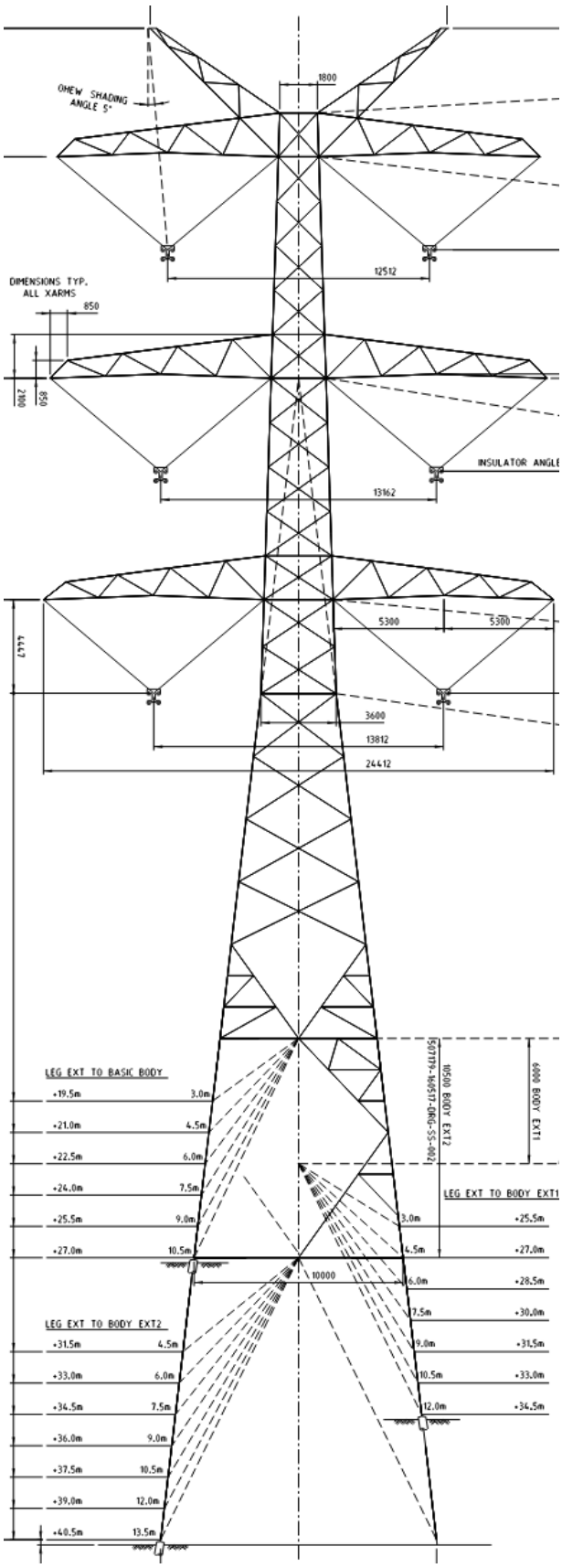


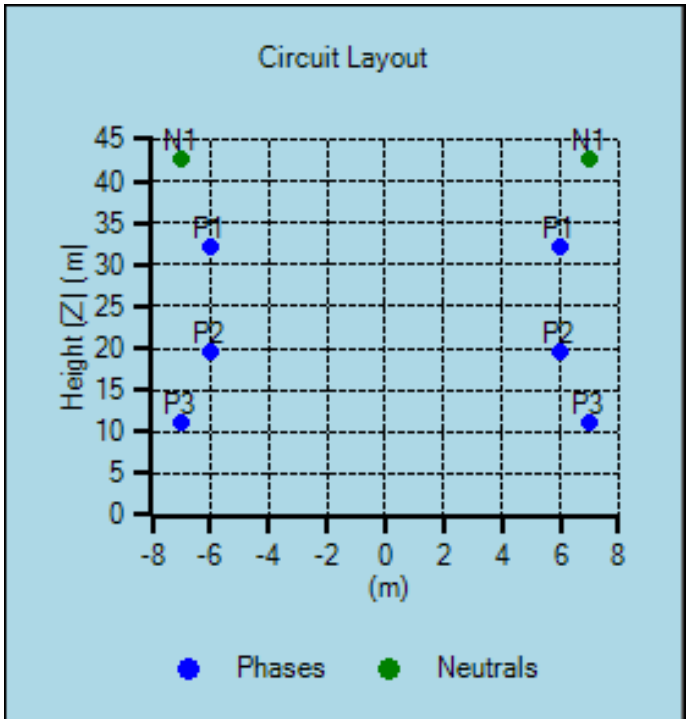


- Phase separation = 10.9 m
- Circuit separation:
  Top phase = 12.98 m,
  Middle phase = 19.57 m and
  Bottom phase = 14.17 m.
- Shield wire separation = 16.38 m
- Ground Clearance midspan = 11 m (conservative worst-case)

Figure 2-3: 500 kV Double Circuit Tower Outline type VSL (extract from TL-799084)

2.2.3 HumeLink 500 kV non-alpine double circuit vertical tower (VSE)



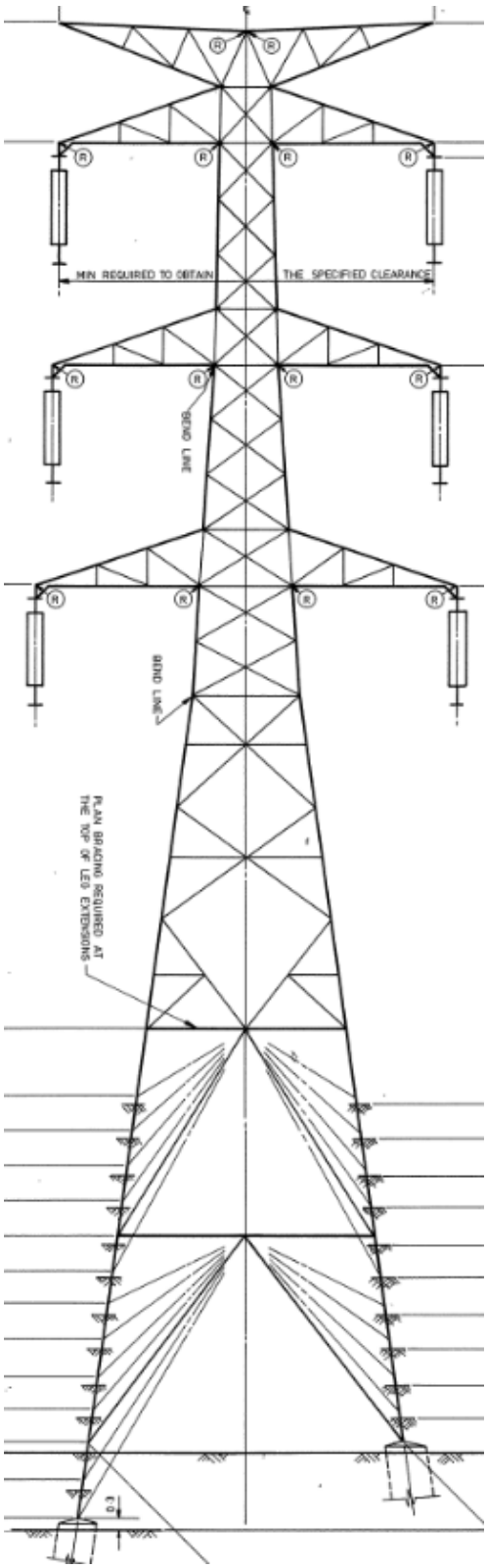


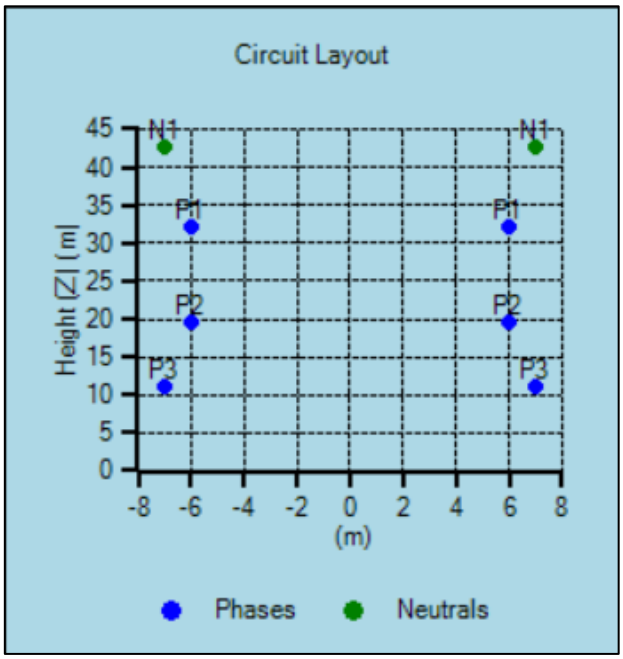
- Vertical phase separation = 10.6 m
- Circuit separation:
  Top phase = 12.51 m,
  Middle phase = 13.16 m and
  Bottom phase = 13.81 m.
- Shield wire separation = 14.2 m
- Ground Clearance midspan = 11 m
  (conservative worst-case)

Figure 2-4: 500 kV double circuit tower outline type VSE (extract from TL-799081)

2.2.4 HumeLink double circuit vertical tower (DSP)

New DSP double circuit towers will be used for a section of the route between proposed Gugaa substation and existing Wagga 330 kV substation.





- Vertical phase separation = 7.05 m
- Circuit separation:
  Top phase = 11.82 m,
  Middle phase = 12.05 m and
  Bottom phase = 12.95 m.
- Shield wire separation = 11.97 m
- Ground Clearance midspan = 8 m
  (conservative worst-case)

Figure 2-5: Double circuit tower type DSP (extract from TL-141353)

2.3 Weather

From our simulations it was concluded that higher altitudes and temperatures produce higher noise levels. CDEGS software was used for calculations involving fair weather and heavy rain, however it does not support custom rain rates. EPRI applets were used for L50 light rain. L50 is used to represent very light rain and mist. However, custom temperatures are not supported in EPRI.

The following assumptions were made for weather cases to produce worst-case results:

- **Fair Weather**: Use maximum ambient temperature and altitude from historical weather data[1] for the region.
- **L50 or Light Rain**: Use maximum altitude. Temperature is not supported in the EPRI applets. L50 rain is simulated at a rate of 0.75 mm/h.
- **Heavy Rain**: Use typical expected temperatures during rain and maximum altitude for the region. Heavy rain is simulated at a rate of 18 mm/h.

Light rain or mist conditions were considered. Based on evidence provided in the EPRI AC Transmission Line Reference Book, it is expected that heavy rain produces higher audible noise than light rain (refer to Figure 2-6 below). A similar conclusion is documented in papers by EirGrid[2] and Al-Faraj[3]. However, during heavy rain the ambient noise is very high due to the rain hitting various objects. It is therefore of more interest to look at light (L50) rain since this will cause more noise than fair weather, while the sound of the light rain is not expected to mask the sound of the transmission line so effectively.

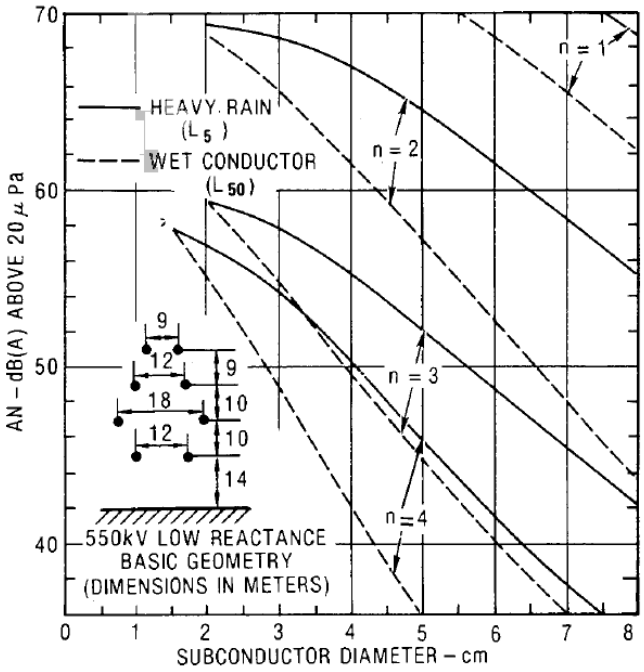


Figure 6.4.27. Audible noise, dB(A), at 15 m from the outer phase.

Figure 2-6: EPRI: Audible Noise

Due to dependence on altitude, the project is divided into three portions, and the highest altitude relevant to the portion used for the noise calculations, as shown in Table 2-1 below.

[1] www.timeanddate.com/weather/australia/wagga-wagga/climate and Climate History (meteorology.com.au)

[2] EirGrid (2016) Evidence Based Environmental Studies Study 8: Noise, Literature review and evidence based field study on the noise effects of high voltage transmission development.

[3] Al-Faraj, M.A., Shwehdi, M.H, Farag, A.S (1997) Environmental Effect on High Voltage AC Transmission Lines Audible Noise IECEC-97 Proceedings, Thirty-Second Intersociety Energy Conversion Engineering Conference

Table 2-1: Weather cases for noise

Weather Case	Altitude	Temperature
Route 1: Maragle to Wondalga DC Alpine		
Fair Weather	1,250 m	39 °C
Light Rain	1,250 m	Not supported in EPRI applets
Heavy Rain	1,250 m	26 °C
Route 2: Wondalga to Gugaa DC Non-Alpine		
Fair Weather	720 m	38 °C
Light Rain	720 m	Not supported in EPRI applets
Heavy Rain	720 m	25 °C
Route 3: Wondalga to Bannaby DC Non-Alpine		
Fair Weather	935 m	39 °C
Light Rain	935 m	Not supported in EPRI applets
Heavy Rain	935 m	26 °C
Route 4: Gugaa to Wagga Wagga DC Non-Alpine		
Fair Weather	340 m	38 °C
Light Rain	340 m	Not supported in EPRI applets
Heavy Rain	340 m	25 °C

2.4 Observation zone

- Height above ground = 1.8 m (typical ear height of a person standing)
- Width = Easement width 70 m DC + 170 m on both sides.

2.5 Limits

2.5.1 Audible noise

With the absence of standards or guidelines on noise limits applicable to lines, the following guidelines are derived from Figure 2-7. The recommended project noise level for industrial developments is 5 dBA below the recommended amenity noise level. The NSW EPA Noise Policy for Industry (2017) specifically applies to generators and substations, specifically does not apply to wind turbines and is silent regarding transmission lines.

Table 2.2: Amenity noise levels.

Receiver	Noise amenity area	Time of day	L_{Aeq}, dB(A)
(see Table 2.3 to determine which residential receiver category applies)			**Recommended amenity noise level**
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table)
Hospital ward internal external	 All All	 Noisiest 1-hour Noisiest 1-hour	 35 50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50

Figure 2-7: NSW EPA Noise Limits for Industry (2017), table 2.2

The EPA recommended maximum audible noise level is 35 dB(A), which is not practical for EHV overhead lines especially during wet conditions. In accordance with the EPA document, practical measures should be taken to minimize noise where it is predicted to be above 35 dB(A). Reasonable attempts should be made to minimize the noise by centring the line away from dwellings.

Ambient noise during rain can vary substantially due to different factors such as rainfall rate, wind and surface types. It is therefore difficult to predict a maximum value. In addition, the noise from a transmission line is of a different character to noise from mining operations or industrial premises.

The impact of transmission line audible noise was first reported by Perry in 1972. These general guidelines are still widely referenced. From the guidelines in Figure 2-8 below it can be seen that noise levels below 52.5 dB(A) at the edge of the easement will cause no to low complaints.

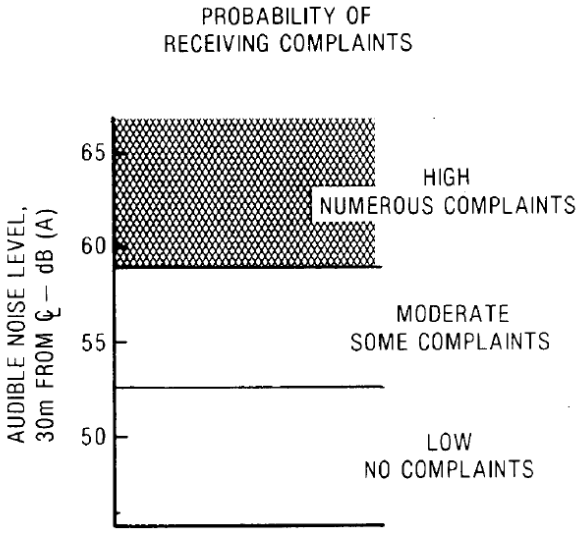


Figure 6.3.4. Audible-noise complaint guidelines *(17)*.

Figure 2-8: EPRI- Perry's Audible Noise Complaint Guidelines

The value of 52.5 dB(A) is therefore recommended as the target maximum value during light rain for the HumeLink project. While it is not a compliance level, it is recommended in order to avoid nuisance to neighbours.

- Maximum recommended Audible Noise (L50 rain) = 52.5 dB(A)

2.5.2 Radio Interference

AS 2344 Tables 1 and 2 give the following limits for Radio Interference, as follows. In the terminology of AS 2344, the project is located in "Zone C", and the "boundary of the line corridor" is interpreted as the edge of the easement, as detailed above in Section 2.4, Observation zone.

TABLE 1

LIMITS OF RADIATED RADIO DISTURBANCE
0.15 MHz TO 30 MHz

Frequency (MHz)(5)	Field strength(2) (dBμA/m) at the boundary of the line corridor(1) or 30 m from an installation		
	Region 3 (Australia)		
	Zone A	Zone B	Zone C
0.15–0.3	–4.5	5.5	–1.5
0.3–3(3)	–18.5	–8.5	–15.5
3 to 30(4)	–18.5 to –31.5	–8.5 to –21.5	–15.5 to –28.5

NOTES:

1 The corridor width is determined by the relevant regulatory authority or from Table 3 where no regulation is applicable.

2 The limits of Tables 1 and 2 apply at the distances defined in Clause 7(c).

3 The limits given for Region 3 apply to rural areas and to urban areas not serviced by local m.f. broadcasts. For urban areas serviced by local broadcast stations, the limits may be increased by 14 dB over the frequency range of 0.5 MHz to 1.7 MHz.

4 The limit decreases linearly with the logarithm of the frequency from 3 MHz to 30 MHz.

5 At the transition frequency the lower limit applies.

Figure 2-9: AS 2344 Table 1 Limits of Radiated Radio Disturbance 0.15 MHz to 30 MHz

TABLE 2

LIMITS OF RADIATED RADIO DISTURBANCE
30 MHz TO 3000 MHz

Frequency (MHz)	Field Strength (dBμV/m) at the boundary of the line corridor or 30 m from an installation
30–230	30
230–1 000	37
1 000–3 000*	60

* This frequency shall apply only if it is established that there is a radio disturbance emission with a fundamental frequency exceeding 200 MHz.

Figure 2-10: AS 2344 Table 2 Limits of Radiated Radio Disturbance 30 Mhz to 3000 Mhz

2.5.3 Calculation of the radio interference limit according to AS 2344

Classification of the HumeLink lines using AS 2344 Table 1 (Figure 2-11 below) identifies them in Region 3 and Zone C.

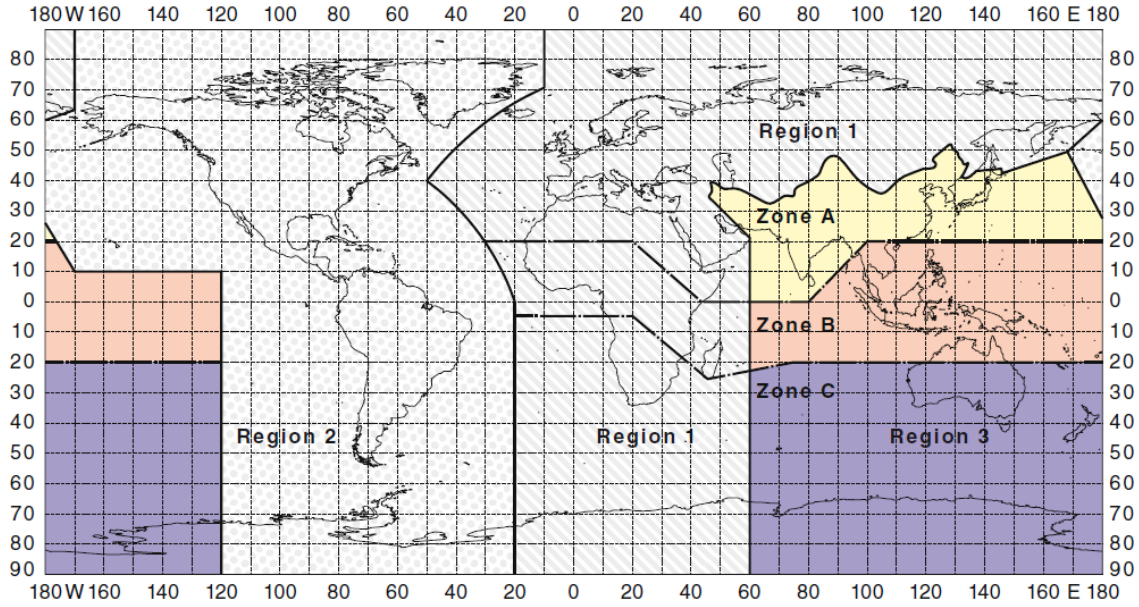


FIGURE 1 MAP SHOWING THE REGIONS AND ZONES

Figure 2-11: AS 2344 Figure 1, Map Showing the Regions and Zones

- 0.3 to 3 MHz Limit according to AS 2344 Table 1 is -15.5 dBµA/m
- AS 2344 page 9 specifies the following formula to convert dBµA/m to dBµV/m:
- Limit in dBµV/m = Limit in dBµA/m + 51.5

  = -15.5 + 51.5*

  = 36 dBµV/m

  *Where 51.5 represents the characteristic impedance of free space (377 ohms) in decibels.

Accordingly, the adopted limit, maximum radio interference at 0.5 MHz (Fair Weather), is 36 dBµV/m.

This limit is still conservative in comparison to other international standards.

3 Audible noise

3.1 Method selection

In the project Preliminary Conductor Selection and Structure Report (refer to Table 1-1), the GE empirical method was used to calculate the estimated dB at a distance from the line. The GE method produced good average results.

In the following IEEE study various methods were compared by comparing the difference in calculated value and actual measured value. The data was obtained from the IEEE, *A comparison of Methods for Calculating Audible Noise of HV transmission lines* document. Table 3-1 below represent the difference in dB:

Table 3-1: Difference between calculated and measured values in dB (IEEE, extract)

Method	AEP	BPA	GE	GE	ENEL	Ontario Hydro	CRIEPI	EdF	FGH	IREQ	Best
Weather	Avg	L50	L50	L5	HR	HR	HR	HR	Max	Max	
Line 1 Horizontal 525kV	-1.6	-0.2	-1.1	1.7	-3.6	-0.8	NA	-3.6	-6.4	-10.5	BPA
Line 2 Horizontal 525kV	-1.8	-0.2	0.6	3	-1.5	0.6	NA	-1	-1.4	-4.3	BPA
Line 3 Horizontal 525kV	1.6	0.3	1.3	1.7	4	3.1	NA	4.4	4.3	2.2	BPA
Line 4 Delta SC 525kV	NA	-2.4	-1	0.8	2	NA	-0.8	1.1	2.3	0.8	GE
Line 6 Horizontal 735kV	-0.6	0.2	1.1								BPA
Line 7 Horizontal 735kV	-0.2	0.3	3.8								BPA
Line 8 Horizontal 765kV	-1.1	-0.9	-0.4	2	-0.1	-1.4	-0.9	-0.4	0	-2.5	FGH
Line 9 Horizontal 765kV	-1	-0.2	-1.3	1.5	-0.5	-3	-1.3	-0.7	-0.4	-0.4	BPA
Line 10 Horizontal 775kV	0.6	0.1	-1.1	-2.5	0.6	0.9	-2.3	0.9	1.8	-2.8	BPA
Line 11 Horizontal 1050kV	NA	4.1	4.2	3	2.5	NA	-3.1	1.1	0.9	0.6	IREQ
Line 12 Horizontal 1050kV	-5.7	-0.5	0.4	0.6	0.2	-8.8	-5.4	0.7	1	1	ENEL
Line 13 Delta SC 1150kV	NA	-0.5	0.6	1.9	2.3	Na	NA	2	2.4	2.3	BPA

From the above comparison the BPA method is the most accurate across a wide variety of line configurations and voltages.

The EPRI method was not part of the above study and therefore further research was done to find a comparison between the BPA and EPRI methods. In the “IEEE, Audible Noise Calculation for Different Overhead Transmission Lines” document, laboratory results were compared with the BPA and EPRI methods.

The following figures represent laboratory results (TUG) and calculated results from BPA and EPRI on the conductor bundles.

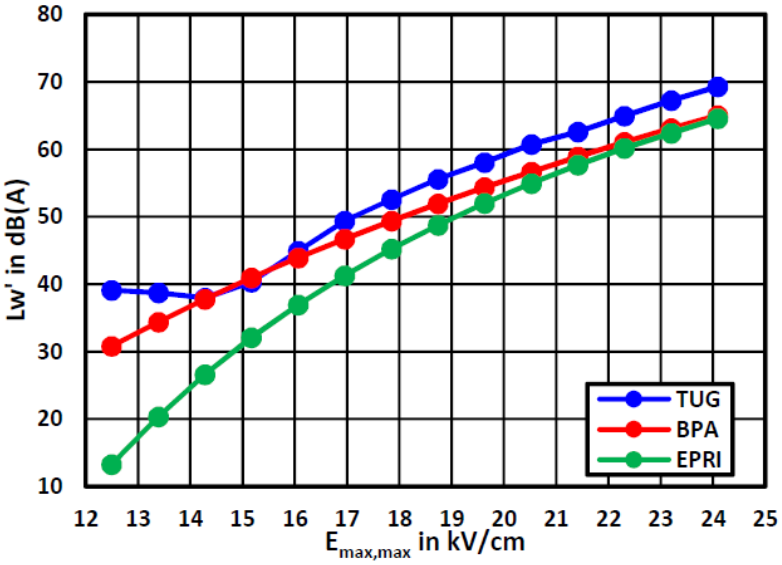


Figure 3-1: Comparison between the sound power levels from laboratory experiments and prediction equations. (AC, precipitation rate: 2 mm/h)

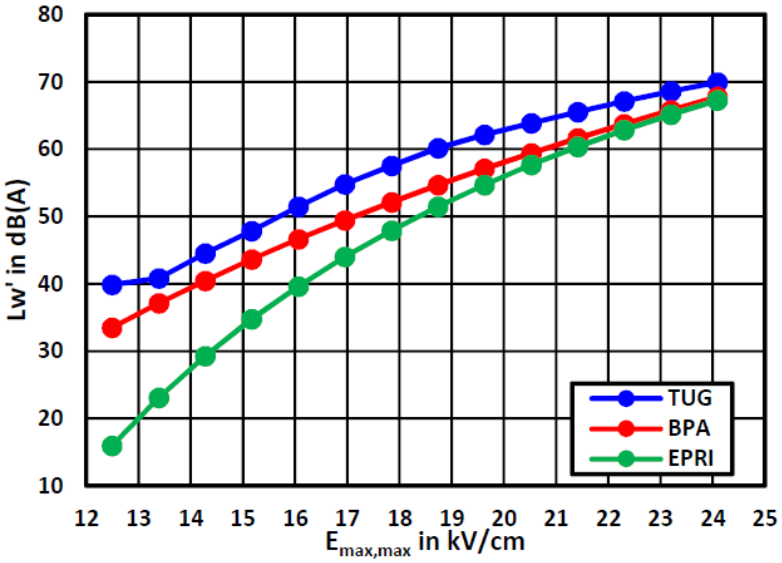


Figure 3-2: Comparison between the sound power levels from laboratory experiments and prediction equations. (AC, precipitation rate: 8 mm/h)

It can be seen from the above that the sound power levels obtained from the laboratory results (TUG) are slightly higher than the BPA and EPRI predictions. It should be noted that the BPA and EPRI equations were designed for moderately aged conductors (two to three years in operation). Aged conductors are expected to be more quiet than new conductors. The difference between the methods reduce as the surface gradient voltage increases.

Further comparisons between the methods were done on a typical Danube AC 400 kV tower setup.

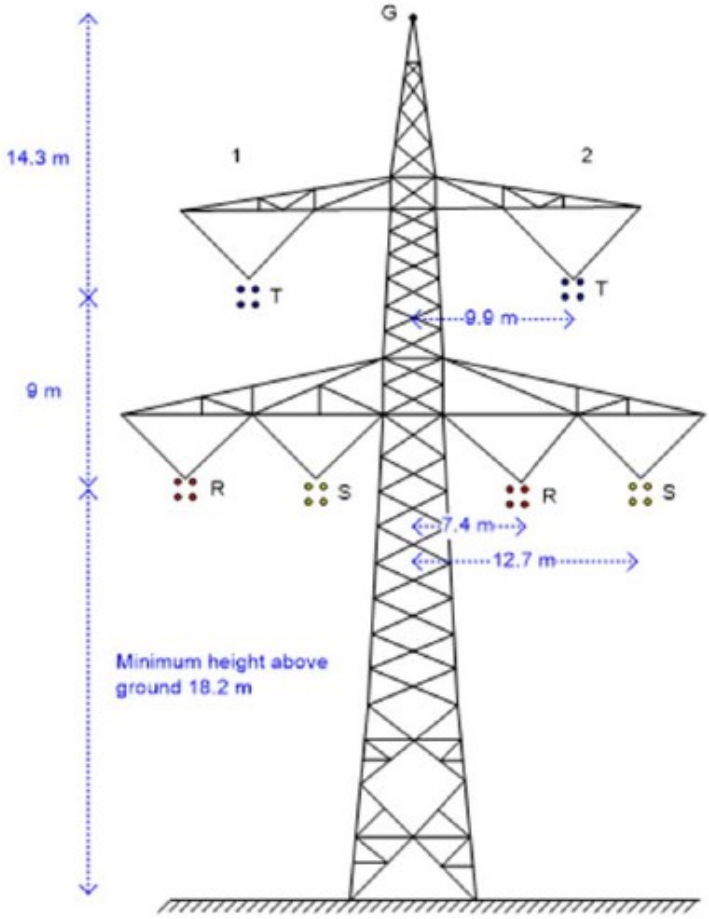


Figure 3-3: Typical Danube AC 400 kV Tower Setup

Line	*E* kV/cm	L_w' in dB(A) ref 1 pW/m		
		TUG	BPA	EPRI
		5 mm/h		
R1	20.15	62.44	57.41	55.43
T1	17.09	54.04	48.85	43.64
S1	21.27	65.01	60.24	58.92
R2	21.14	64.74	59.93	58.54
T2	16.99	53.72	48.54	43.17
S2	20.20	62.56	57.55	55.60
SLA in dB(A) ref 20 µPa		44.8*	39.91	39.70

*Calculated with BPA propagation model

Figure 3-4: Audible noise prediction of Danube 400 kV AC tower setup

From the above it can be seen that the total A-weighted sound level (SLA) at a reference point from the line differ by about 5dB between the TUG results and the predicted results from BPA and EPRI.

Both the BPA and EPRI methods seem similar with acceptable outcome. The EPRI method was used on other Transgrid projects and therefore it would be beneficial for comparison reasons to use the EPRI method in this project.

3.2 Hum or tonal noise

From CIGRE B2-305 it can be observed that 100 Hz tonal noise can be higher than wideband noise during rain. Tonal calculations were not carried out as part of the assessment in CIGRE B2-305 because it was difficult to predict, further research will be required in the future to calculate tonal noise.

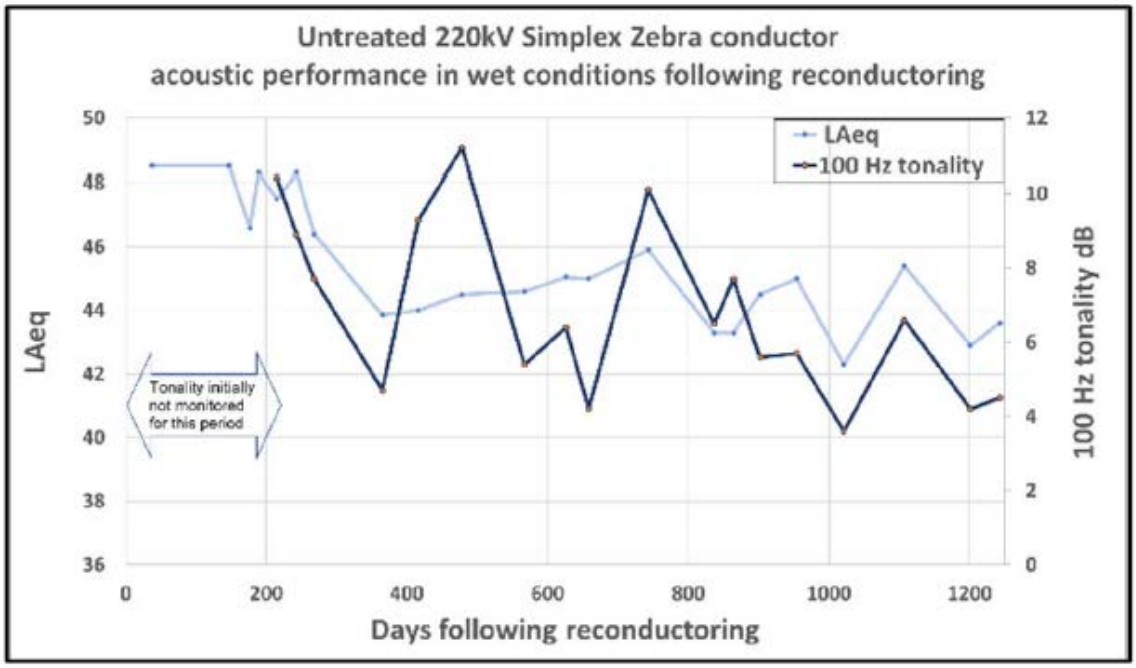


Figure 3-5: Cigre B2-205: Wideband and tonal audibility after reconductoring.

Dulling of new conductor surfaces using glass bead blasting reduce wideband noise but result in high long-term tonality.

3.3 Modelling

CDEGS, SESEnviroPlus module version 16.2 was used to simulate the noise.

The following inputs were used:

- Air Resistivity: 1 x 10^{18} Ω.m
- Soil Resistivity: 100 Ω.m
- Conductor Bundle: 4 x Orange or 3 x PawPaw
- Phase Energization: 540 kV for 500 kV operation and 345 kV for 330 kV operation at 3,464 A
- Observation Profile Height: 1.8 m
- Acoustical Noise Method: Semi-Empirical EPRI (USA)
- Altitude: As per Table 2-1: Weather cases for noise
- Temperature: As per Table 2-1: Weather cases for noise
- Weather: Fair Weather, Heavy Rain (18 mm/h) and L50 Rain (Modelled in EPRI Applets)

The CDEGS, SESEnviroPlus module version 16.2 does not support hum or tonal noise modelling, therefore EPRI Applets were used to model hum during rain for comparison.

- Altitude: 100 m as per EPRI applet
- Weather: L50 Rain (0.75 mm/h).

3.4 Results

3.4.1 Audible Noise (Alpine)

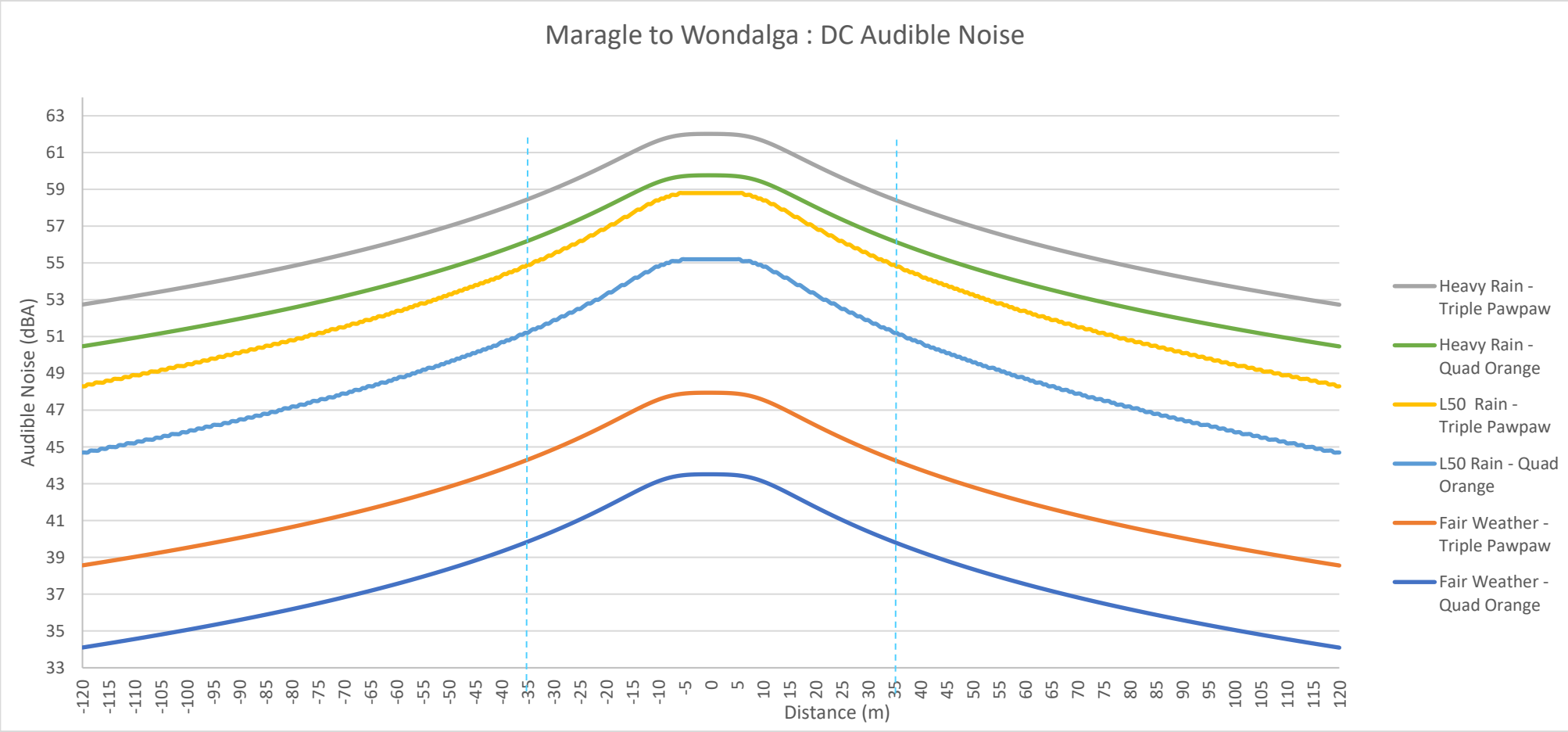


Figure 3-6: Audible Noise: Maragle to Wondalga DC

3.4.2 Audible Noise (Non-Alpine)

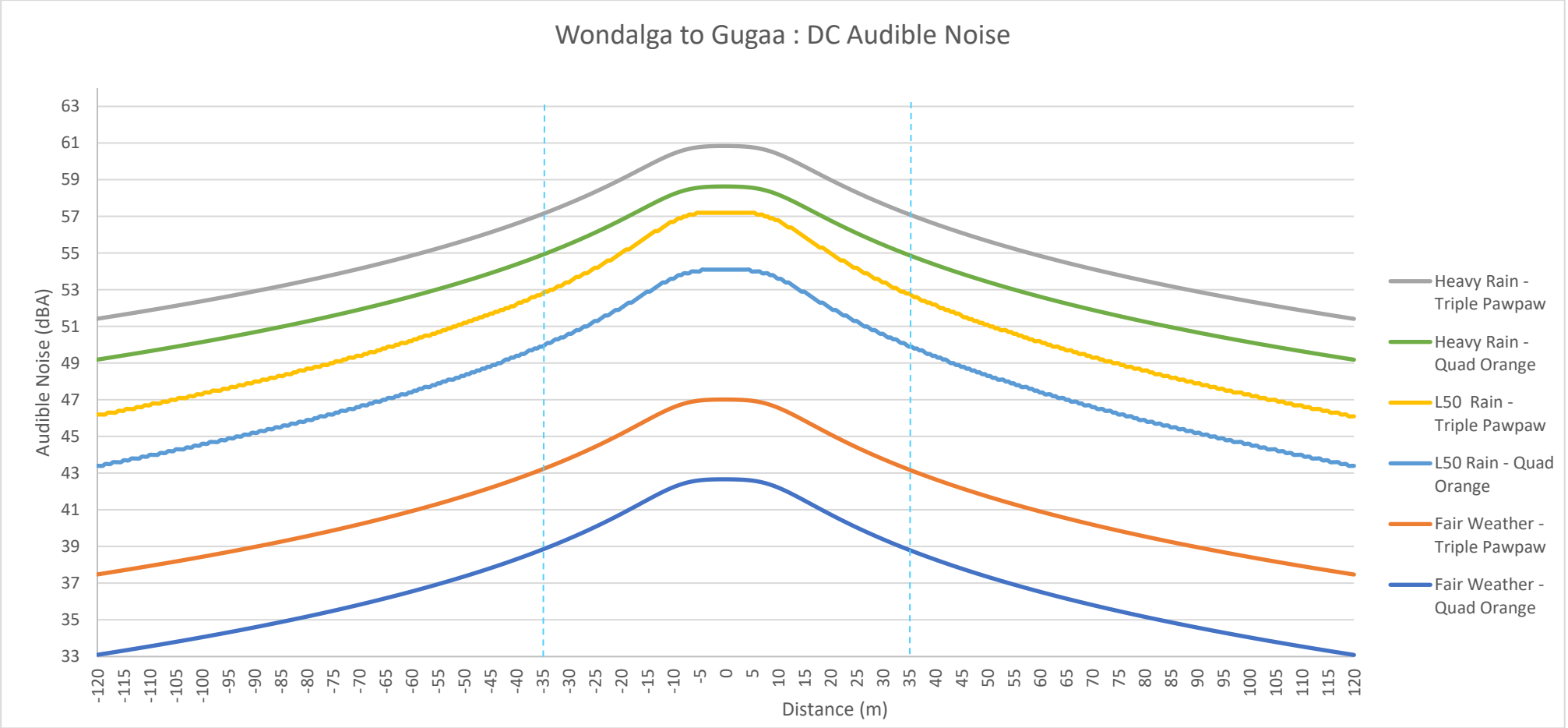


Figure 3-7: Audible Noise: Wondalga to Gugaa DC

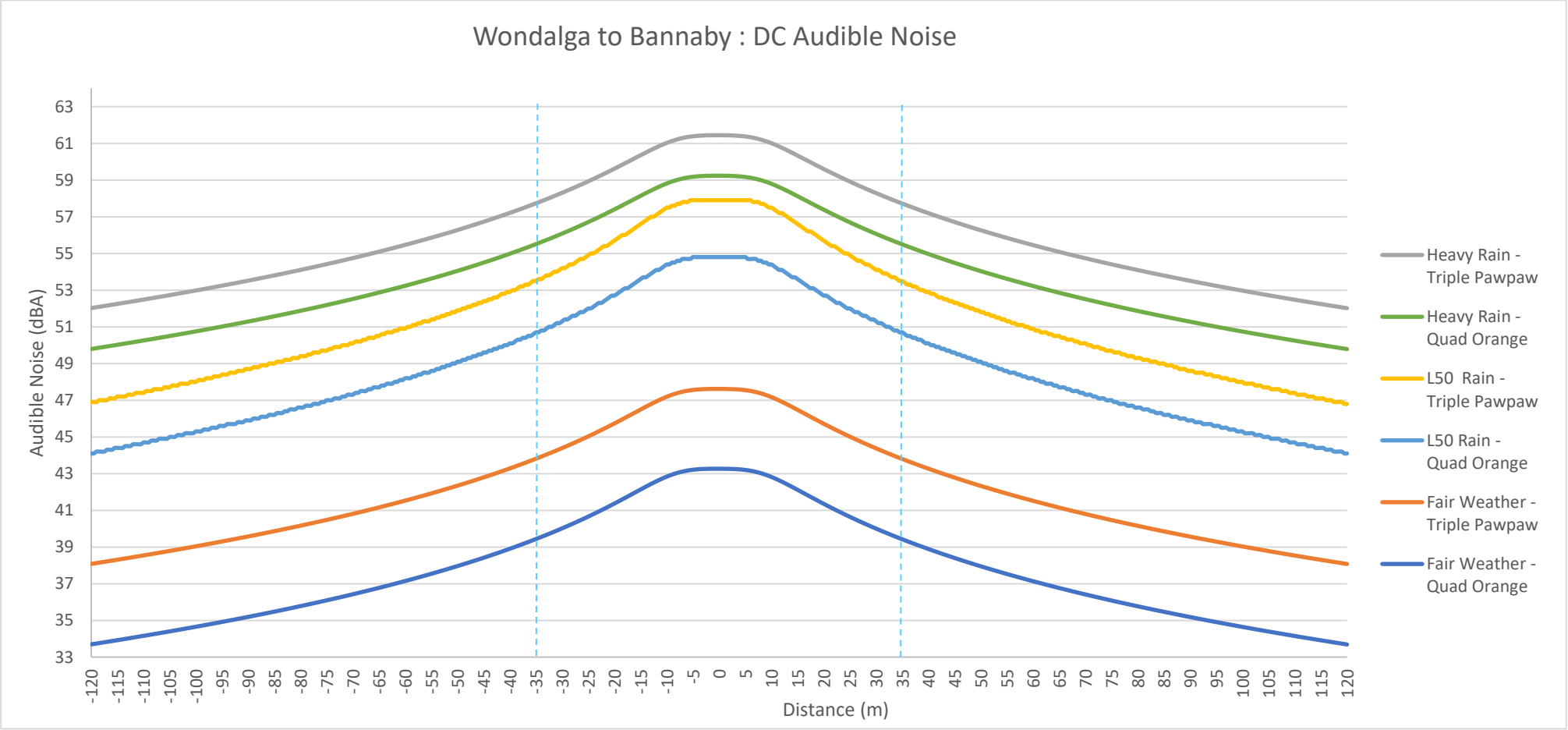


Figure 3-8: Audible Noise: Wondalga to Bannaby DC

3.4.3 Audible Noise (Gugaa to Wagga)

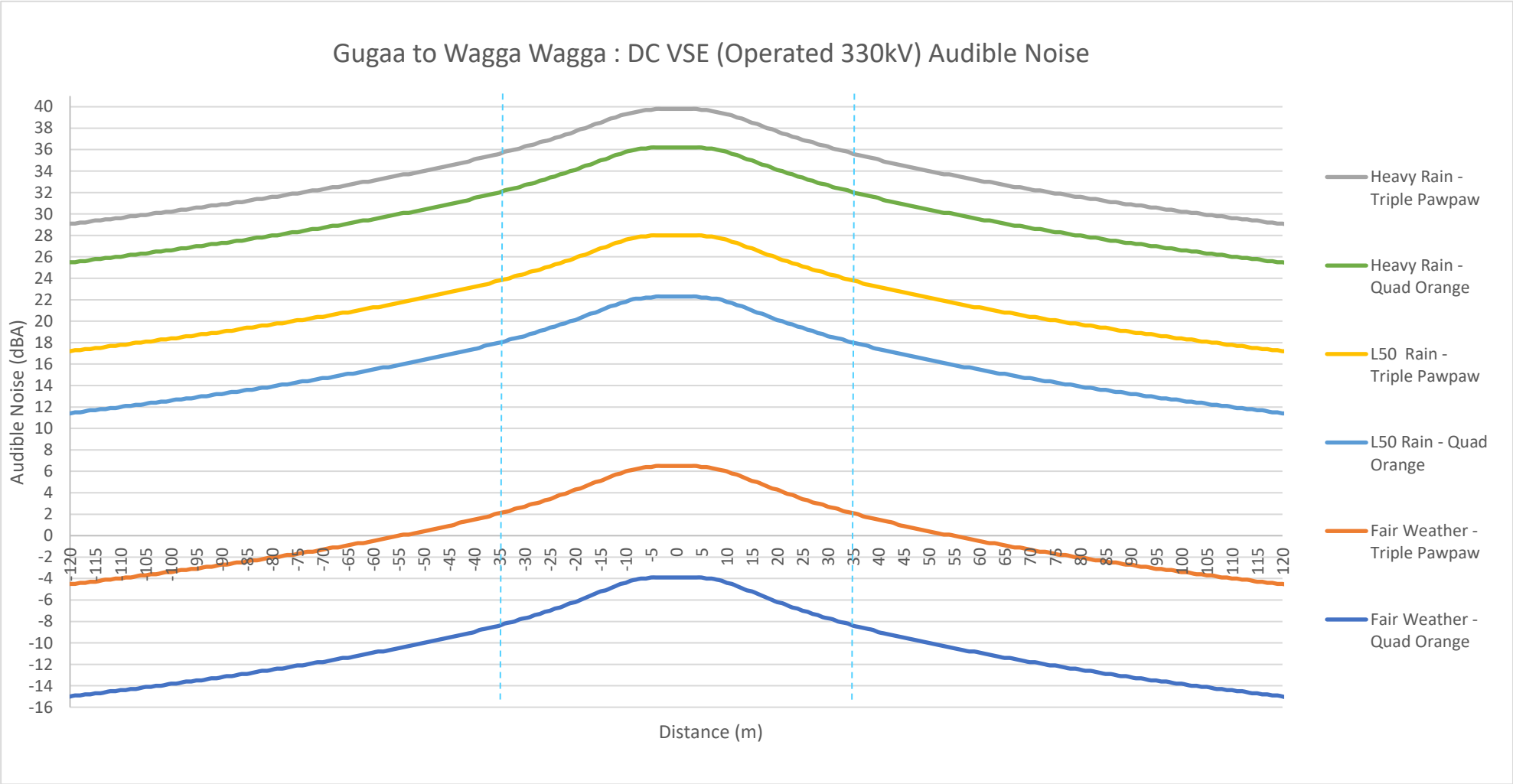


Figure 3-9: Audible Noise: Gugaa to Wagga Wagga DC VSE (Operated at 330 kV)

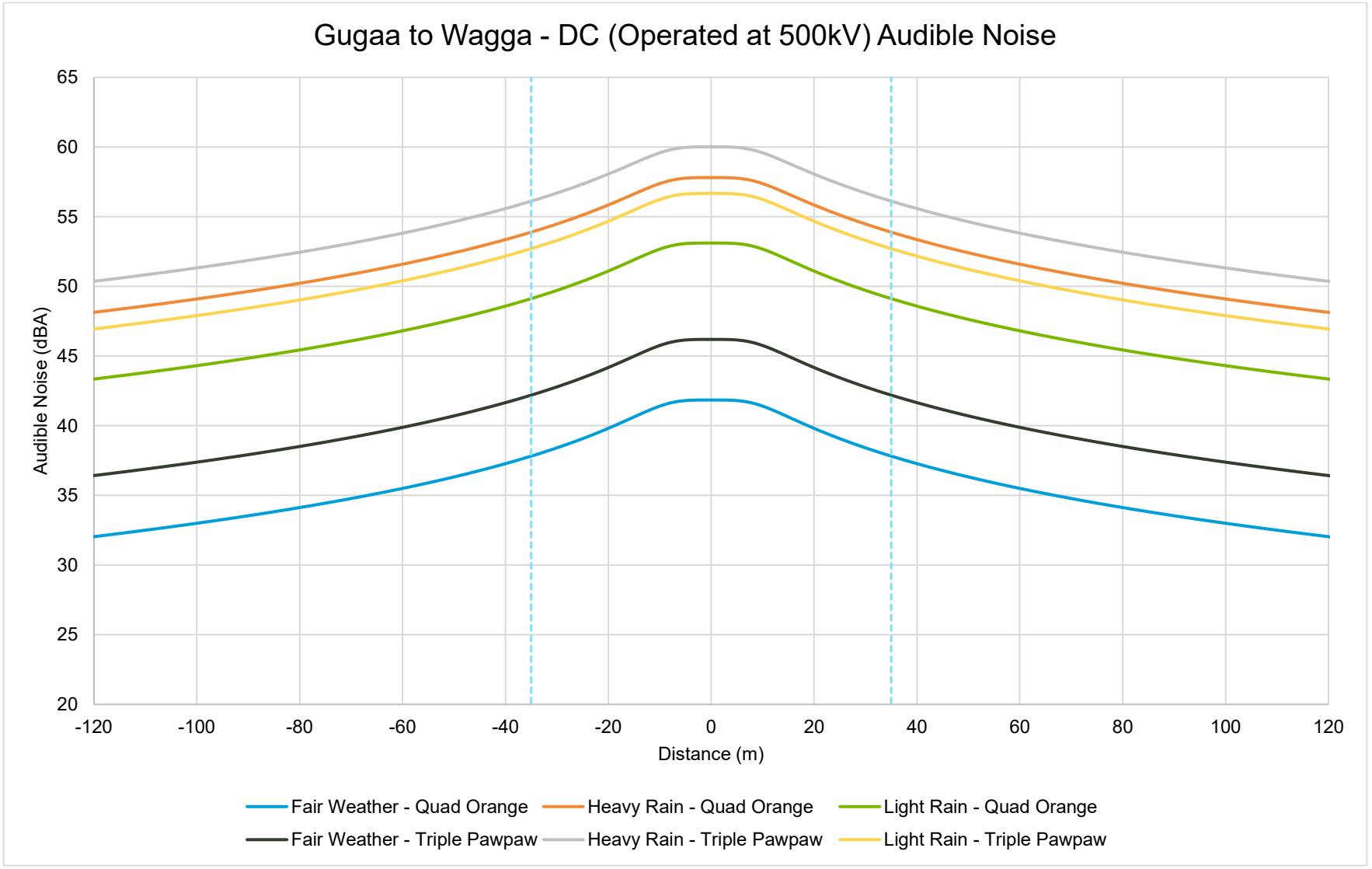


Figure 3-10: Audible Noise : Gugaa to Wagga Wagga DC VSE (Operated at 500kV)

3.4.4 Hum or Tonal Noise

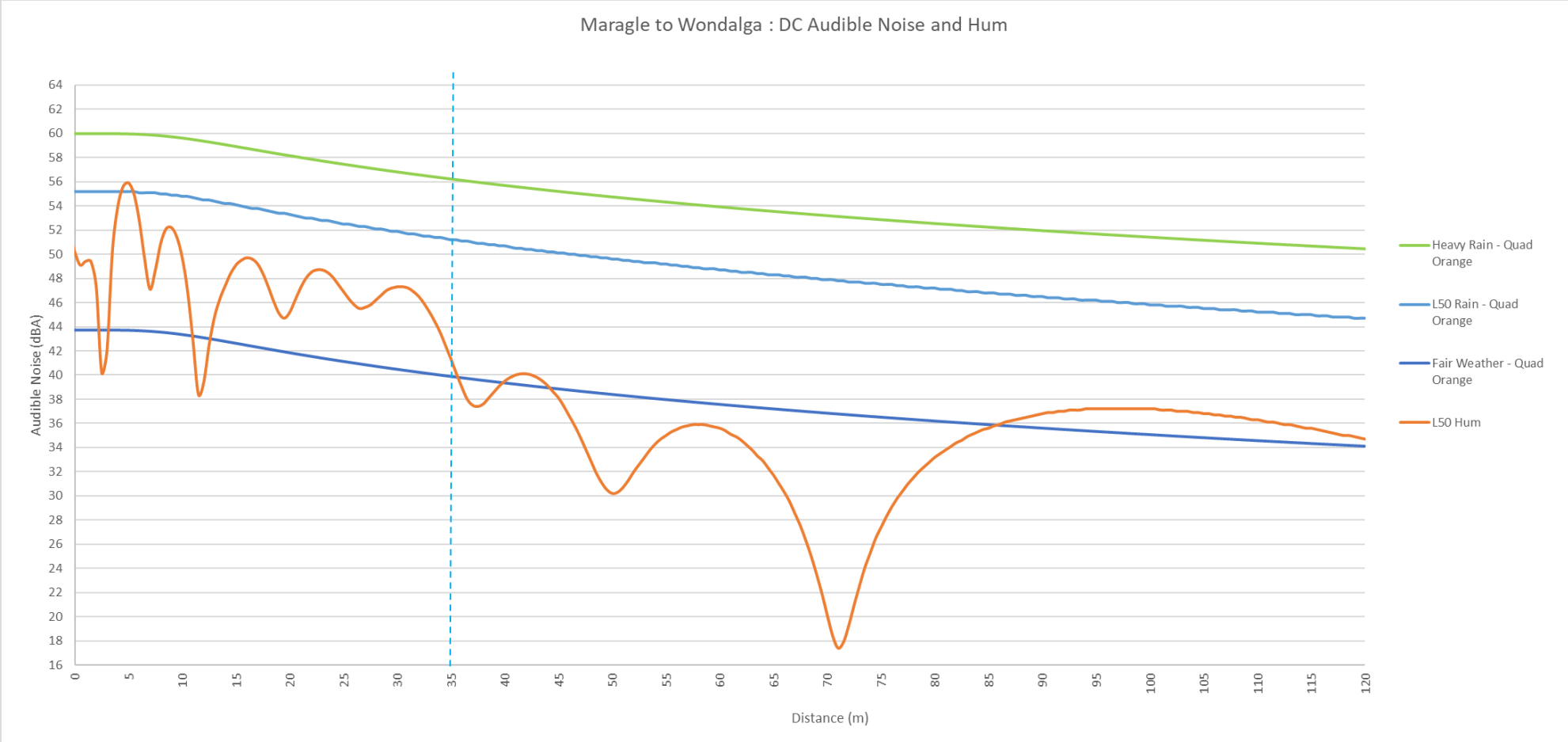


Figure 3-11: Hum: Maragle to Wondalga DC

3.4.5 Audible noise summary

Table 3-2 below is a summary of the expected noise at the edge of the easement with the EPRI method.

Table 3-2: Summary of Audible Noise at the edge of the easement

Audible Noise at edge of easement	Fair Weather	L50 Rain	Heavy Rain	Distance from the centre line to achieve 35 dB(A) (Fair Weather)	Distance from the centre line to achieve 35 dB(A) (L50 Rain)	Distance from the centre line to achieve 35 dB(A) (L5 Rain)	Distance from the centre line to achieve 52.5 dB(A) (L50 Rain)	Distance from the centre line to achieve 52.5 dB(A) (Heavy Rain)
QUAD ORANGE								
Route 1: Maragle to Wondalga DC 4 x Orange	39.8 dBA	51.2 dBA	56.2 dBA	91.5 m	366 m	526 m	25 m	81 m
Route 2: Wondalga to Gugaa DC 4 x Orange	38.8 dBA	49.9 dBA	54.9 dBA	82.5 m	326 m	469 m	17 m	62 m
Route 3: Wondalga to Bannaby DC 4 x Orange	39.4 dBA	50.7 dBA	55.5 dBA	93 m	348 m	496 m	21.5 m	70.5 m
Route 4: Gugaa to Wagga Wagga DC 4 x Orange (330 kV)	-8.4 dBA	18.0 dBA	32.0 dBA	0 m	0 m	15 m	0 m	0 m
Route 4: Gugaa to Wagga Wagga DC 4 x Orange (500 kV)	37.8 dBA	49.1 dBA	53.9 dBA	70 m	395 m	708m	12 m	49 m
TRIPLE PAWPAW								
Route 1: Maragle to Wondalga DC 3 x Pawpaw	44.3 dBA	54.9 dBA	58.5 dBA	223 m	486 m	651 m	58.5 m	125.5 m
Route 2: Wondalga to Gugaa DC 3 x Pawpaw	43.2 dBA	52.8 dBA	57.1 dBA	186 m	410 m	570 m	37.5 m	97.5 m
Route 3: Wondalga to Bannaby DC 3 x Pawpaw	43.8 dBA	53.5 dBA	57.7 dBA	206 m	434 m	601 m	44 m	109.5 m
Route 4: Gugaa to Wagga Wagga DC 3 x Pawpaw (330 kV)	2.1 dBA	23.8 dBA	35.6 dBA	0 m	0 m	40 m	0 m	0 m

During 330 kV operation, noise is negligible. When the 500 kV built and 330 kV operated line is uprated to 500 kV in future, its performance is similar to the other 500 kV lines as shown in Table 3-2 above.

3.4.6 Hum or tonal noise summary

Only the Maragle to Wondalga DC was modelled for hum. From the results in Figure 3-14: Hum: Maragle to Wondalga DC above the following can be concluded regarding hum:

- During L50 rain is the hum always lower than the wideband audible noise
- During Heavy rain is the hum slightly higher than the wideband audible noise at the centre of the line, but from the outside phase further away from the line centre, the hum is below the wideband audible noise.

- In this case hum does not seem to be the limiting criteria for audible noise. However, it should be kept in mind that the hum is less treatable by acoustical barriers (hedges, walls etc).

3.5 Accumulative noise

If the noise level at a reference point differs by more than 10 dB between sources, the effect of the lower source is neglectable due to the log scale used for noise measurements. The following formula can be applied to calculate the accumulative noise of more than one source with similar frequencies.

$$dB_{total} = 10 \times log\left(\sum_{i=1}^{n} 10^{\left(\frac{dB_i}{10}\right)}\right)$$

The following lines run parallel to the new HumeLink lines. 132 kV lines are not expected to produce any significant noise and were therefore not considered.

3.5.1 Accumulative Noise (Alpine)

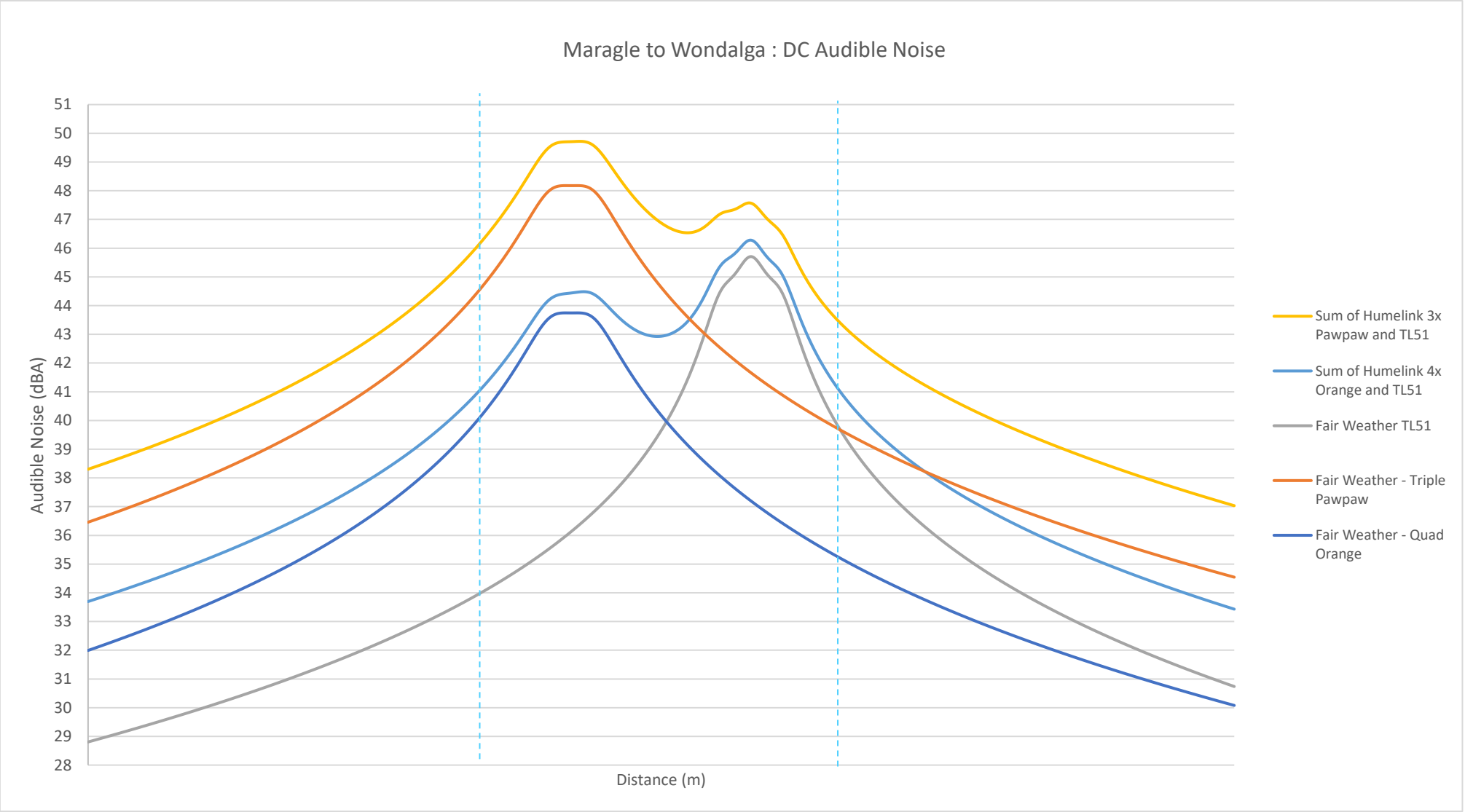


Figure 3-12: Accumulative Noise: Maragle to Wondalga DC – TL51

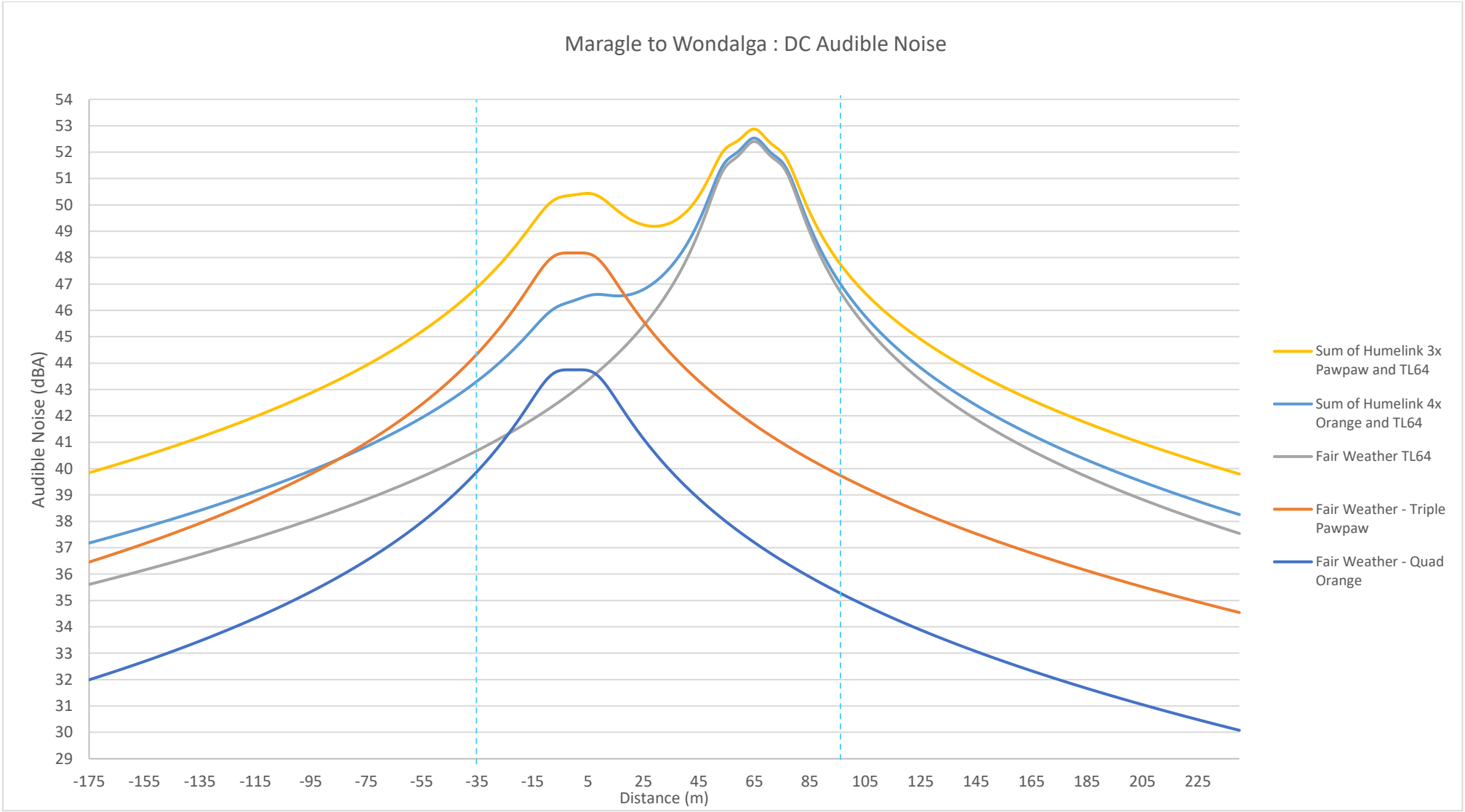


Figure 3-13: Accumulative Noise: Maragle to Wondalga DC – TL64

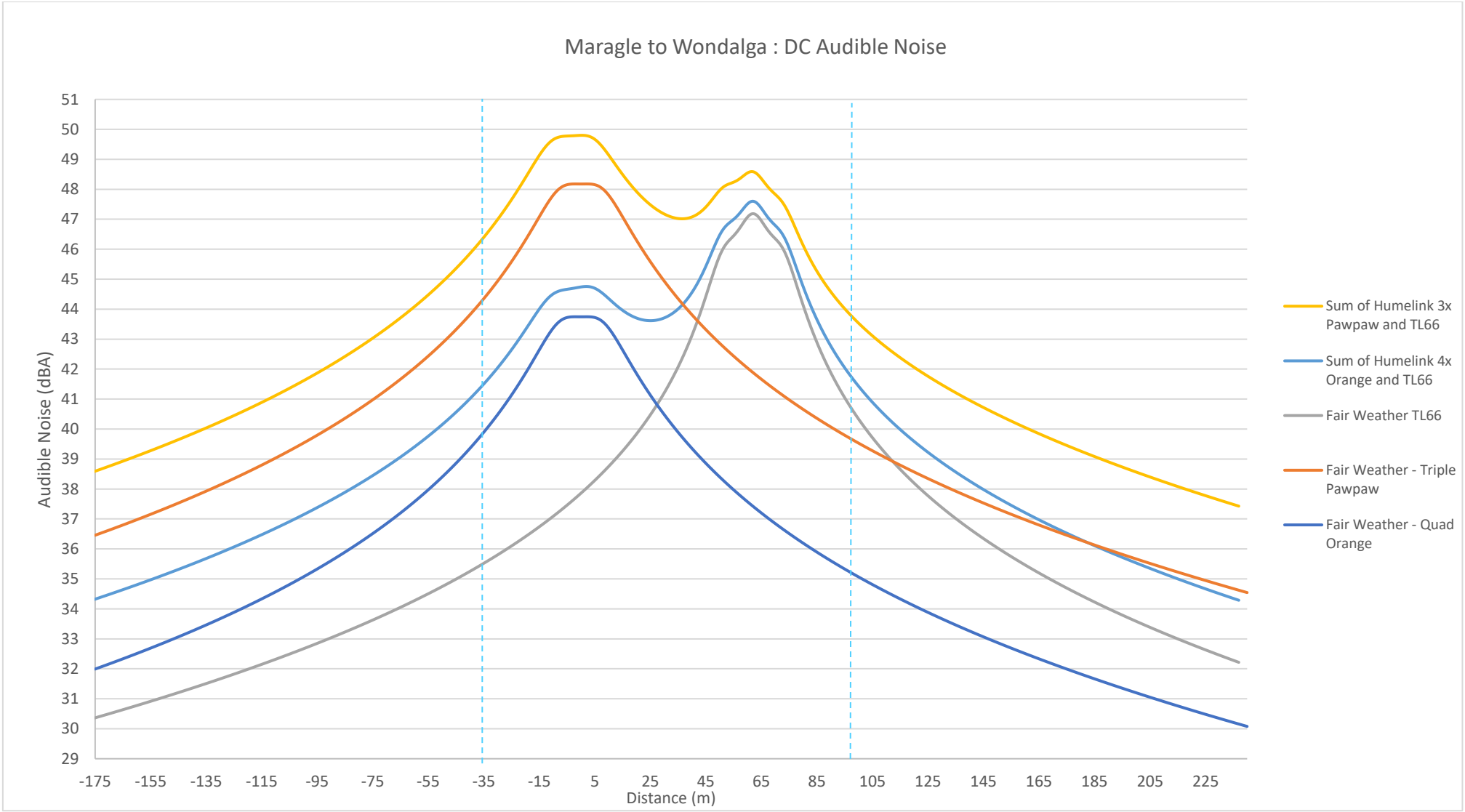


Figure 3-14: Accumulative Noise: Maragle to Wondalga DC – TL66

3.5.2 Accumulative Noise (Non-Alpine)

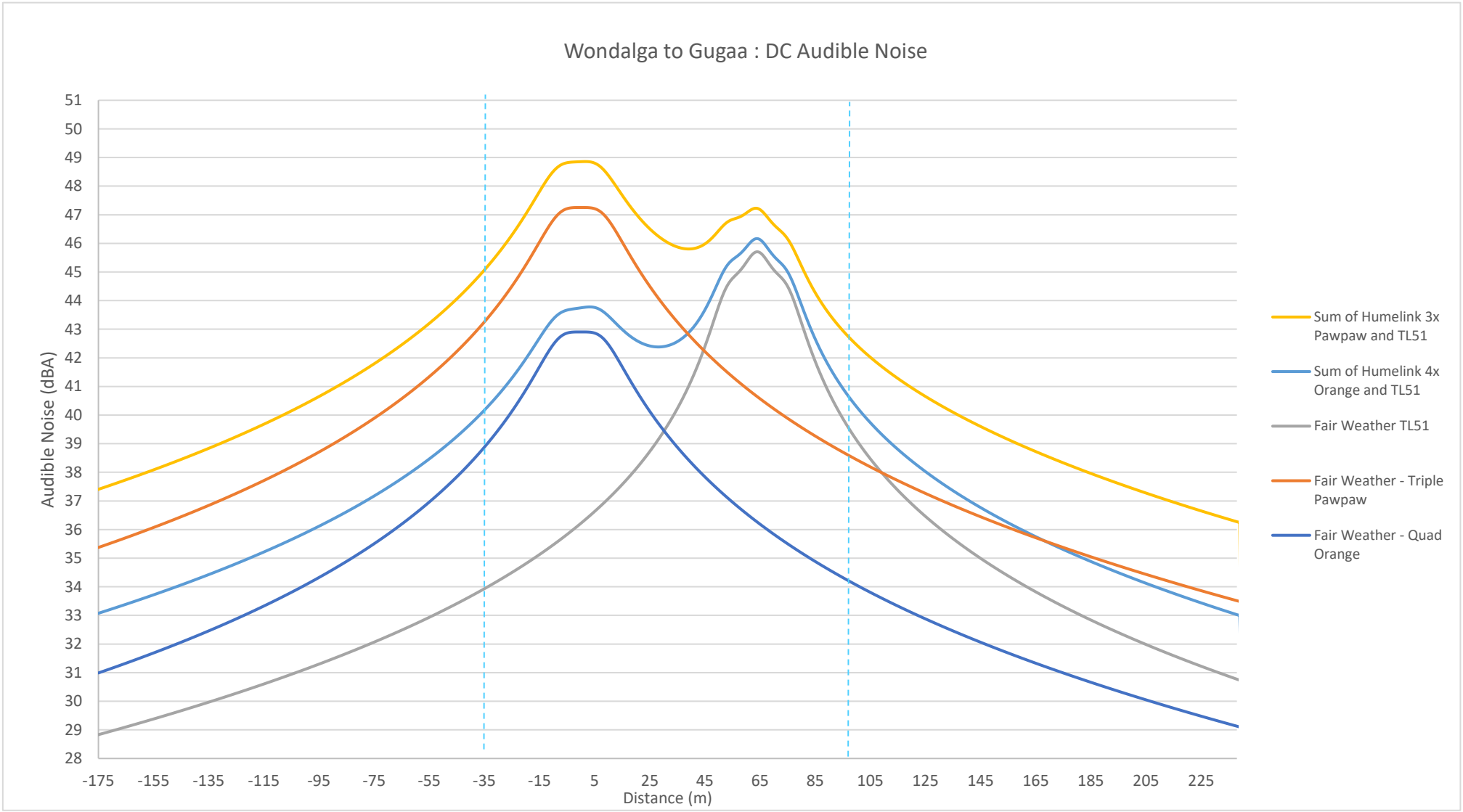


Figure 3-15: Accumulative Noise: Wondalga to Gugaa DC – TL51

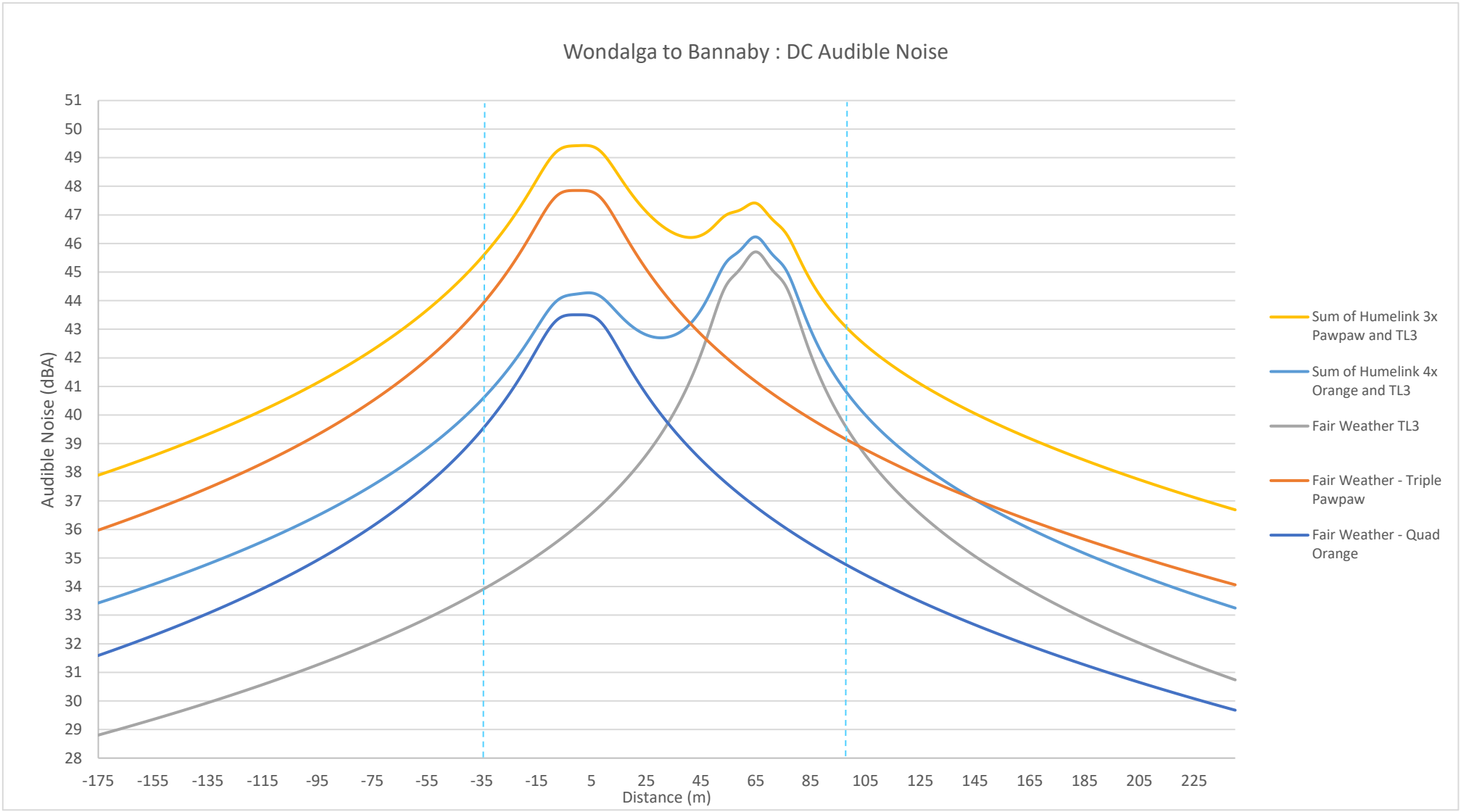


Figure 3-16: Accumulative Noise: Wondalga to Bannaby DC – TL3

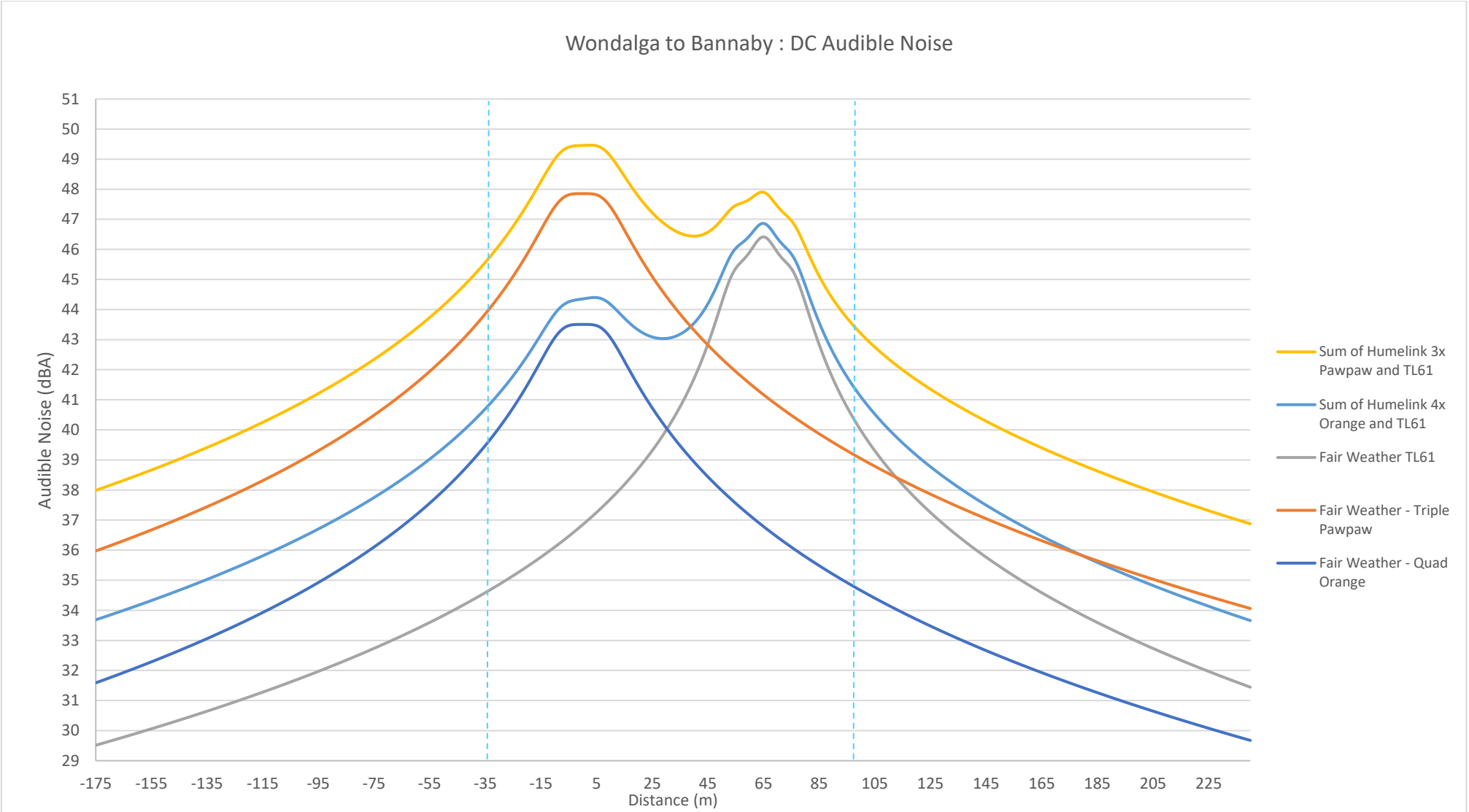


Figure 3-17: Accumulative Noise: Wondalga to Bannaby DC – TL61

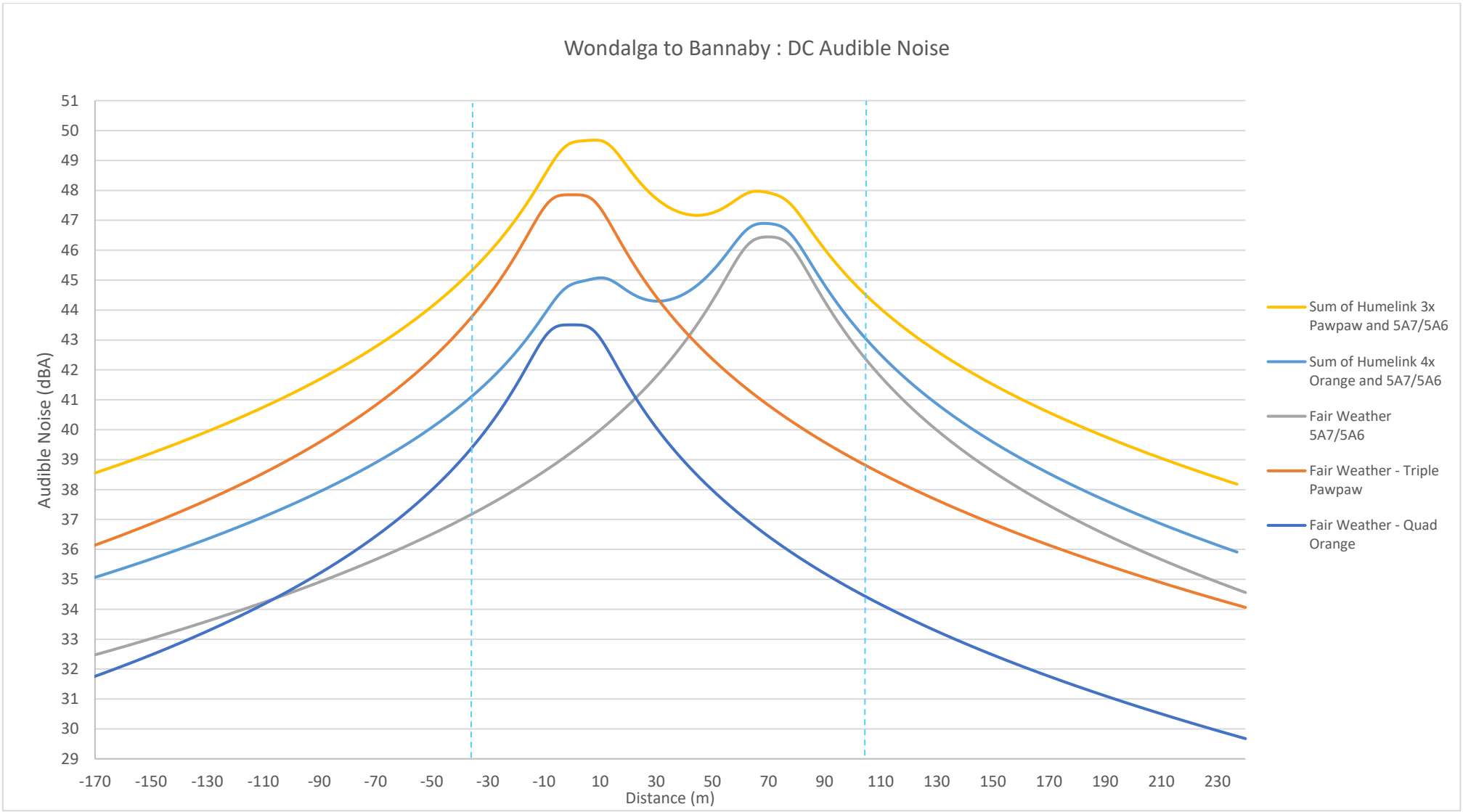


Figure 3-18: Accumulative Noise: Wondalga to Bannaby DC – 5A7/5A6

3.5.3 Accumulative Noise (Gugaa to Wagga)

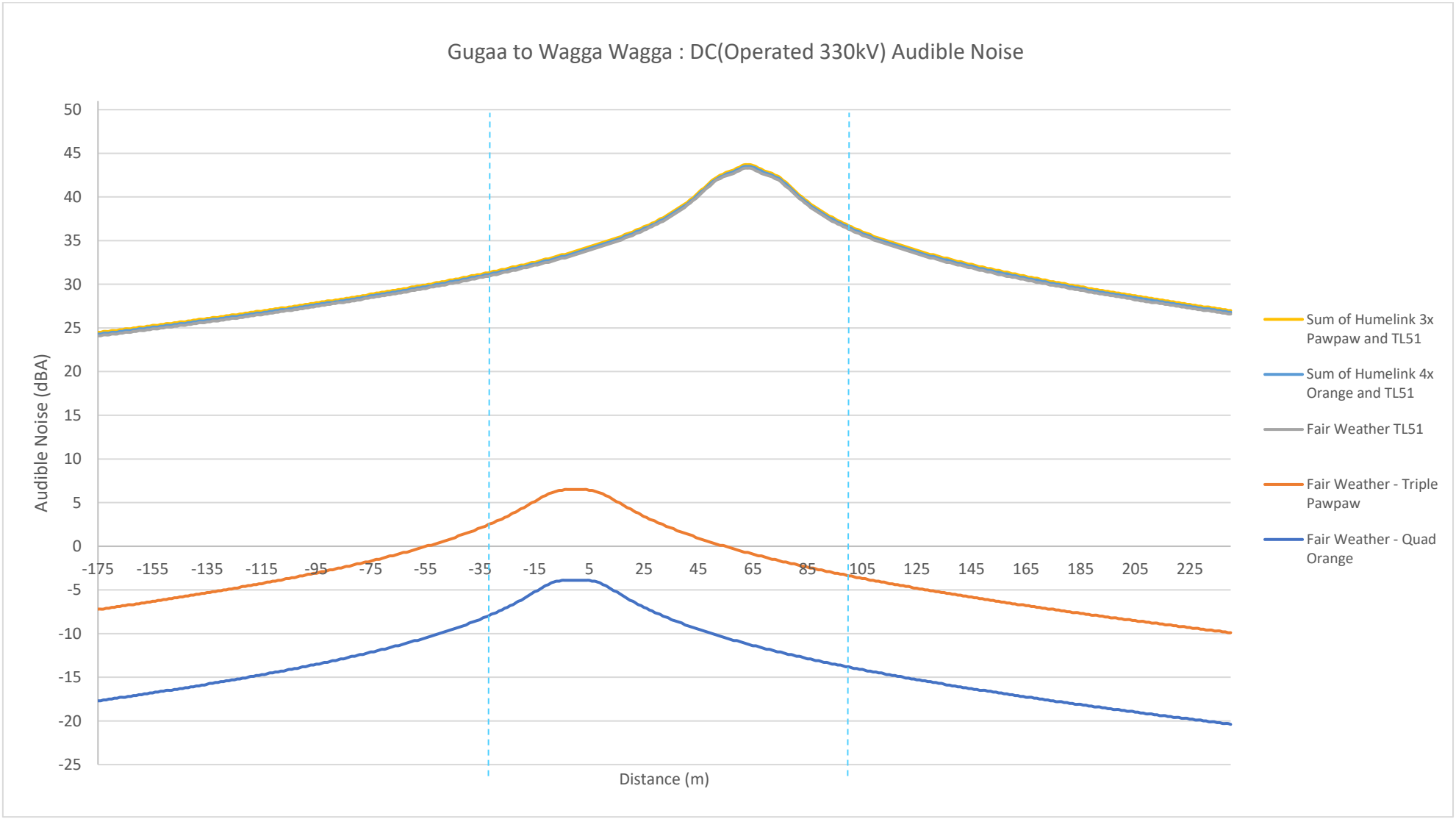


Figure 3-19: Accumulative Noise: Gugaa to Wagga Wagga DC (Operated at 330kV) – TL51 SC

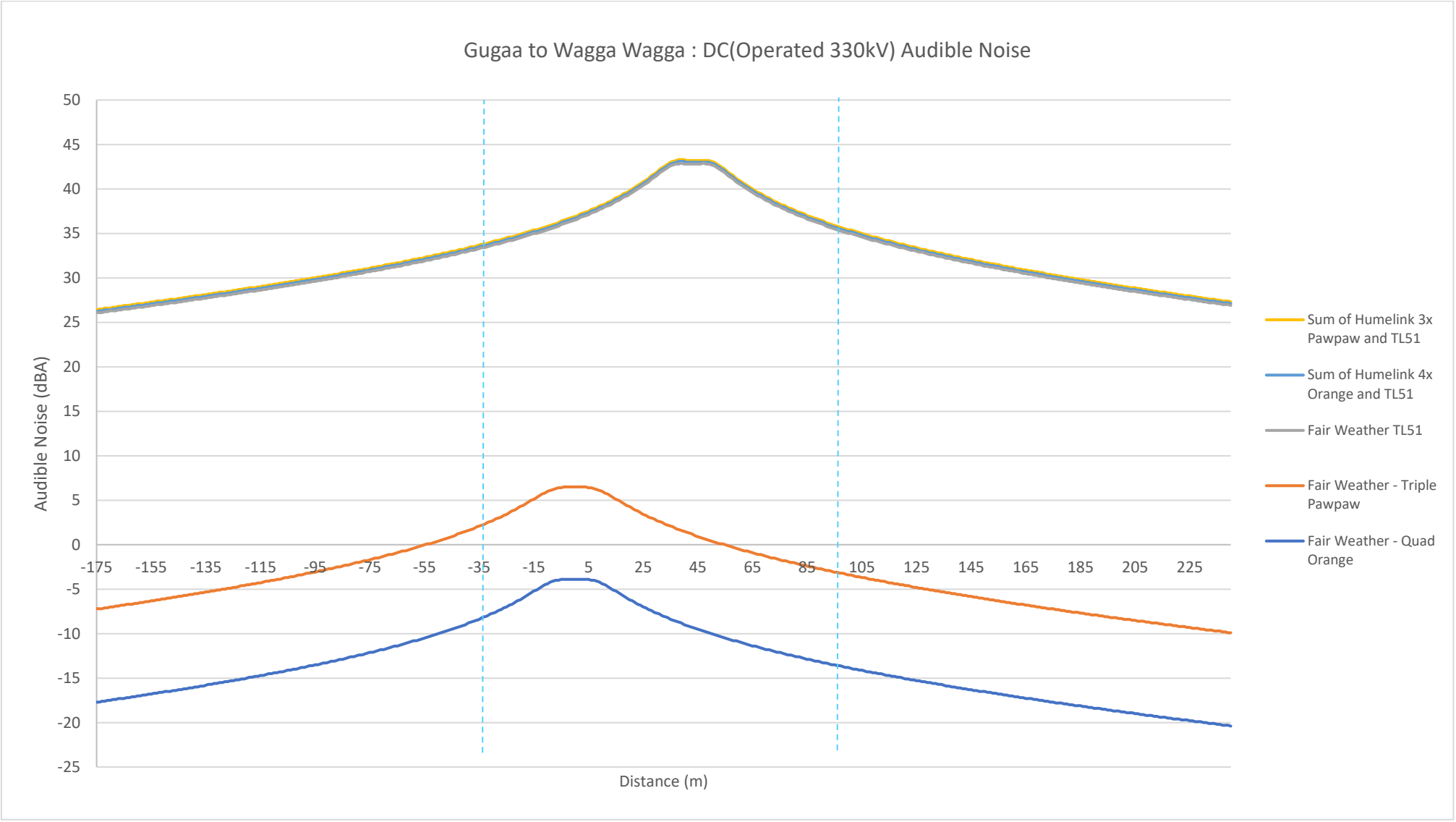


Figure 3-20: Accumulative Noise: Gugaa to Wagga Wagga DC (Operated at 330kV) – TL51 DC

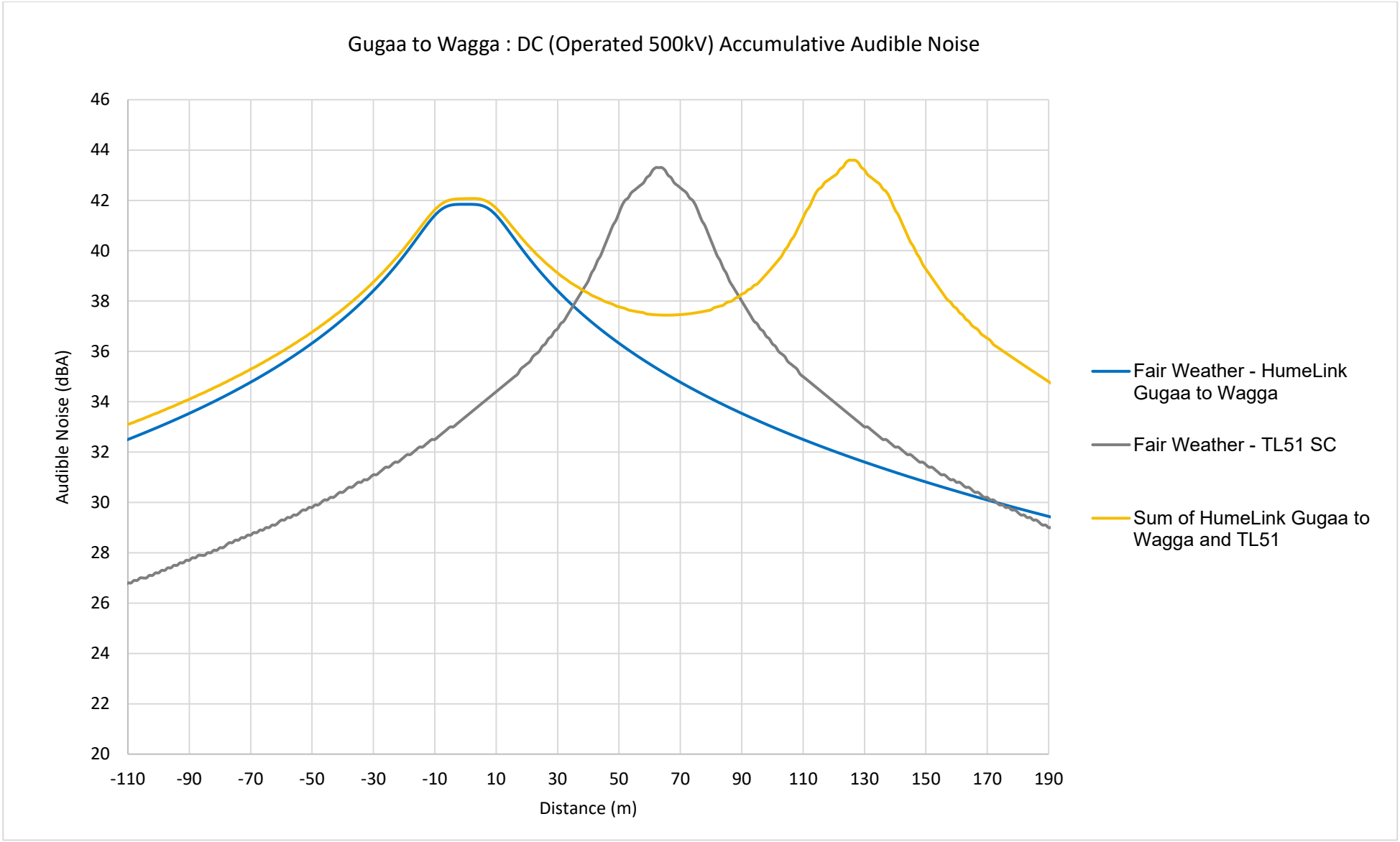


Figure 3-21: Accumulative Noise: Gugaa to Wagga Wagga DC (Operated at 500kV) – TL51 SC

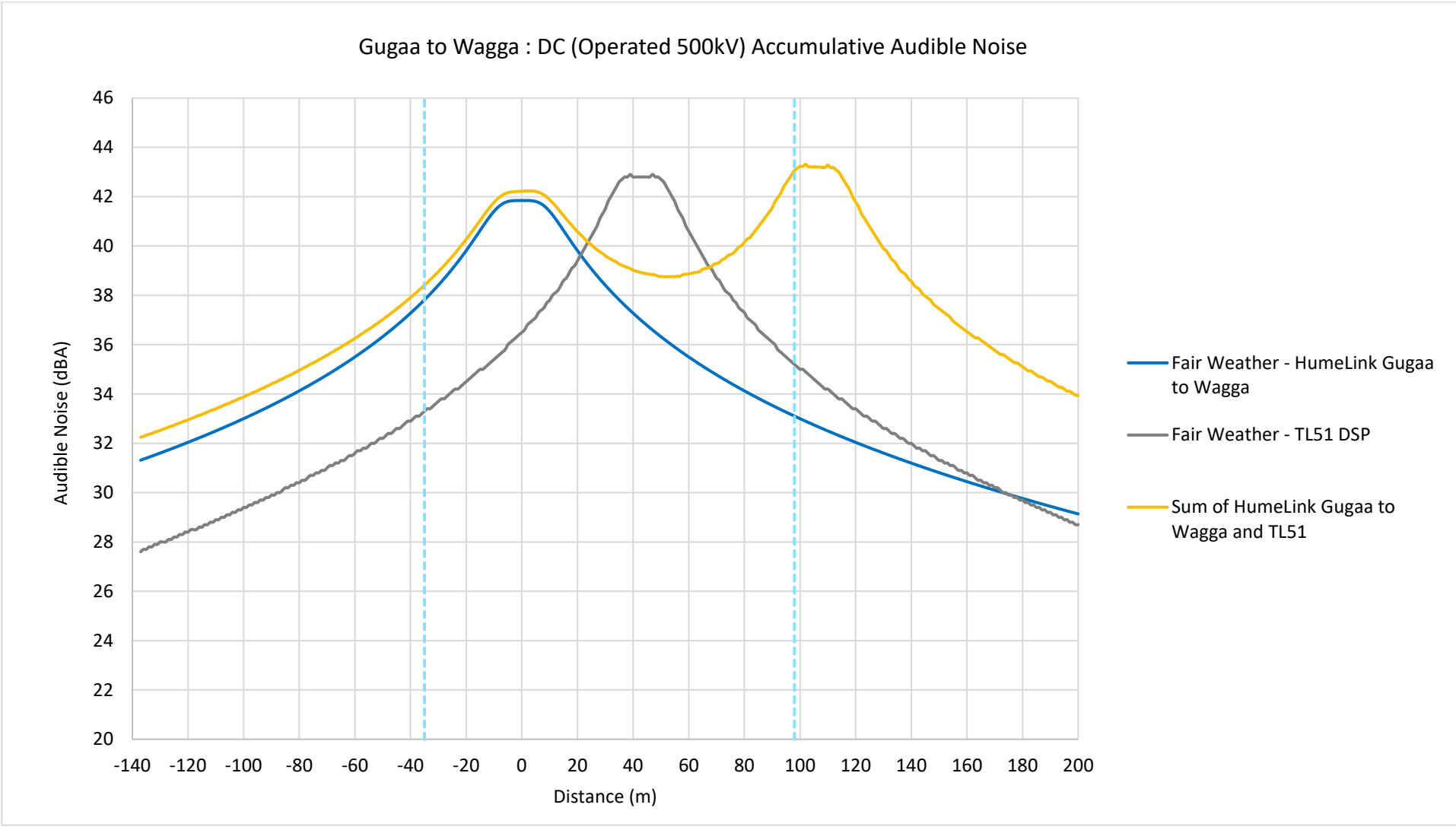


Figure 3-22: Accumulative Noise: Gugaa to Wagga Wagga DC (Operated at 500kV) – TL51 DC

3.5.4 Accumulative Audible noise summary

Table 3-3 below is a summary of the expected accumulative noise at the edge of the easement with the EPRI method.

Table 3-3: Summary of Accumulative Audible Noise at the edge of the easement

Audible Noise at edge of easement	Fair Weather	L50 Rain	Heavy Rain	Distance from the centre line to achieve 35 dB(A) (Fair Weather)	Distance from the centre line to achieve 35 dB(A) (L50 Rain)	Distance from the centre line to achieve 35 dB(A) (L5 Rain)	Distance from the centre line to achieve 52.5 dB(A) (L50 Rain)	Distance from the centre line to achieve 52.5 dB(A) (Heavy Rain)
QUAD ORANGE								
Route 1: Maragle to Wondalga DC 4 x Orange TL03, 51 & 66	40.8, 41.3dBA	51.8, 50.3dBA	57.6, 57.7dBA	136.5 m, 128 m	392 m, 362 m	608 m, 598 m	28 m, 18 m	100 m, 90 m
Route 1: Maragle to Wondalga DC 4 x Orange TL64	42.2, 45.1dBA	52.6, 53.8dBA	58.7, 61.3dBA	200 m, 223 m	440 m, 442 m	682 m, 700 m	34 m, 40 m	130 m, 148 m
Route 2: Wondalga to Gugaa DC 4 x Orange TL51	40.2, 41.1dBA	50.4, 48.3dBA	56.0, 55.5dBA	120 m, 118 m	348 m, 316 m	550 m, 536 m	18 m, 10 m	76 m, 66 m
Route 3: Wondalga to Bannaby DC 4 x Orange TL03, 51 & 61	40.5, 41.2dBA	51.1, 49.5dBA	56.7, 56.8dBA	129 m, 124 m	372 m, 337 m	576 m, 563 m	24 m, 13 m	86 m, 75 m
Route 3: Wondalga to Bannaby DC 4 x Orange TL5A6 & 5A7	41.2, 43.0dBA	52.4, 54.0dBA	57.5, 58.7dBA	170 m, 180 m	450 m 470 m	630 m 644 m	34 m 48 m	104 m, 118 m
Route 4A: Gugaa to Wagga Wagga DC 4 x Orange (330 kV) TL 51 SC	30.7, 37.4dBA	38.6, 45.3dBA	46.9, 53.5dBA	0 m, 17 m	101 m, 164 m	326 m, 387 m	0 m, 0 m	0 m, 36 m
Route 4B: Gugaa to Wagga Wagga DC 4 x Orange (330 kV) TL 51 DC	33.4, 38.3dBA	42.0, 47.0dBA	51.0, 55.8dBA	16 m, 59 m	172 m, 215 m	440 m, 482 m	0 m, 0 m	17 m, 59 m
Route 4A: Gugaa to Wagga Wagga DC 4 x Orange (500 kV) TL 51 SC	38.2, 39.1dBA	48.1, 49.2dBA	54.2, 55.1dBA	74 m, 187 m	404m, 447m	722m, 764m	12m, 13m	55m, 160m
Route 4B: Gugaa to Wagga Wagga DC 4 x Orange (500 kV) TL 51 DC	33.4, 43.1dBA	49.5, 52dBA	54.7, 60.2dBA	78m, 172m	435m, 487m	744m, 797m	12m, 16m	61m, 175m
TRIPLE PAWPAW								
Route 1: Maragle to Wondalga DC 3 x Pawpaw TL03, 51 & 66	45.9, 43.6dBA	55.1, 52.1dBA	59.5, 58.3dBA	214 m, 238 m	498 m, 451 m	670 m, 643 m	60 m, 25 m	132 m, 107 m
Route 1: Maragle to Wondalga DC 3 x Pawpaw TL64	46.9, 47.9dBA	55.4, 54.5dBA	60.2, 61.5dBA	238 m, 292 m	525 m, 500 m	724 m, 726 m	67 m, 49 m	157 m, 162 m
Route 2: Wondalga to Gugaa DC 3 x Pawpaw TL51	45.0, 42.9dBA	53.8, 50.6dBA	58.0, 56.8dBA	182 m, 206 m	450 m, 401 m	612 m, 581 m	46 m, 15 m	104 m, 79 m

Audible Noise at edge of easement	Fair Weather	L50 Rain	Heavy Rain	Distance from the centre line to achieve 35 dB(A) (Fair Weather)	Distance from the centre line to achieve 35 dB(A) (L50 Rain)	Distance from the centre line to achieve 35 dB(A) (L5 Rain)	Distance from the centre line to achieve 52.5 dB(A) (L50 Rain)	Distance from the centre line to achieve 52.5 dB(A) (Heavy Rain)
Route 3: Wondalga to Bannaby DC 3 x Pawpaw TL03, 51 & 61	45.5, 43.7dBA	54.5, 51.3dBA	58.7, 57.5dBA	200 m, 222 m	476 m, 427 m	638 m, 609 m	24 m, 52 m	91 m, 116 m
Route 3: Wondalga to Bannaby DC 3 x Pawpaw TL5A6 & 5A7	45.0, 44.5dBA	55.1, 54.6dBA	59.2, 59.1dBA	218 m, 270 m	451 m, 522 m	611 m, 678 m	62 m, 58 m	132 m, 130 m
Route 4A: Gugaa to Wagga Wagga DC 3 x Pawpaw TL 51 SC	30.8, 37.4 dBA	45.3, 38.7 dBA	53.5, 47.1 dBA	0 m, 47 m	102 m, 165 m	329 m, 389 m	0 m, 0 m	0 m, 37 m
Route 4B: Gugaa to Wagga Wagga DC 3 x Pawpaw TL 51 DC	32.8, 37.7 dBA	41.7, 46.5 dBA	50.6, 55.4 dBA	9 m, 52 m	160 m, 202 m	425 m, 467 m	0 m, 0 m	13 m, 55 m

From the above results it is shown that the new HumeLink 500 kV lines with quad Orange conductor have lower noise levels than the existing 330 kV lines. This is mainly due to the quad bundle and tower geometry. Accumulative noise is not significant but is evaluated in more detail at specific sensitive receivers along the route in Table 3-3 above.

3.6 Surface gradient voltage

Table 3-4 below is a summary of the maximum surface gradient voltages calculated using CDEGS as part of the noise simulation.

Table 3-4: Summary of maximum surface gradient voltages

Line	Voltage	Conductor	Bundle	Surface Gradient Voltage
HumeLink DC VSE	540 kV	Orange	4x	16.4 kV/cm
HumeLink DC VSE	540 kV	Pawpaw	3x	17.5 kV/cm
HumeLink DC VSE	354 kV	Orange	4x	10.7 kV/cm
HumeLink DC VSE	354 kV	Pawpaw	3x	11.4 kV/cm
HumeLink DC VSL	540 kV	Orange	4x	16.0 kV/cm
HumeLink DC VSL	540 kV	Pawpaw	3x	17.1 kV/cm
TL3, TL51, TL61 &TL 66 SC	354 kV	Bison	2x	17.2 kV/cm
TL64 SC	354 kV	Jarrah	1x	15.8 kV/cm
5A7/5A6 DC	540 kV	Orange	4x	17.1 kV/cm
TL51 DC	354 kV	Olive	2x	15.8 kV/cm

The surface gradient voltage recommendation from AS/NZS 7000:2016 is 16.0 kV/cm. For 500 kV operation, this is met with quad Orange for the VSL tower and slightly exceeded with the VSE tower. With triple Pawpaw it is exceeded by at least 1 kV/cm. Various parameters influence the surface gradient voltage, the main parameters are number of sub conductors, sub conductor diameter and bundle spacing. These parameters have been considered in the Humelink Preliminary Conductor Selection and Structure Selection report TL-799007. Higher surface gradient voltage causes higher corona losses and higher noise levels. While the recommended 16.0 kV/cm limit is exceeded, we note that the calculated corona inception voltage

of each the above conductors is not exceeded, which indicates that problems with corona (such as noise levels and losses) are not expected.

For the 500 kV line operating at 330 kV, surface voltage gradient is very low, which is consistent with the low audible noise findings in the modelling discussed above.

3.7 Corona Losses

Different methods for fair weather and rain exists. From the EPRI applets the following summary of corona losses can be obtained. Corona losses are typically limited to 1 per cent of the line capacity.

Table 3-5: Summary of Corona Loss for the VSE tower at 935 m

	Fair Weather Corona Loss		Heavy Rain Corona Loss				
Bundle	**EdF(W/m)**	**BPA(W/m)**	**EdF(W/m)**	**BPA(W/m)**	**IREQ(W/m)**	**EPRI(W/m)**	**Project EHV (W/m)**
1A	0.2 to 3.3	0.2	36.8	25.7	20.7	41.4	24.2
1B	0.1 to 2.0	0.1	26.7	18.5	14.7	30.1	18.8
1C	0.1 to 2.4	0.1	30.7	21.3	17.0	34.5	20.9
2C	0.1 to 2.4	0.1	30.7	21.3	17.0	34.5	20.9
2B	0.1 to 2.0	0.1	26.7	18.5	14.7	30.1	18.8
2A	0.2 to 3.3	0.2	36.8	25.7	20.7	41.4	24.2
Total	**0.8 to 15.4**	**0.9**	**188.4**	**131.1**	**104.7**	**211.9**	**127.6**

Table 3-6: Summary of Corona Loss for the VSL tower at 1,250 m

	Fair Weather Corona Loss		Heavy Rain Corona Loss				
Bundle	**EdF(W/m)**	**BPA(W/m)**	**EdF(W/m)**	**BPA(W/m)**	**IREQ(W/m)**	**EPRI(W/m)**	**Project EHV (W/m)**
1A	0.2 to 4.6	0.2	43.2	30.1	24.1	48.6	22.6
1B	0.1 to 3.5	0.2	36.1	25.1	19.9	40.7	19.7
1C	0.2 to 3.4	0.2	35.4	24.6	19.5	39.9	19.3
2C	0.2 to 3.4	0.2	35.4	24.6	19.5	39.9	19.3
2B	0.1 to 3.5	0.2	36.1	25.1	19.9	40.7	19.7
2A	0.2 to 4.6	0.2	43.2	30.1	24.1	48.6	22.6
Total	**0.9 to 23.2**	**1.0**	**229.5**	**159.5**	**127.0**	**258.2**	**123.3**

The longest section of line is 235 kilometres, one circuit is rated for a maximum of 3,239 MVA.

If we use the VSL tower and EPRI as worst-case 258.2 W/m divided by two for one circuit is 129.1 W/m.

- 129.1 x 235,000 = 30,338,500 W/m, 0.93 per cent of 3,239 MVA.

This is lower than 1 per cent of 3,239 MVA.

From the above it can be seen that corona losses under worst-case will be less than 1per cent of the capacity of the line.

3.8 Risks

According to EPRI research, additional noise of up to 8 dB [4], can be expected post energization due to the following reasons

- Oil on the new conductor surface due to the manufacturing process creates a hydrophobic surface. Small beads of water form all over a hydrophobic surface.
- Significant 100 Hz hum due to the water beads.
- Dust, insects, etc accumulate on the surface of new conductors after installation and before energization.
- Aluminium burrs due to the manufacturing and installation process.

Noise levels should reduce with time and normalize after approximately 1 year.

4 Radio Interference

Electromagnetic interference (EMI) from overhead power lines can be classified as follows:

- Corona, from
  - Conductors
  - Insulators and hardware.
- Gap discharges, from
  - Loose or floating hardware
  - Dissimilar dielectrics
  - Insulator dry-band arcing.
- Passive interference, including
  - Reradiation of broadcast signals
  - Ghosting
  - Blocking.

Radio Interference will decrease as the distance from the source increases. Receivers outside the easement might experience interference if the current signal to noise ratio at the receiver is low. If the easement is between the sender and receiver any additional noise introduced by the overhead line might increase the signal to noise level above an acceptable level.

4.1 Method selection

In the project Preliminary Conductor Selection and Structure Report, the CIGRE method was used to calculate Radio Interference. The CIGRE method produced good average results amongst other methods available.

In this study various methods were compared by comparing the difference in calculated value and actual measured value. The data was obtained from the IEEE ‘Comparison of several methods for calculating power line electromagnetic interference levels and calibration with long term data’ document. Table 4-1 below represents the difference in dB/µV/m.

[44] EPRI Red Book 3rd Edition:10-22

Table 4-1: Difference between calculated and measured values in dB/µV/m

L #	Measured	EdF	EdF (n=1)	HVRAIN	WETCON	IREQ	IREQ (n=1)	CIGRE	BPA
1	74	74.0	79.0	79.3	70.7	74.4	80.4	71.7	72.8
2	73	74.1	74.1	71.4	64.2	73.0	73.0	66.6	65.6
3	66	61.5	65.6	64.9	56.3	61.6	65.6	57.0	59.0
4	73	74.4	80.3	76.5	69.6	71.7	77.7	70.7	72.1
5	58	55.0	61.5	62.1	50.8	56.1	61.9	53.6	55.1
6	70.5	74.1	80.3	73.6	68.5	70.0	76.0	73.2	72.6
7	74	77.3	81.1	76.3	70.2	74.0	78.0	72.0	72.4
8	68	70.2	70.5	69.1	64.1	71.5	71.6	70.4	65.1
9	68	69.1	75.3	69.7	63.9	65.5	71.5	66.9	67.3
RMS difference		2.6	5.8	3.0	5.7	2.2	4.1	4.4	3.8

Table I: Predictions of EMI using WBNOISE with different generation functions. Predictions are compared to long term average stable foul weather data. Numerical values are given in dB/$\mu V/m$ as would be measured with a CISPR quasi-peak receiver having a horizontally oriented loop antenna. In this case, the horizontal magnetic field is converted to an "equivalent" vertical electric field by multiplying by 120π, the impedance of free space. The program also allows calculation of any rectangular component of electric or magnetic field. All ANSI measurements have been converted to CISPR by subtracting 2 dB.

From the above comparison the IREQ method is the most accurate across a wide variety of methods. In Table 4-2, the methods have been optimized and compared.

Table 4-2: Difference between calculated and measured values in dB/µV/m for optimized functions.

L #	Measured	EdF	EdF (n=1)	HVRAIN	WETCON	IREQ	IREQ (n=1)	CIGRE	BPA
1	74	73.4	74.2	77.3	75.8	75.1	76.9	74.2	75.3
2	73	73.5	69.3	69.4	69.3	73.7	69.5	69.1	68.1
3	66	60.9	60.8	62.9	61.4	62.3	62.1	59.5	61.5
4	73	73.8	75.5	74.5	74.7	72.4	74.2	73.2	74.6
5	58	54.4	56.7	60.1	55.9	56.8	58.4	56.1	57.6
6	70.5	73.5	75.5	71.6	73.6	70.7	72.5	75.7	75.1
7	74	76.7	76.3	74.3	75.3	74.7	74.5	74.5	74.9
8	68	69.6	65.7	67.1	69.2	72.2	68.1	72.9	67.6
9	68	68.5	70.5	67.7	69.0	66.2	68.0	69.4	69.8
A in eq. (8)		-.58	4.80	-2.04	5.13	.74	-3.47	2.49	2.50
RMS difference		2.6	3.2	2.2	2.6	2.1	2.2	3.6	2.9

Table II: Comparison of measured long term data to data predicted by WBNOISE with optimized generation functions. Numerical values are in dB/μV/m for a CISPR receiver in average stable foul weather.

The IREQ remains the most accurate method. The CIGRE method was used on other Transgrid projects and therefore it would be beneficial for comparison reasons to use both the IREQ and CIGRE methods.

4.2 Modelling

The CDEGS, SESEnviroPlus module version 16.2 was used to simulate the noise.

The following inputs were used:

- Air Resistivity: 1 x 10^{18} Ω.m
- Soil Resistivity: 100 Ω.m
- Conductor Bundle: 4 x Orange or 3 x Pawpaw
- Phase Energization: 540 kV for 500 kV operation and 354 kV for 330 kV operation at 3464 A
- Observation Profile Height: 1.8m
- Radio Noise Method: Semi-Empirical CIGRE and IREQ
- Altitude: As per Table 2-1: Weather cases for noise
- Temperature: As per Table 2-1: Weather cases for noise
- Weather: Heavy Rain (18 mm/h) and Fair Weather.

4.3 Results

4.3.1 Radio Noise (Alpine)

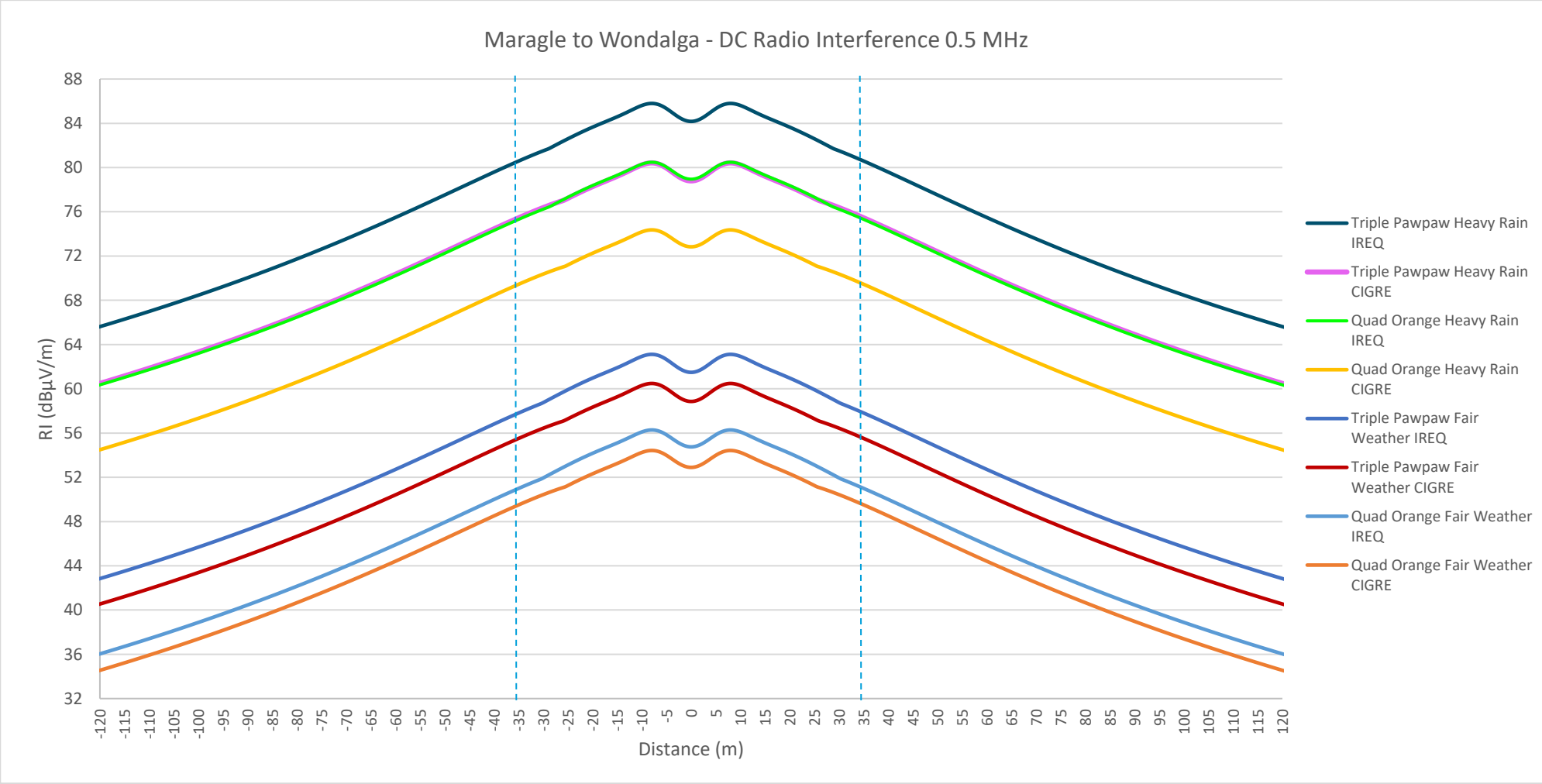


Figure 4-1: Radio Interference: Maragle to Wondalga DC

4.3.2 Radio Noise (Non-alpine)

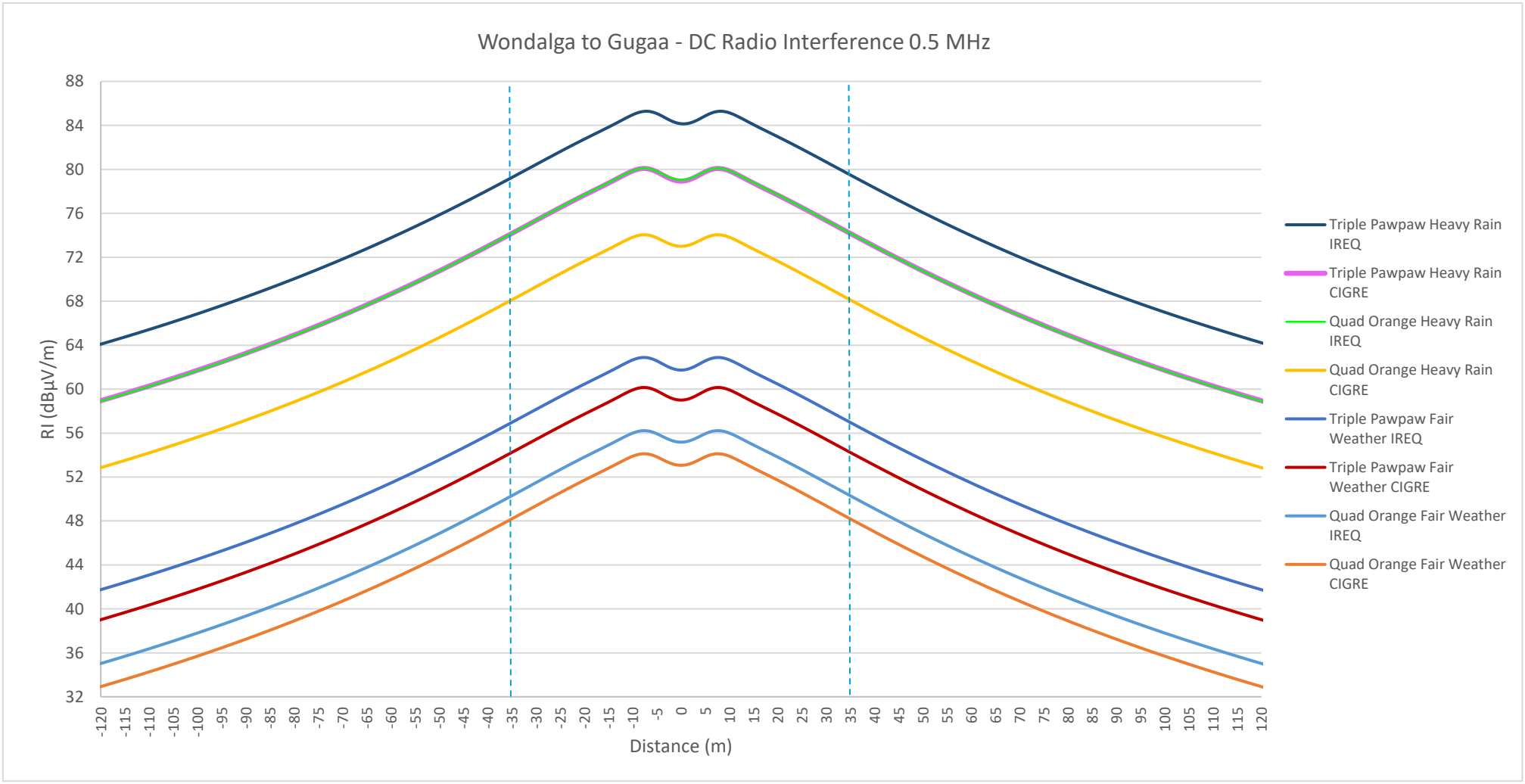


Figure 4-2: Radio Interference: Wondalga to Gugaa DC

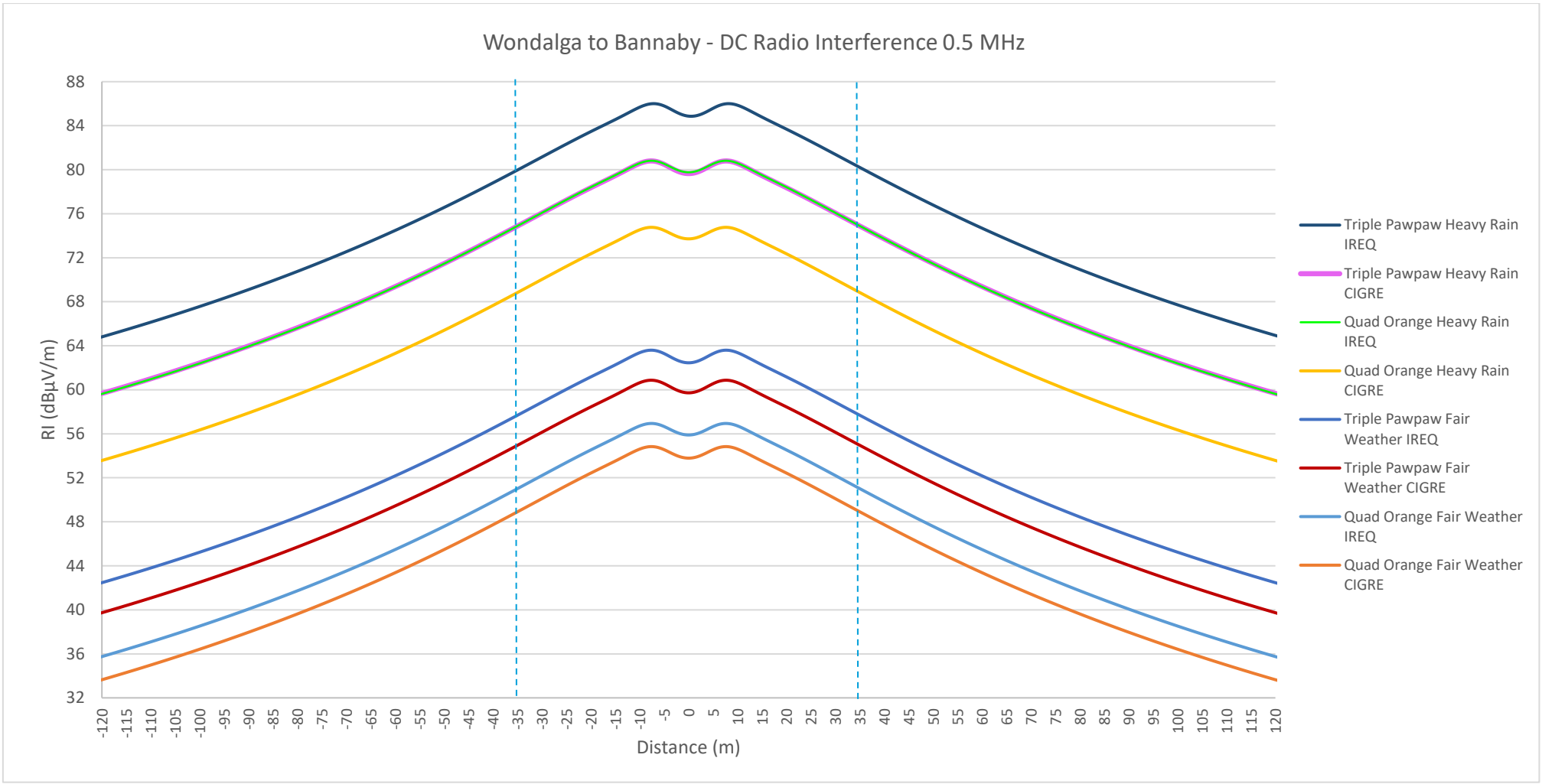


Figure 4-3: Radio Interference: Wondalga to Bannaby DC

4.3.3 Radio Noise (Gugaa to Wagga)

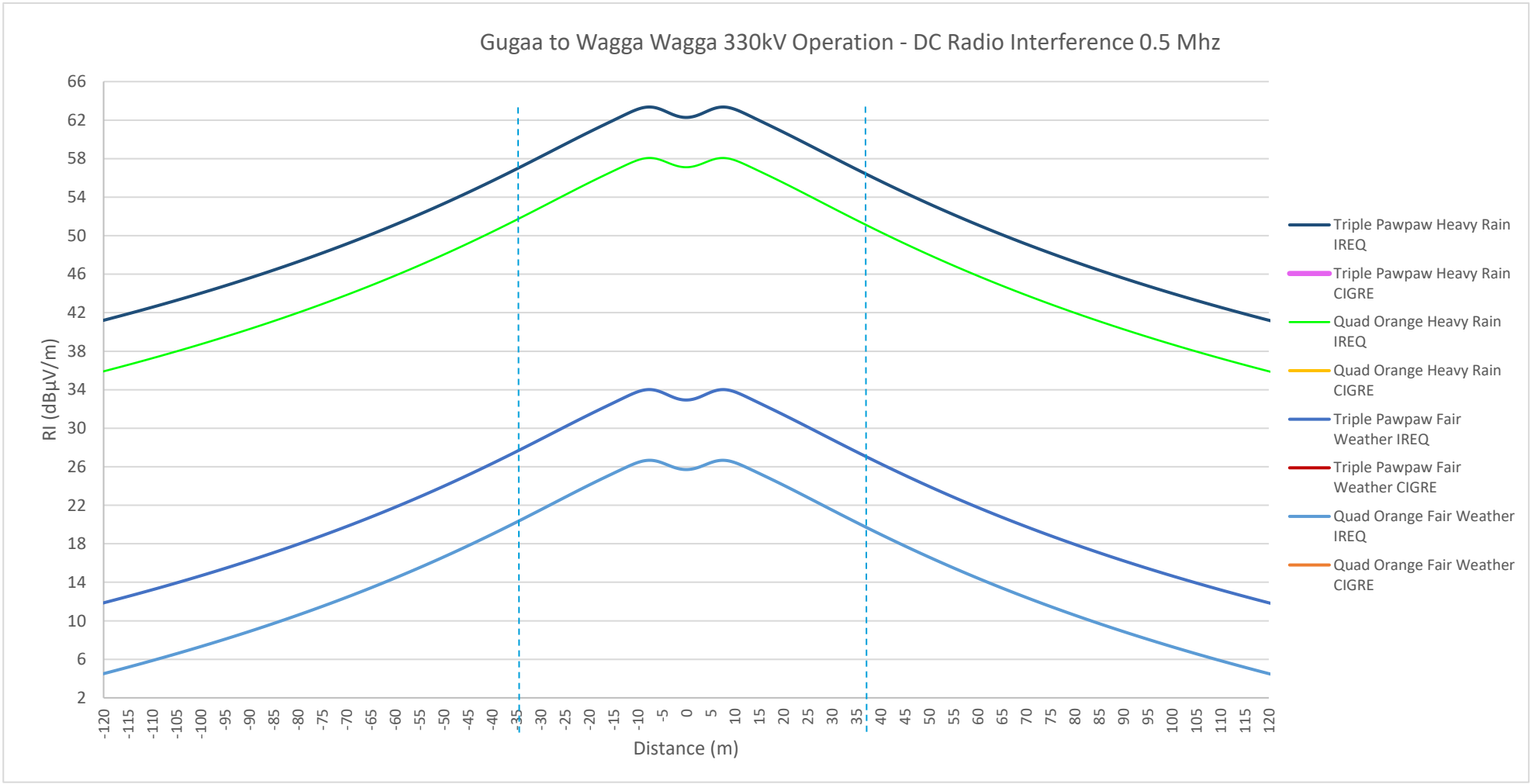


Figure 4-4: Radio Interference: Gugaa to Wagga Wagga DC

CIGRE methods are not valid for surface gradient voltage below 12 kV/cm, therefore no results are shown in the graph above.

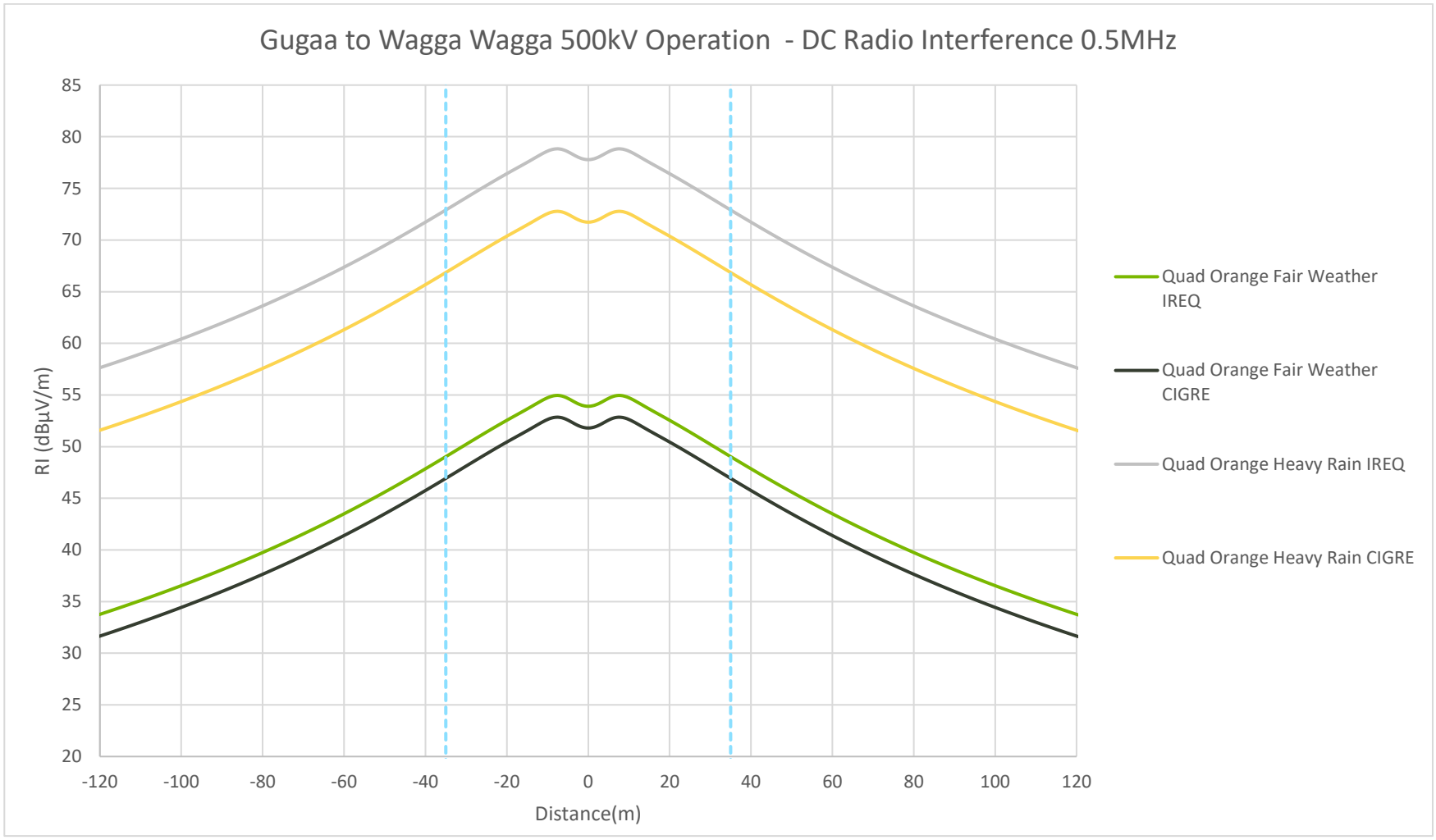


Figure 4-5: Radio Interference: Gugaa to Wagga Wagga DC (500kV)

4.3.4 Radio noise summary

Table 4-3: Summary of Radio Interference at the edge of the easement

Radio Interference at edge of easement	Fair Weather IREQ	Fair Weather CIGRE	Heavy Rain IREQ	Heavy Rain CIGRE
ALPINE				
Route 1: Maragle to Wondalga DC (4 x Orange)	51.0 dBµV/m	49.5 dBµV/m	75.3 dBµV/m	69.5 dBµV/m
Route 1: Maragle to Wondalga DC (3 x Pawpaw)	57.8 dBµV/m	55.5 dBµV/m	80.6 dBµV/m	75.5 dBµV/m
NON-ALPINE				
Route 2: Wondalga to Gugaa DC (4 x Orange)	50.3 dBµV/m	48.2 dBµV/m	74.2 dBµV/m	68.1 dBµV/m
Route 2: Wondalga to Gugaa DC (3 x Pawpaw)	57.0 dBµV/m	54.2 dBµV/m	79.4 dBµV/m	74.2 dBµV/m
Route 3: Wondalga to Bannaby DC (4 x Orange)	51.0 dBµV/m	48.9 dBµV/m	74.9 dBµV/m	68.8 dBµV/m
Route 3: Wondalga to Bannaby DC (3 x Pawpaw)	57.7 dBµV/m	54.9 dBµV/m	80.1 dBµV/m	74.9 dBµV/m
Route 4: Gugaa to Wagga Wagga DC (4 x Orange)	20.2 dBµV/m	N/A*	51.6 dBµV/m	N/A*
Route 4: Gugaa to Wagga Wagga DC (3 x Pawpaw)	27.5 dBµV/m	N/A*	56.9 dBµV/m	N/A*
Route 4: Gugga to Wagga Wagga DC 500kV (4 x Orange)	49.1 dBµV/m	46.9 dBµV/m	72.9 dBµV/m	66.9 dBµV/m

**CIGRE method is not valid for surface gradient voltage below 12 kV/cm*

4.4 RI at higher frequencies

Corona can be a source of severe EMI on the AM Broadcast band, especially during foul weather. However very few complaints over the recent years have been received in this frequency band due to corona. This trend is mainly due to the popularity of the FM Broadcast band (87-108 MHz) which is not affected so much by overhead line EMI.

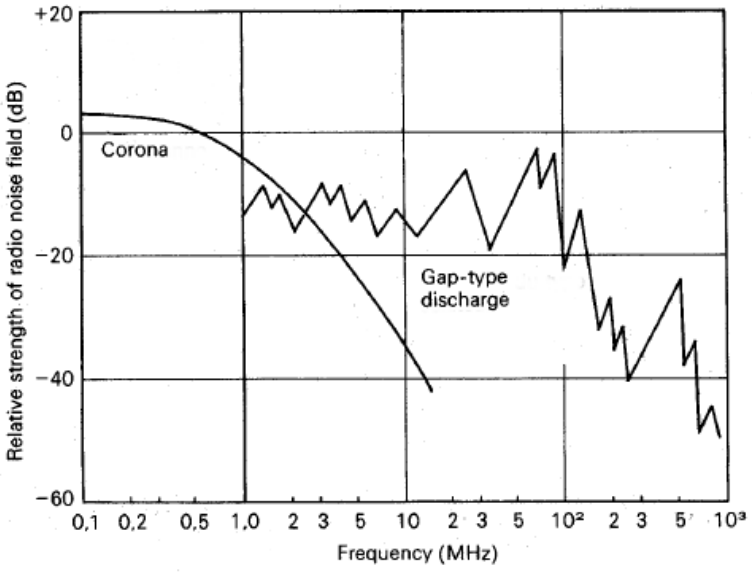


Figure 4-6: EPRI: Relative strength of corona and gap-type discharges as a function of frequency

As can be seen from Figure 4-6 above, RI due to corona rapidly decreases at frequencies above 3.0 MHz.

Current methods do not support accurate predictions above 30 Mhz.

As can be seen from the figures below, AS 2344 Limits for RI increases at frequencies above 30 MHz (the limit being 23 dBuV/m at 30 MHz, 30 dBuV/m between 30 and 230 MHz, and 37 dBuV/m between 230 and 1,000 MHz). Meanwhile, noise produced by the line decreases with frequency. Accordingly, frequencies above 30 MHz are not expected to present any radio interference problems.

GPS devices typically used in agricultural vehicles operates in UHF bands above 1,000 MHz. Since the line noise decreases rapidly above 30 MHz this should not be of any concern.

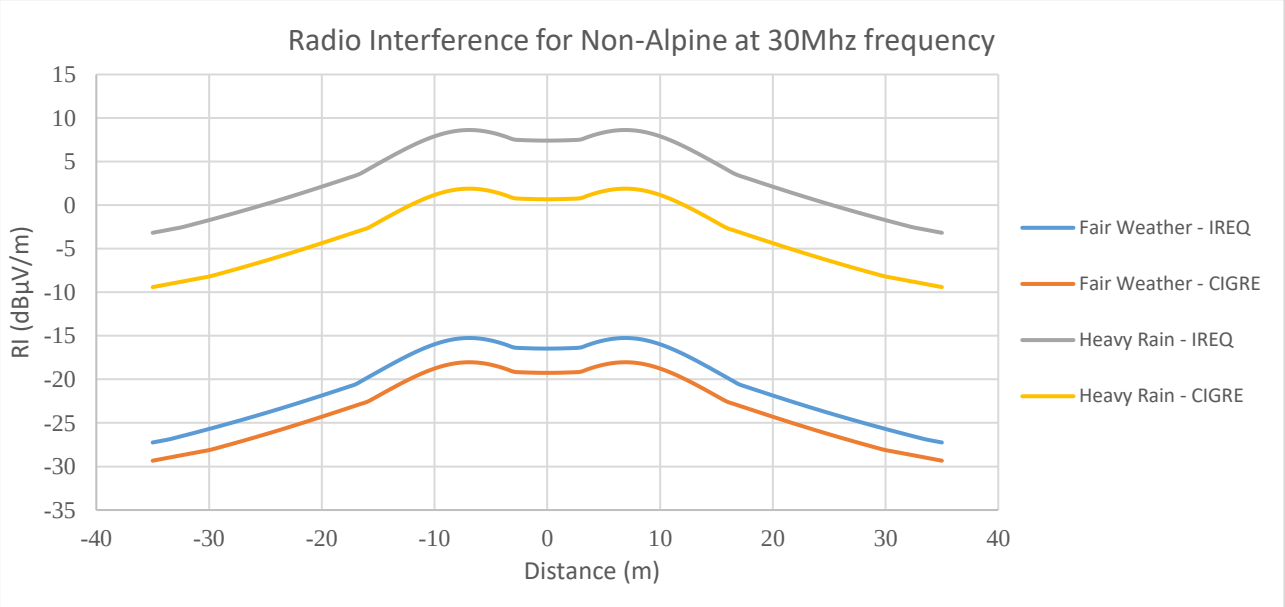


Figure 4-7: Radio Interference at 30 MHz for Typical 500 kV DC VSE HumeLink line

Gap discharge phenomenon is not expected at 500 kV, since it is caused typically by a small air gap opening up between two cap-and-pin insulators which are lightly mechanically loaded. But for our purposes, the insulator strings are always supporting considerable weight spans.

Agricultural machinery might experience interference if the radios operate in the lower band frequencies, especially inside the easement. GPS receivers operate in frequencies bands above 1,000 MHz and should not be affected.

4.5 Risks

According to CIGRE 22/33/36-09 research, additional noise of up to 12 dB can be expected at the edge of the easement post energization due to the following reasons:

- Oil on the new conductor surface due to the manufacturing process creates a hydrophobic surface. Small beads of water form all over a hydrophobic surface.
- Dust, insects, etc accumulate on the surface of new conductors after installation and before energization.
- Aluminium burrs due to the manufacturing and installation process.

Noise levels should reduce with time and normalize after approximately 1 year.

Attachment F Ambient noise monitoring results

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

Noise Monitoring Location	L.10
Noise Monitoring Address	**28 Mates Gully Road, Tarcutta**

Logger Device Type: Svantek 957, Logger Serial No: 20665
Sound Level Meter Device Type: Rion NA-28, Sound Level Meter Serial No: 1060054

Ambient noise logger deployed at 28 Mates Gully Road, Tarcutta. Logger located in driveway, around 230 m north of Mates Gully Road and 400 m west of the Hume Highway.

Attended noise measurements indicate the ambient noise environment at this location is controlled by road traffic noise. Natural noise sources such as birds and wind also contribute to the L_{Aeq} at this location.

Map of Noise Monitoring Location

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	39	50	51	58
Evening	41	51	53	58
Night-time	39	50	53	57

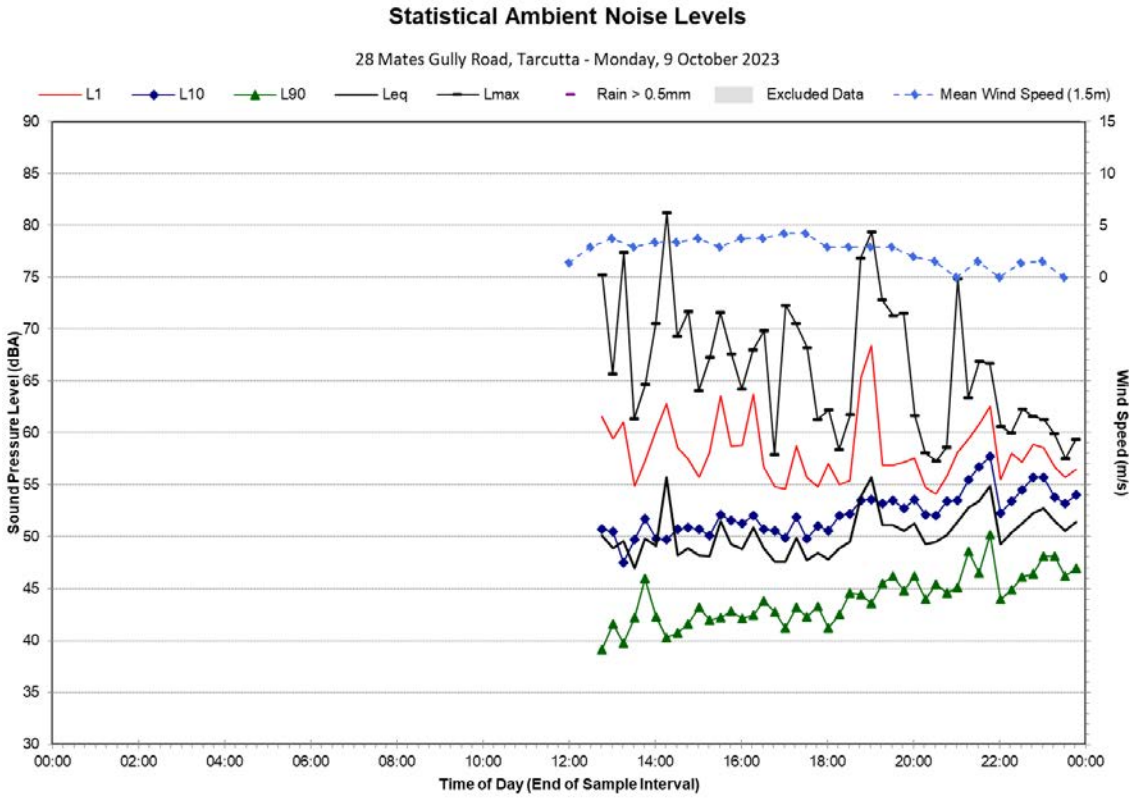
Ambient Noise Logging Results – RNP Defined Time Periods

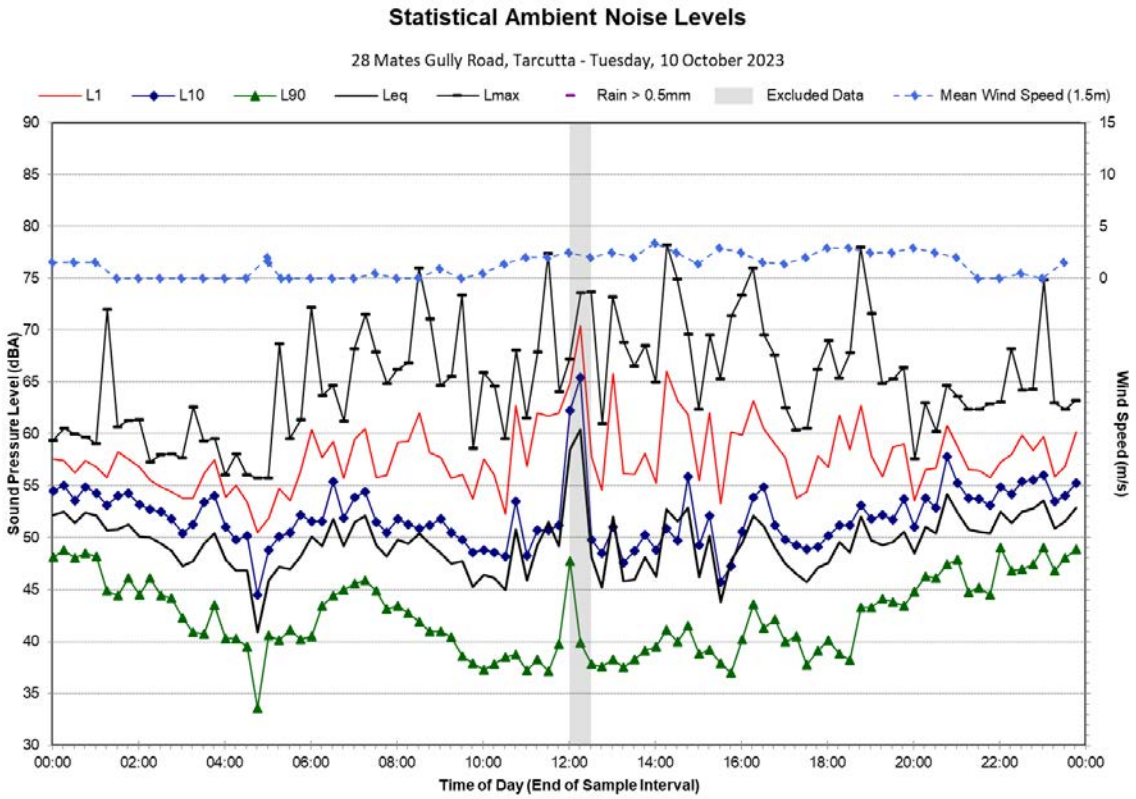
Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	50	52
Night-time (10pm-7am)	50	52

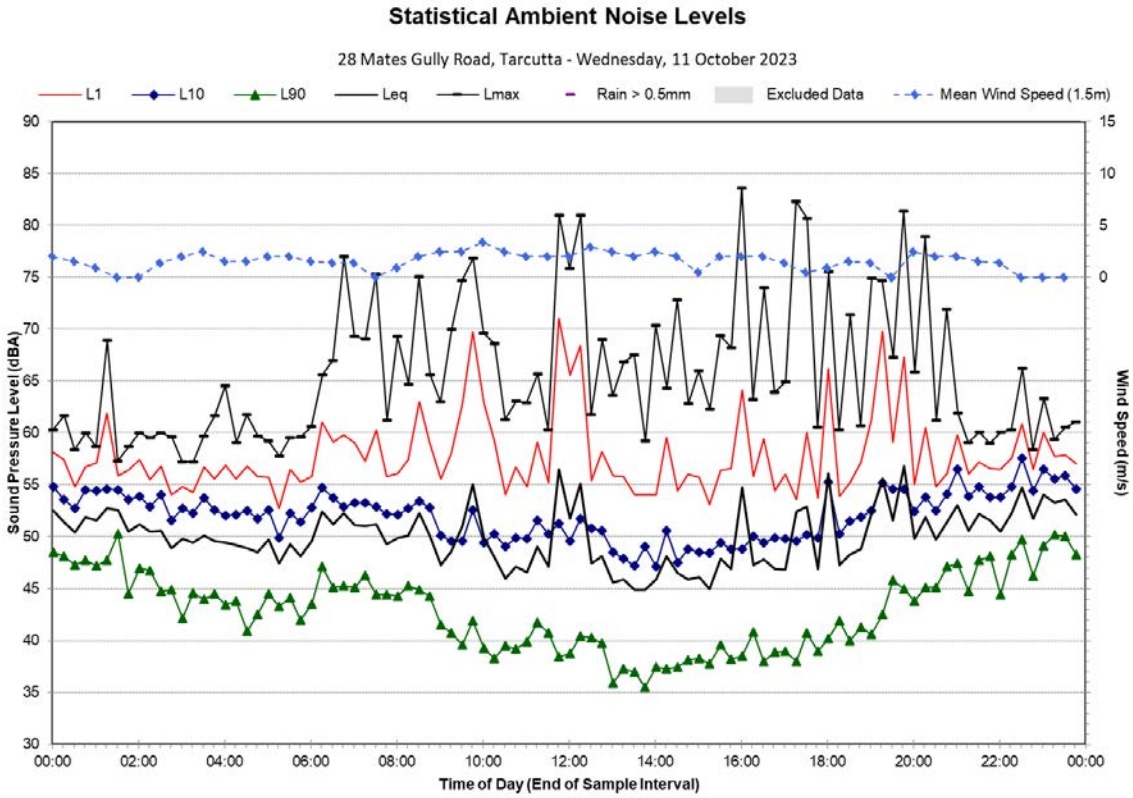
Attended Noise Measurement Results

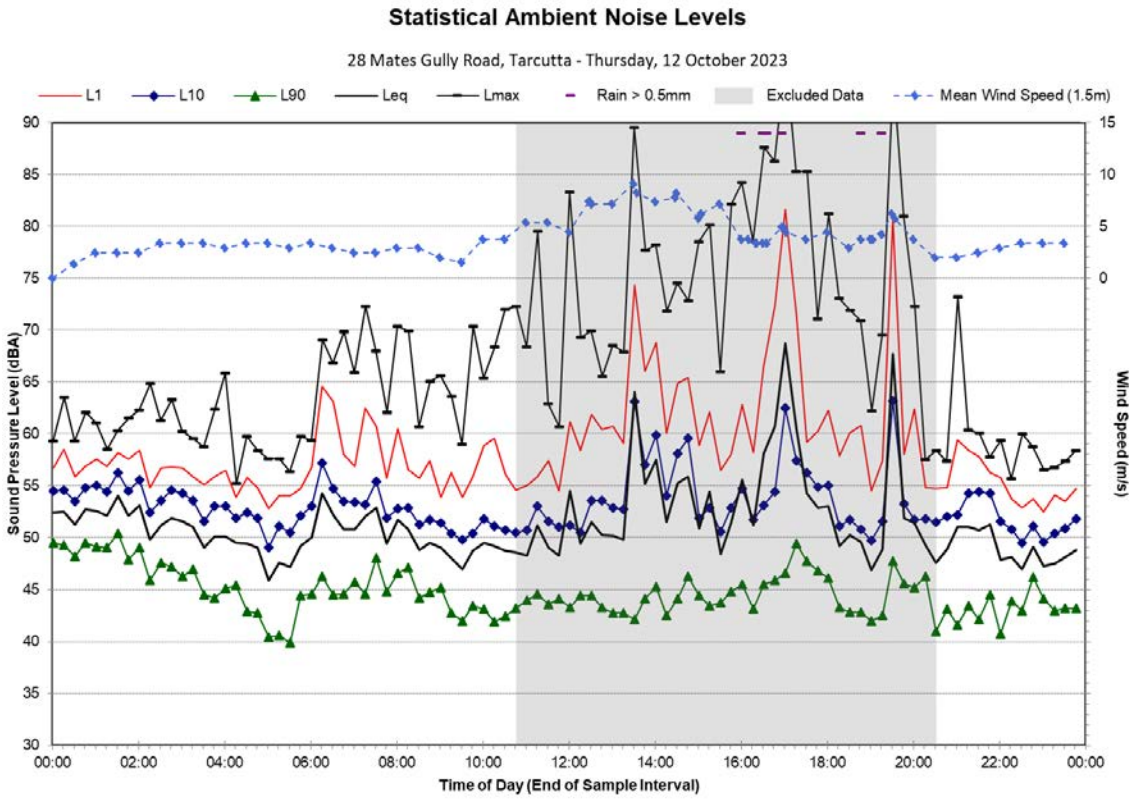
Date	Start Time	Measured Noise Level (dBA)		
		LA90	L_{Aeq}	L_{Amax}
23/10/2023	12:46	37	42	56

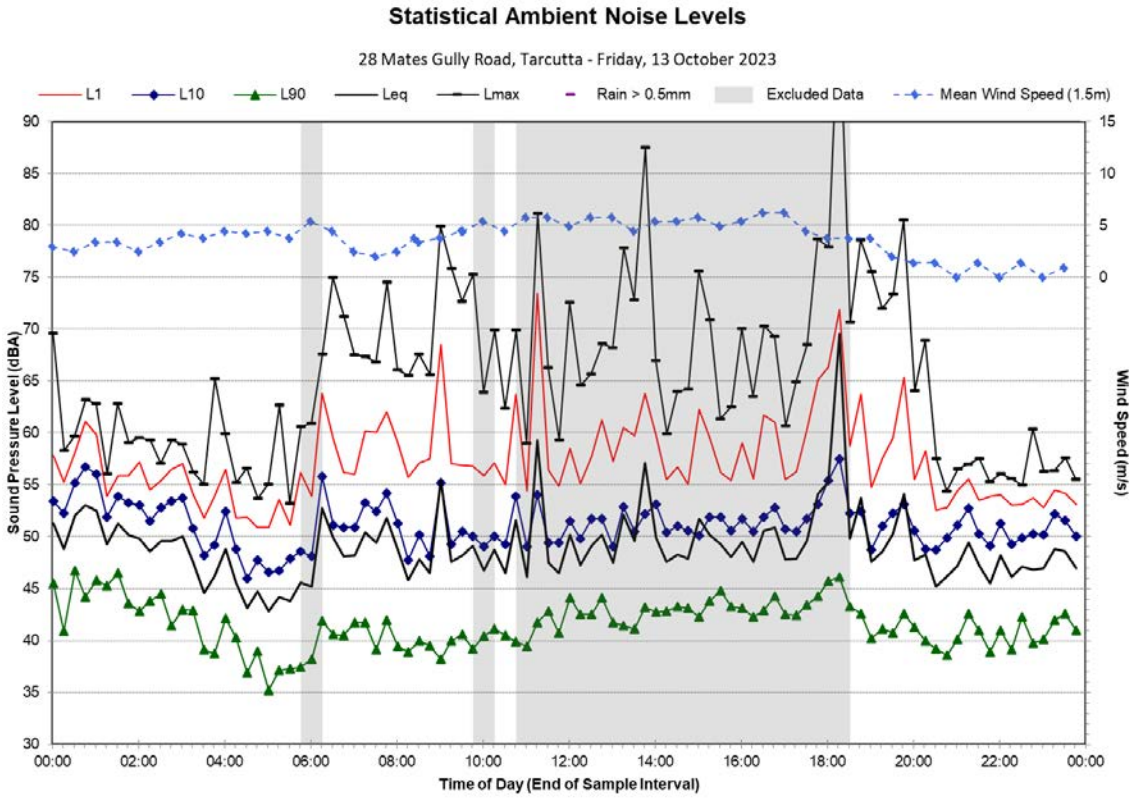
Photo of Noise Monitoring Location

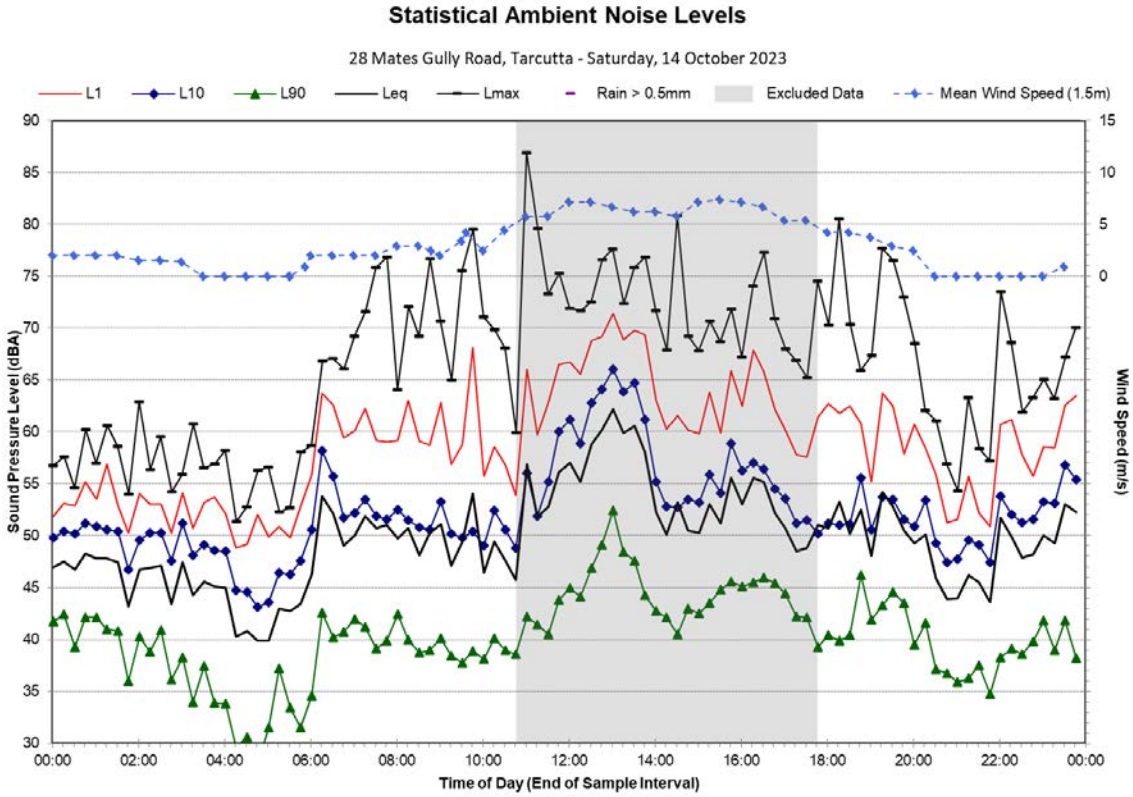

Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Monday, 9 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

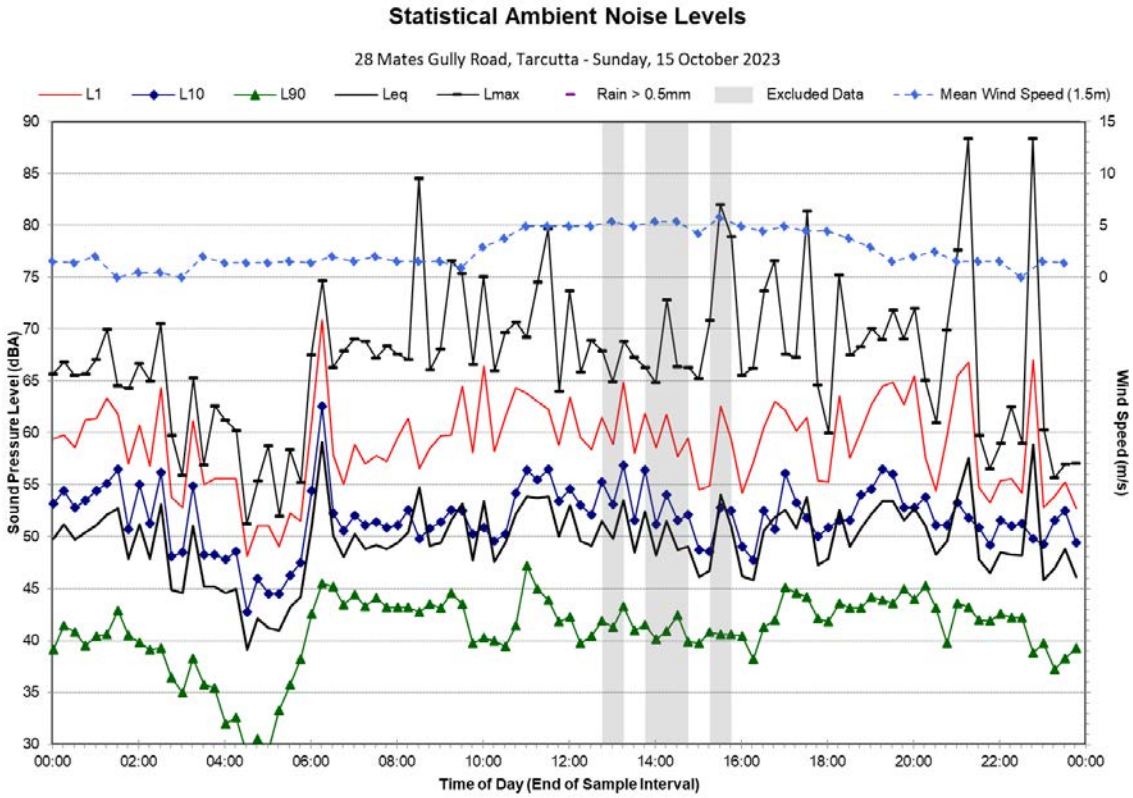

Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Tuesday, 10 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

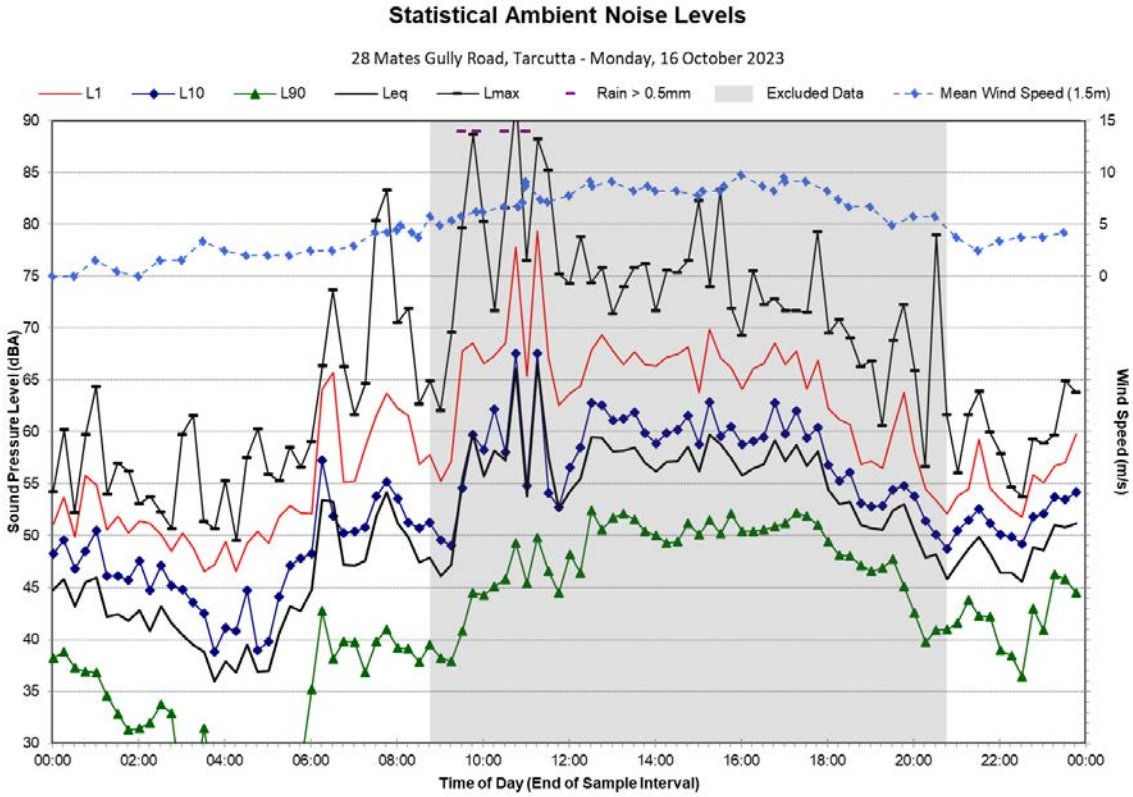

Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Wednesday, 11 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

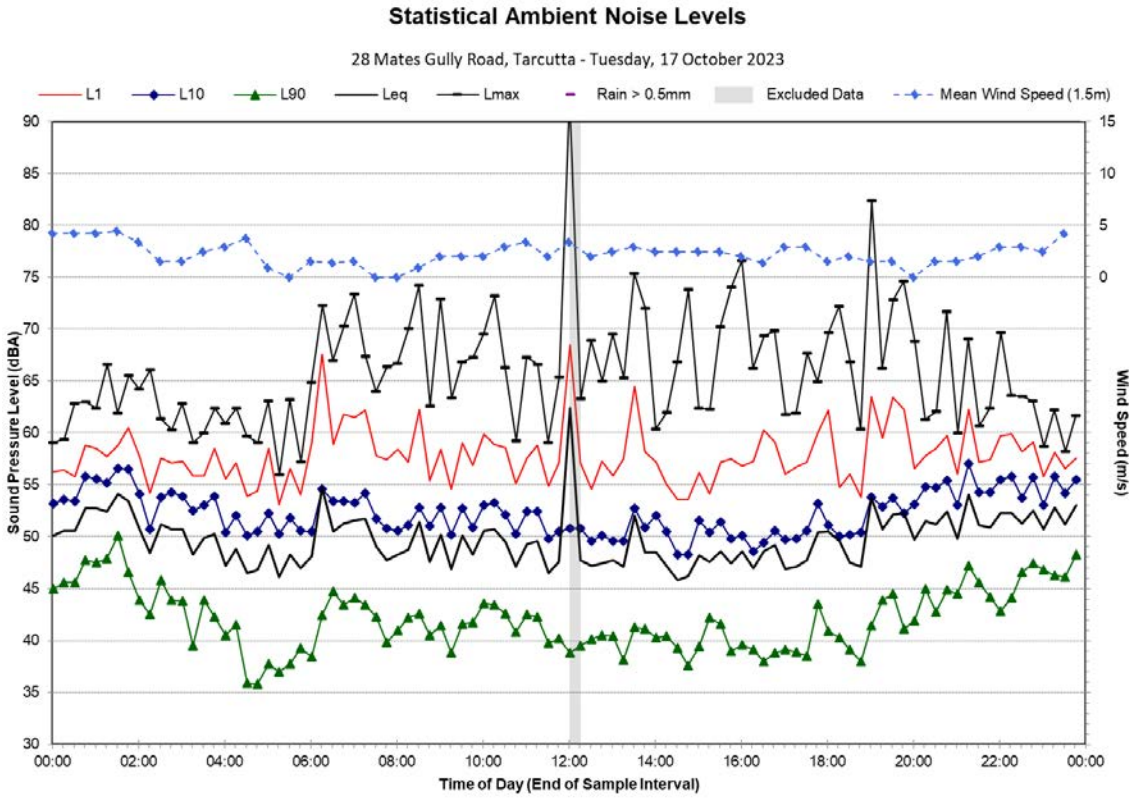

Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Thursday, 12 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

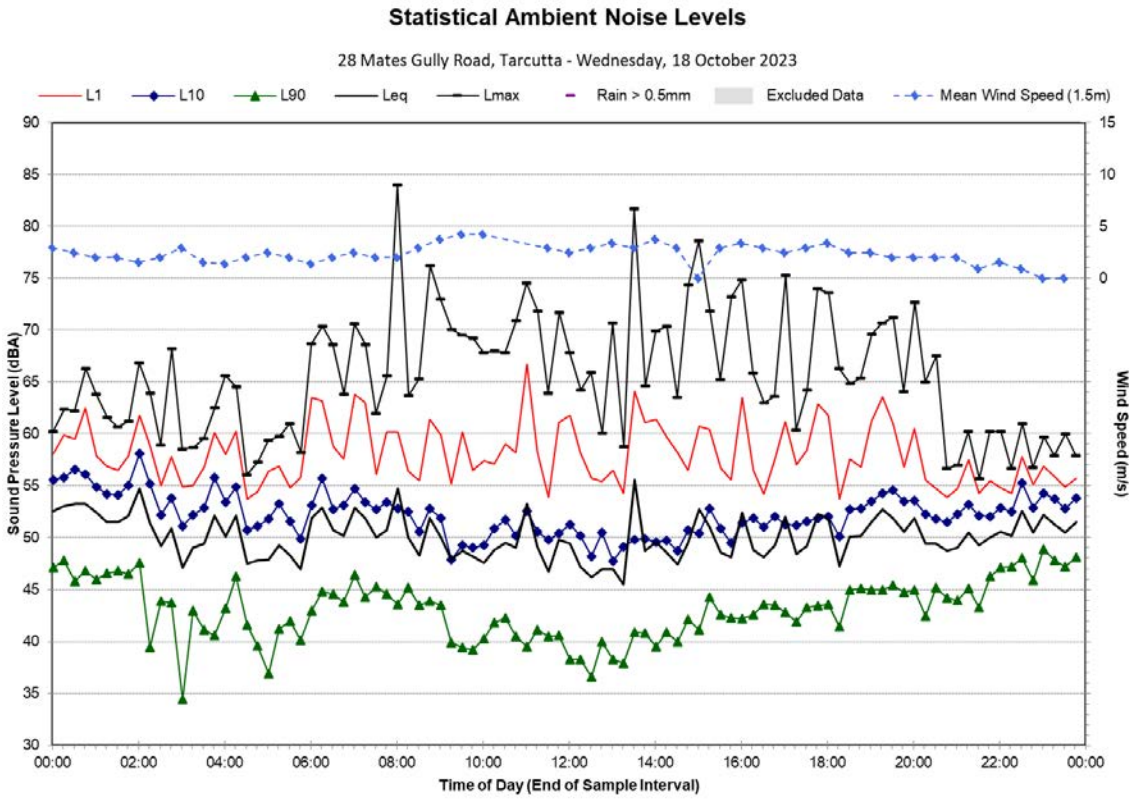

Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Friday, 13 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

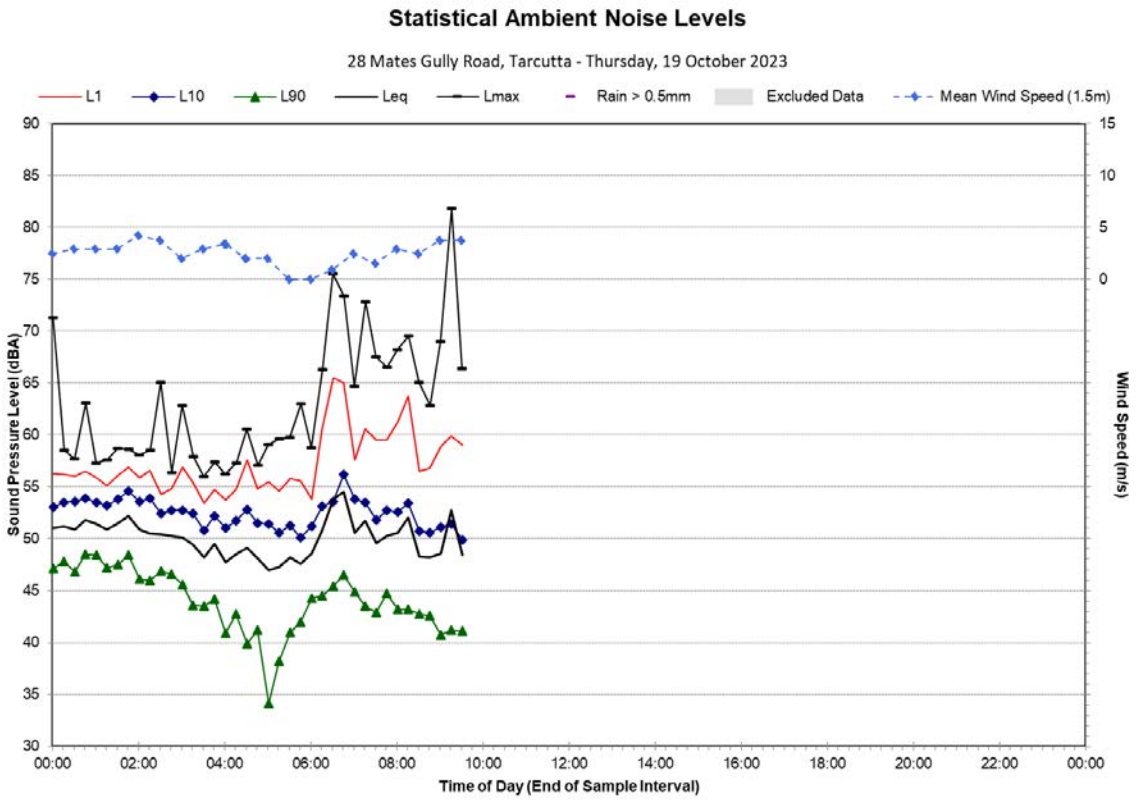

Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Saturday, 14 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Sunday, 15 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Monday, 16 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Tuesday, 17 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Wednesday, 18 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
28 Mates Gully Road, Tarcutta - Thursday, 19 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
90
85
80
75
70
65
60
55
50
45
40
35
30
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

Noise Monitoring Location	L.11
Noise Monitoring Address	**32 Sydney Street, Tarcutta**

Logger Device Type: Svantek 957, Logger Serial No: 27522

Sound Level Meter Device Type: Rion NA-28, Sound Level Meter Serial No: 1060054

Ambient noise logger deployed at 32 Sydney Street, Tarcutta. Logger located at the edge of the Ampol service station, with view of Sydney Street around 40 m to the southeast.

Attended noise measurements indicate the ambient noise environment at this location is controlled by road traffic noise and commercial/industrial activity at the service station.

Map of Noise Monitoring Location

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	42	55	55	64
Evening	44	55	56	65
Night-time	44	55	58	65

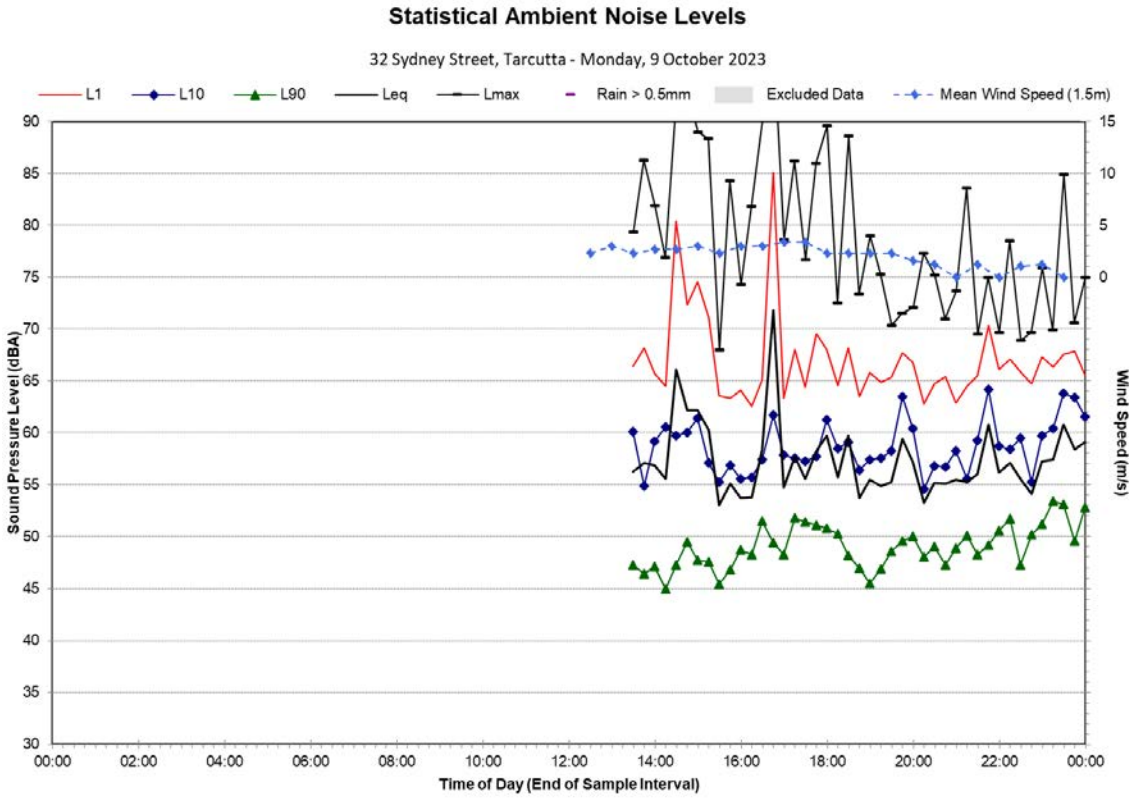
Ambient Noise Logging Results – RNP Defined Time Periods

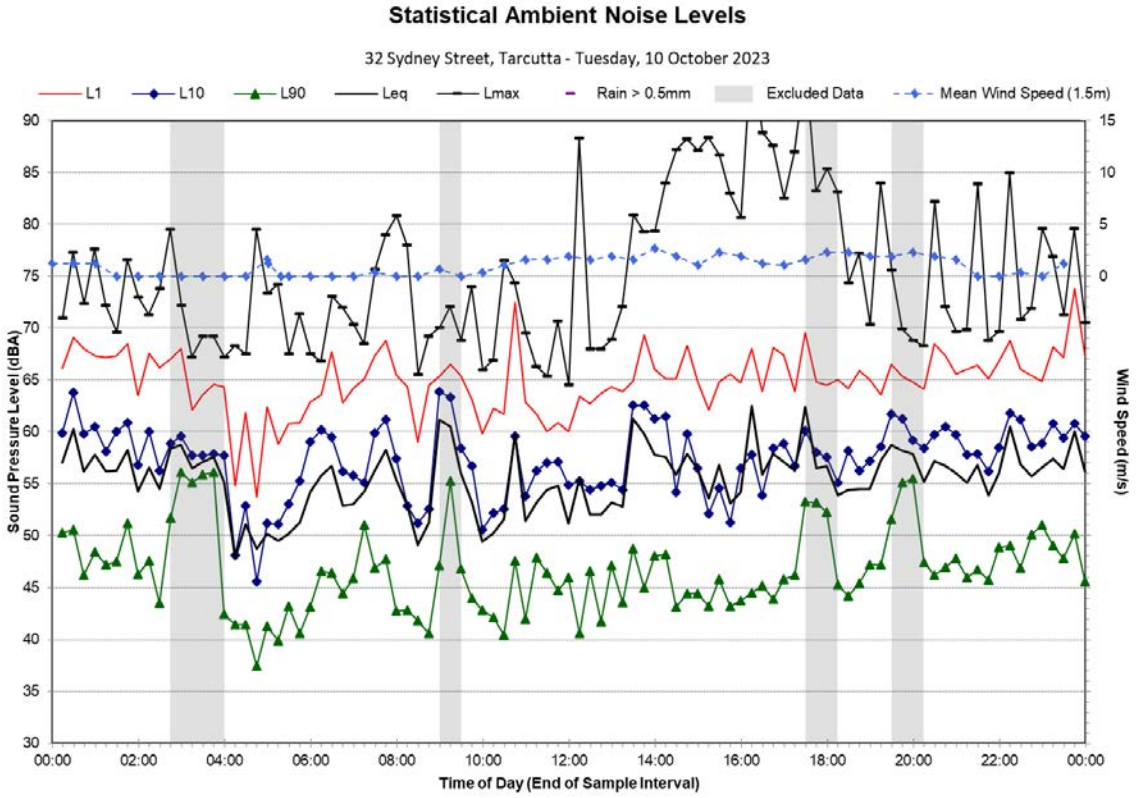
Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	55	57
Night-time (10pm-7am)	55	58

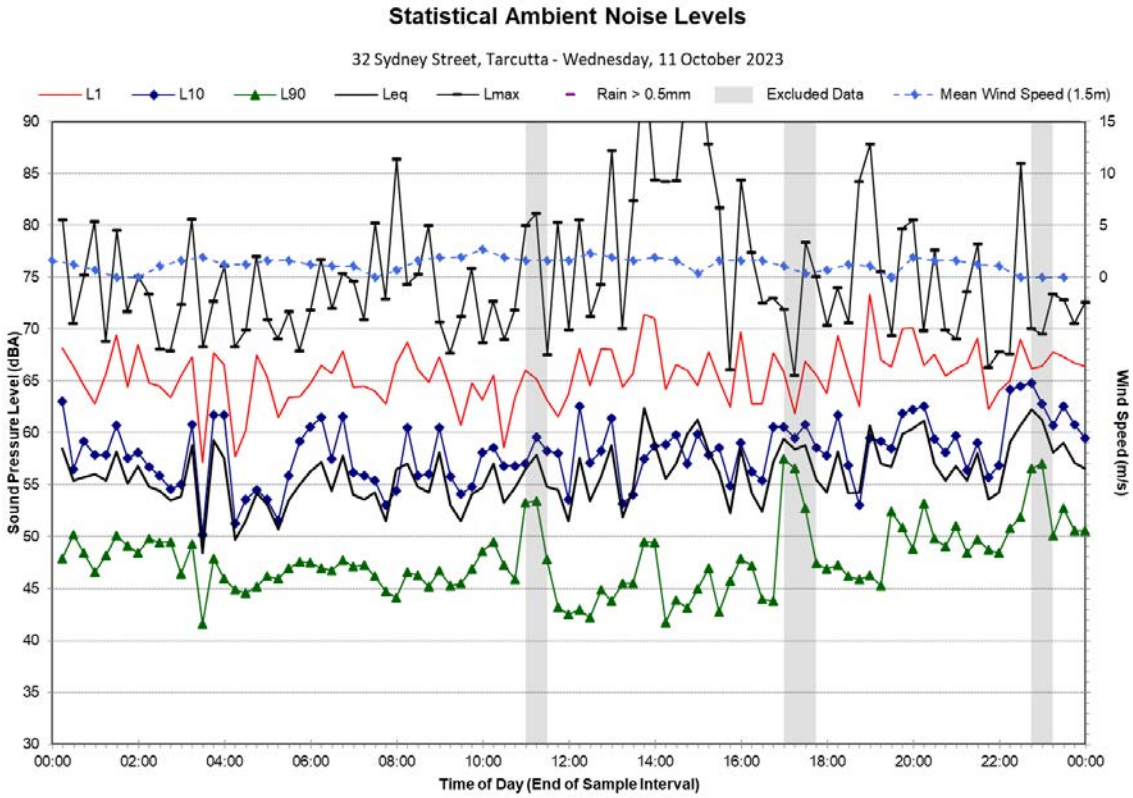
Attended Noise Measurement Results

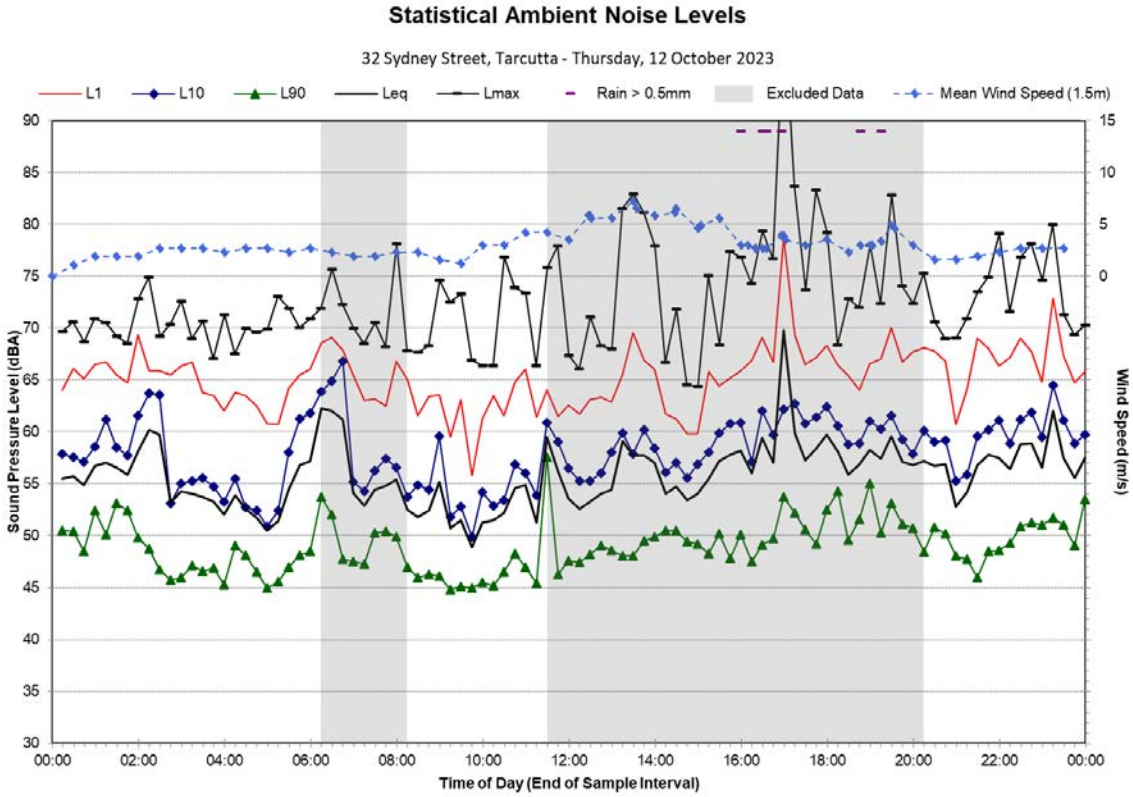
Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	L_{Amax}
23/10/2023	12:07	44	50	71

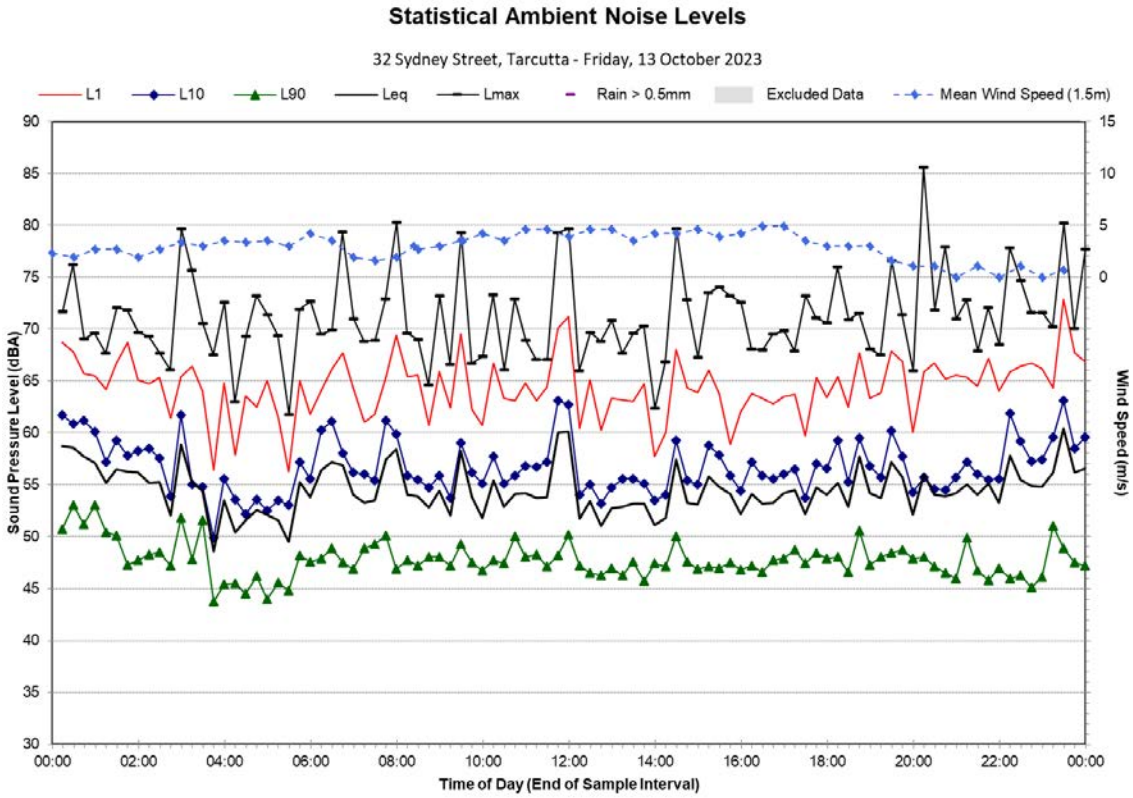
Photo of Noise Monitoring Location

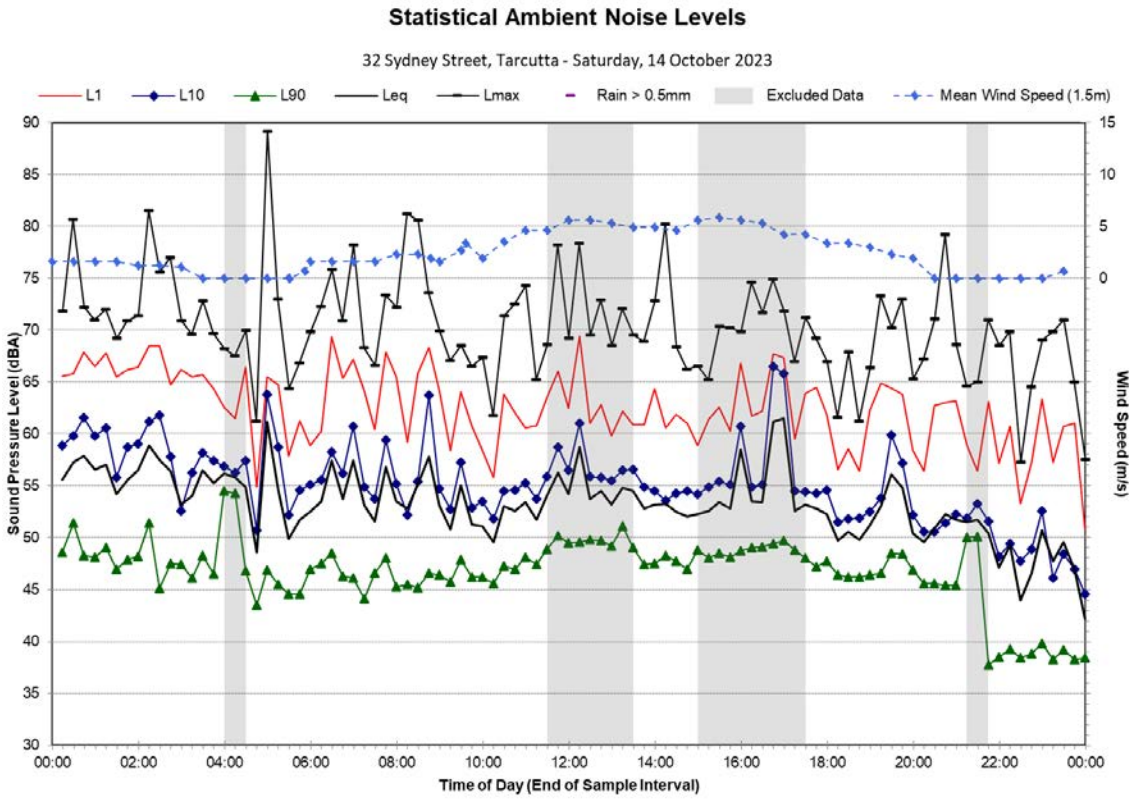

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Monday, 9 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

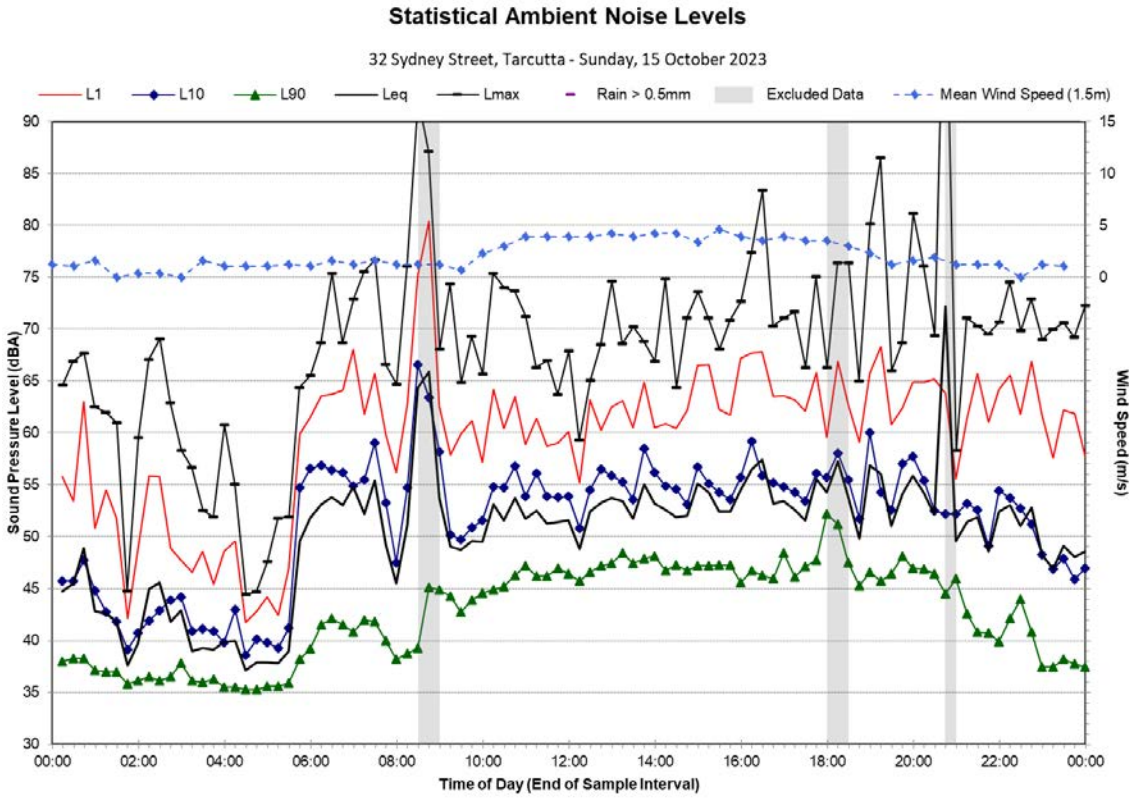

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Tuesday, 10 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

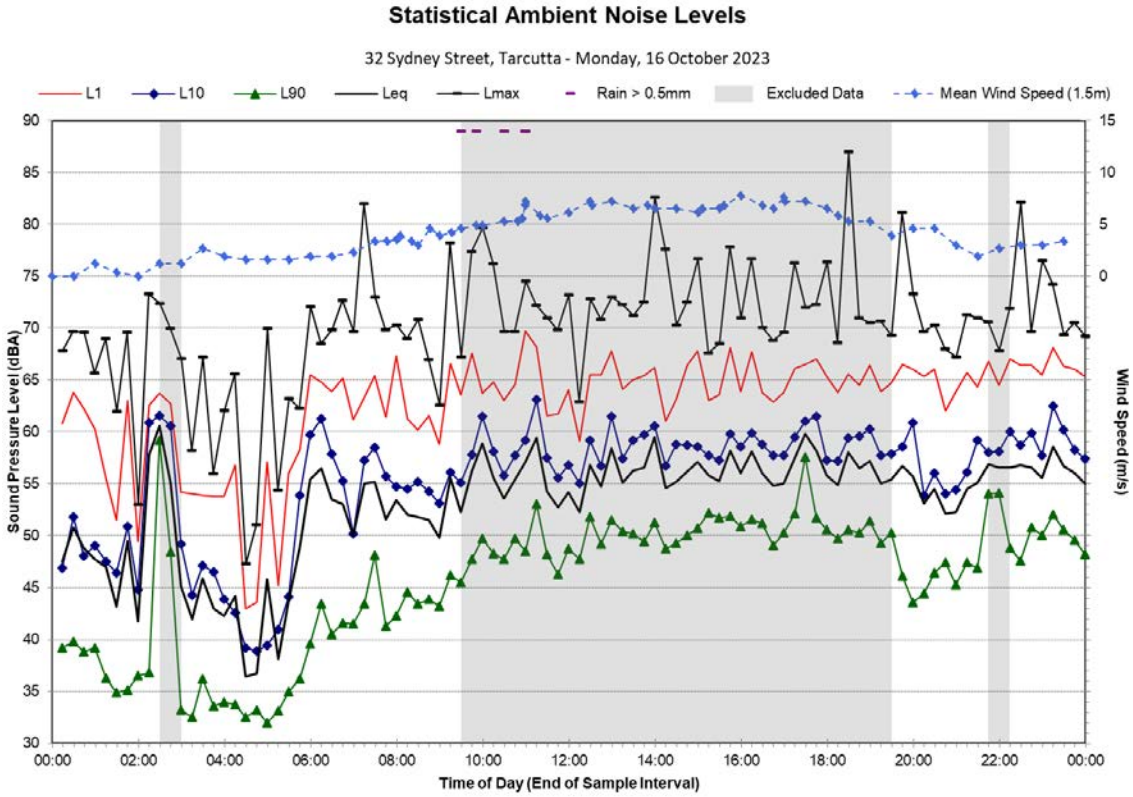

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Wednesday, 11 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

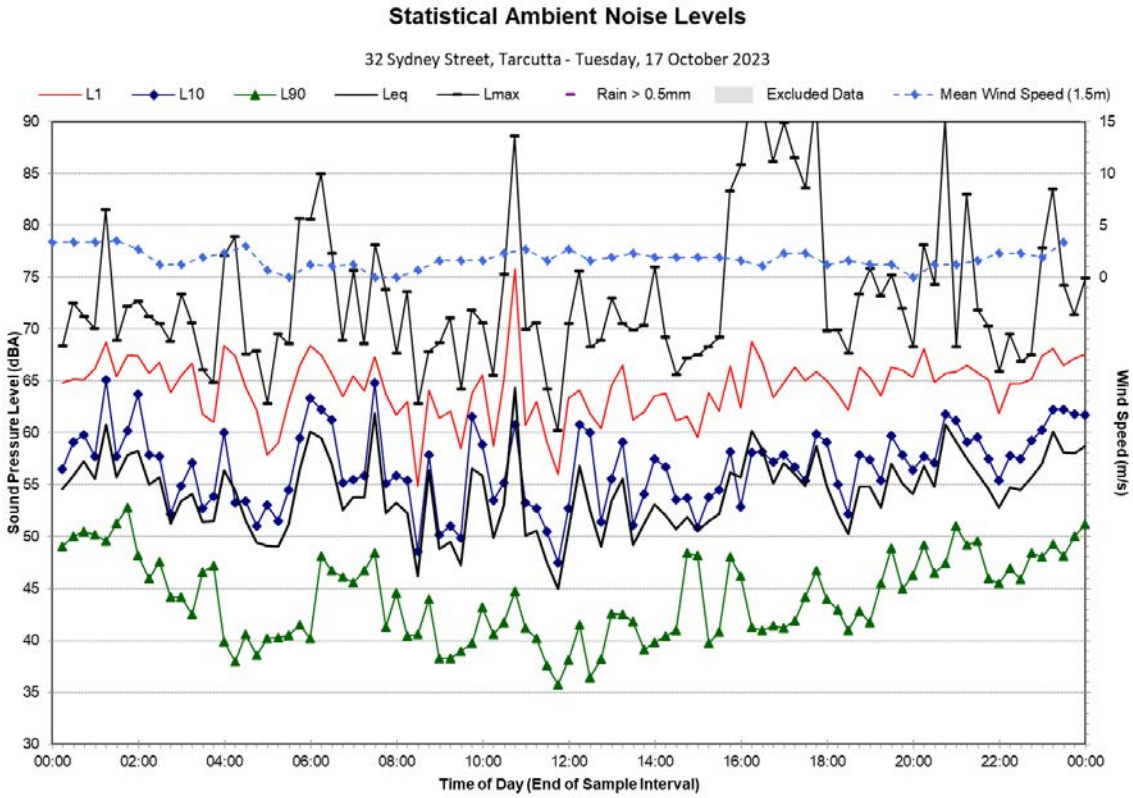

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Thursday, 12 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

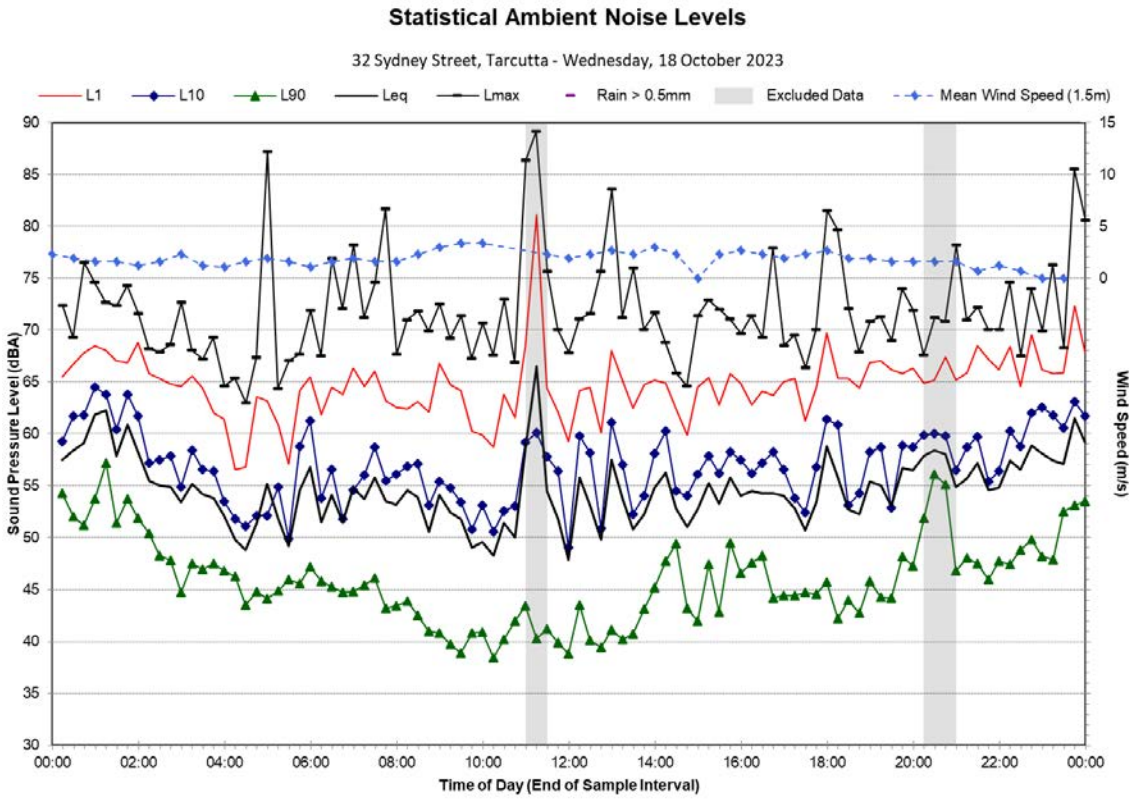

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Friday, 13 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

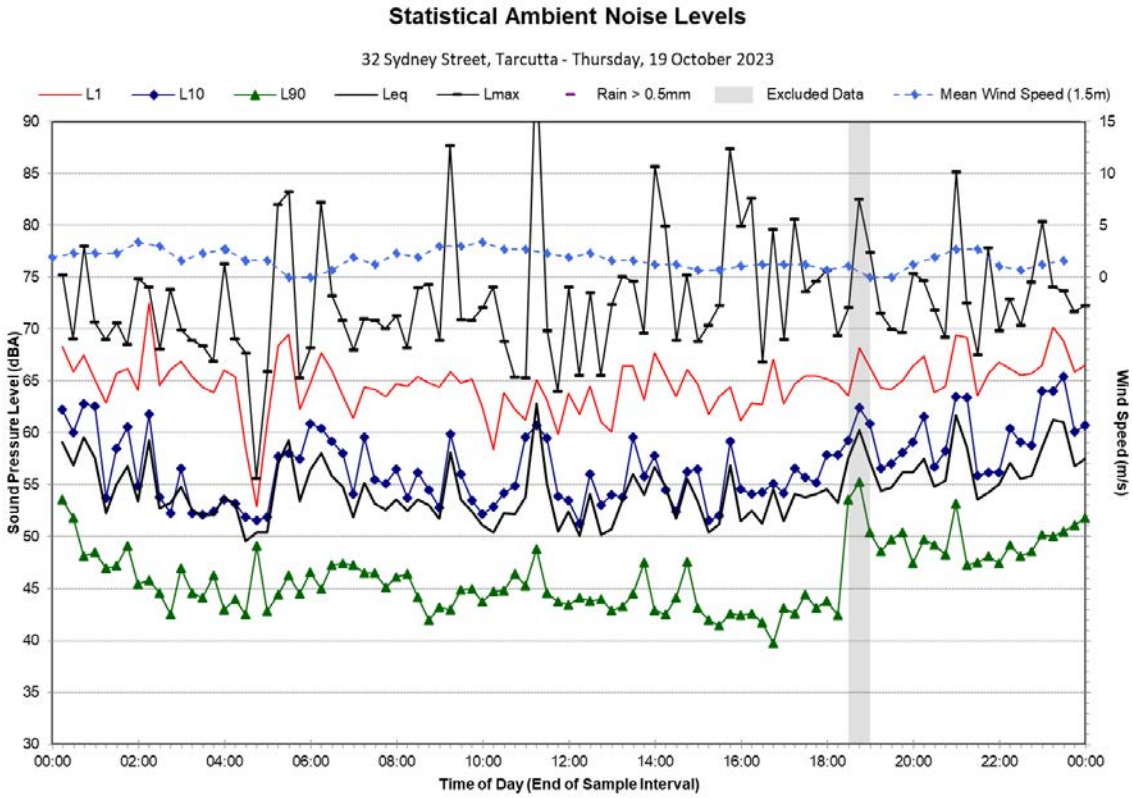

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Saturday, 14 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

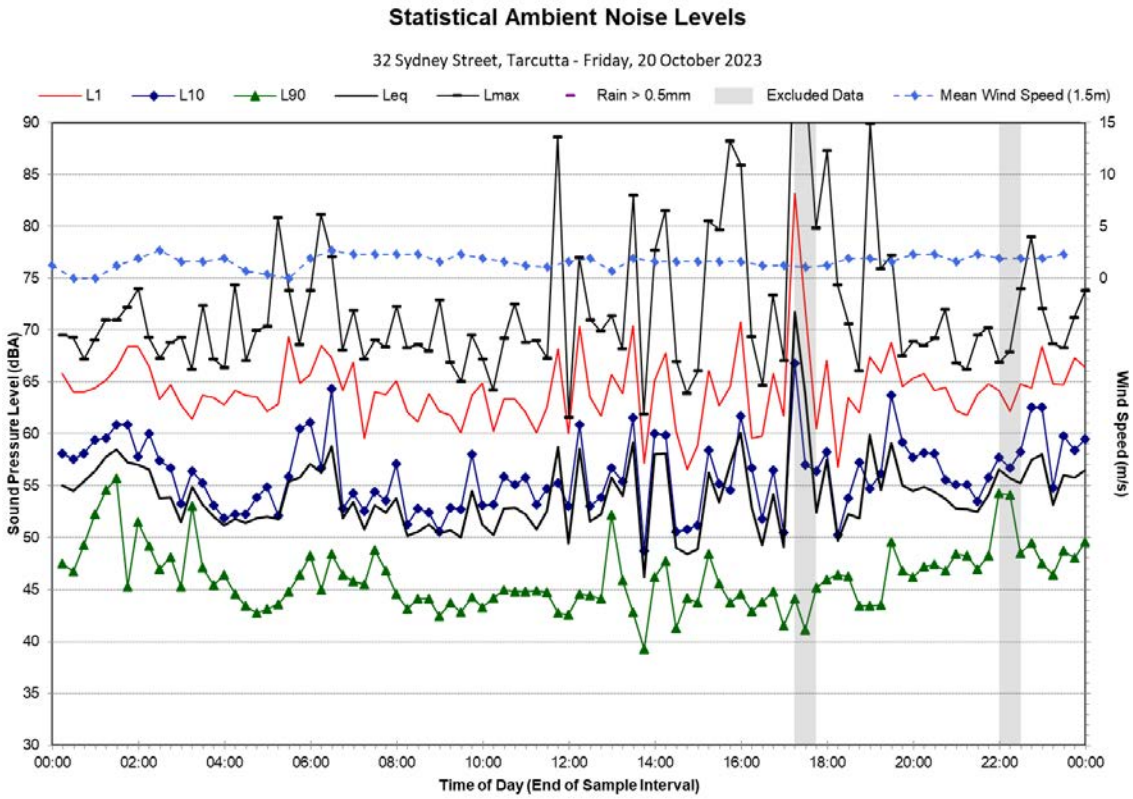

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Sunday, 15 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

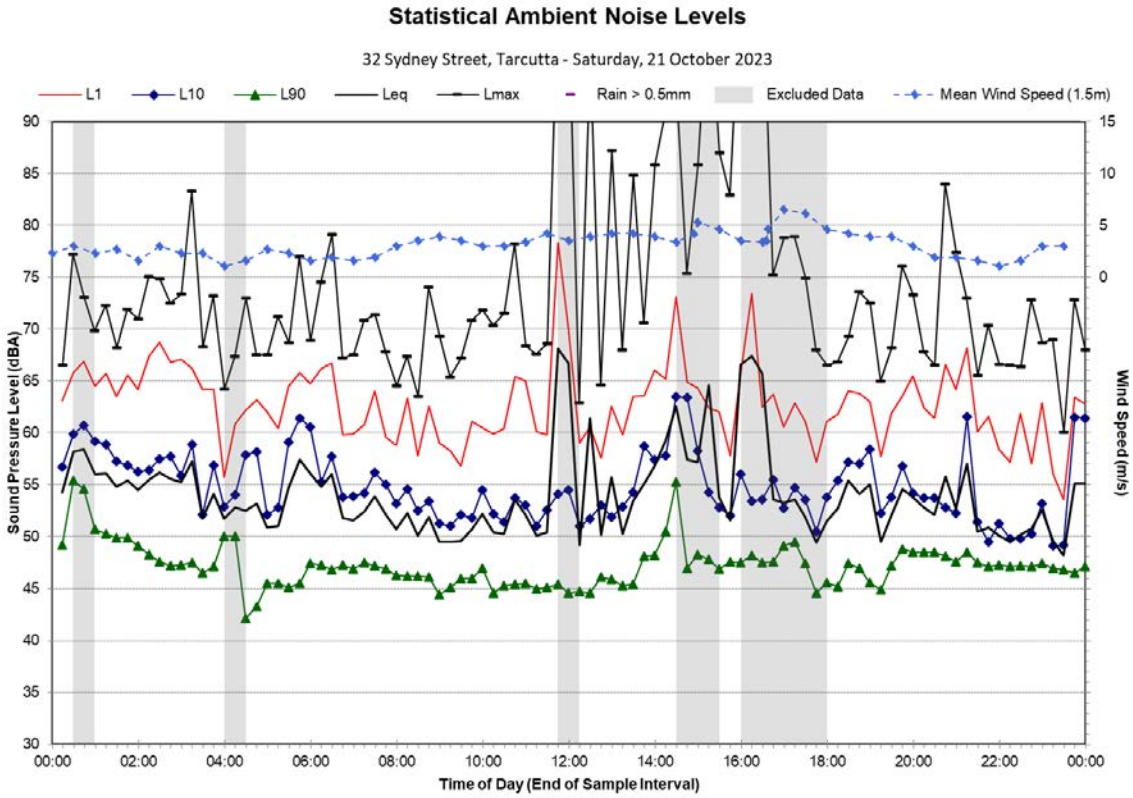

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Monday, 16 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

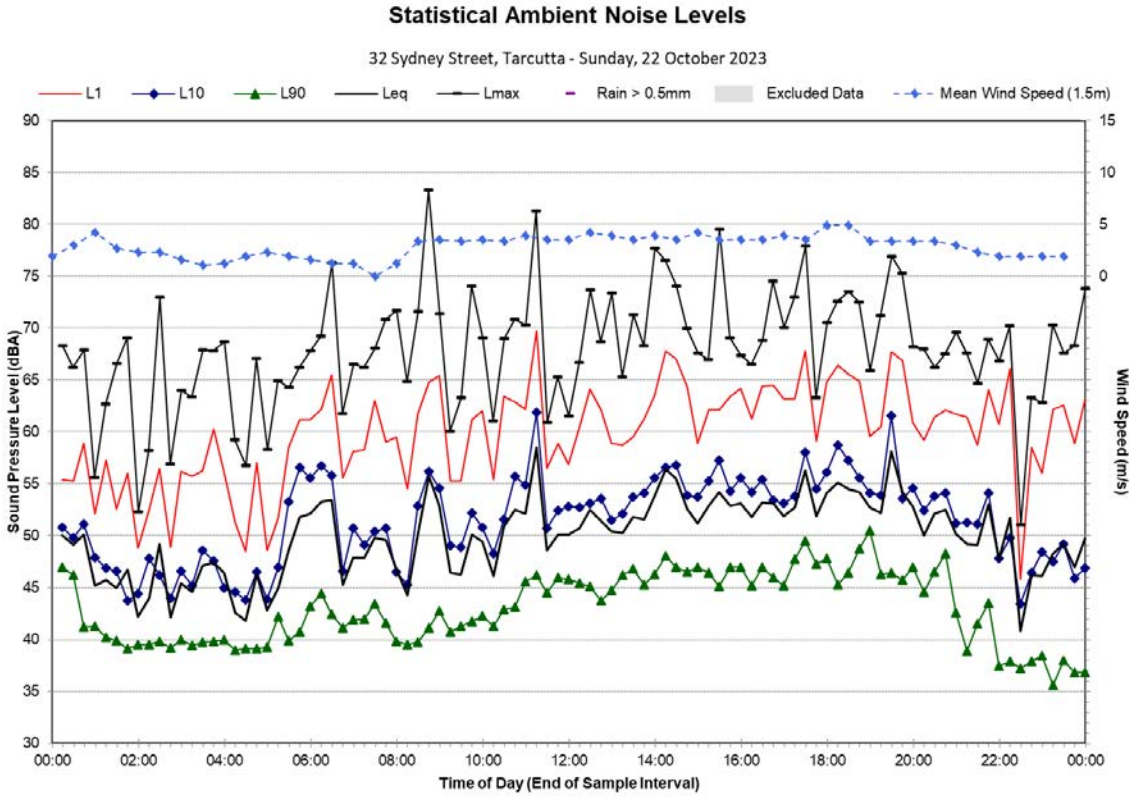

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Tuesday, 17 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

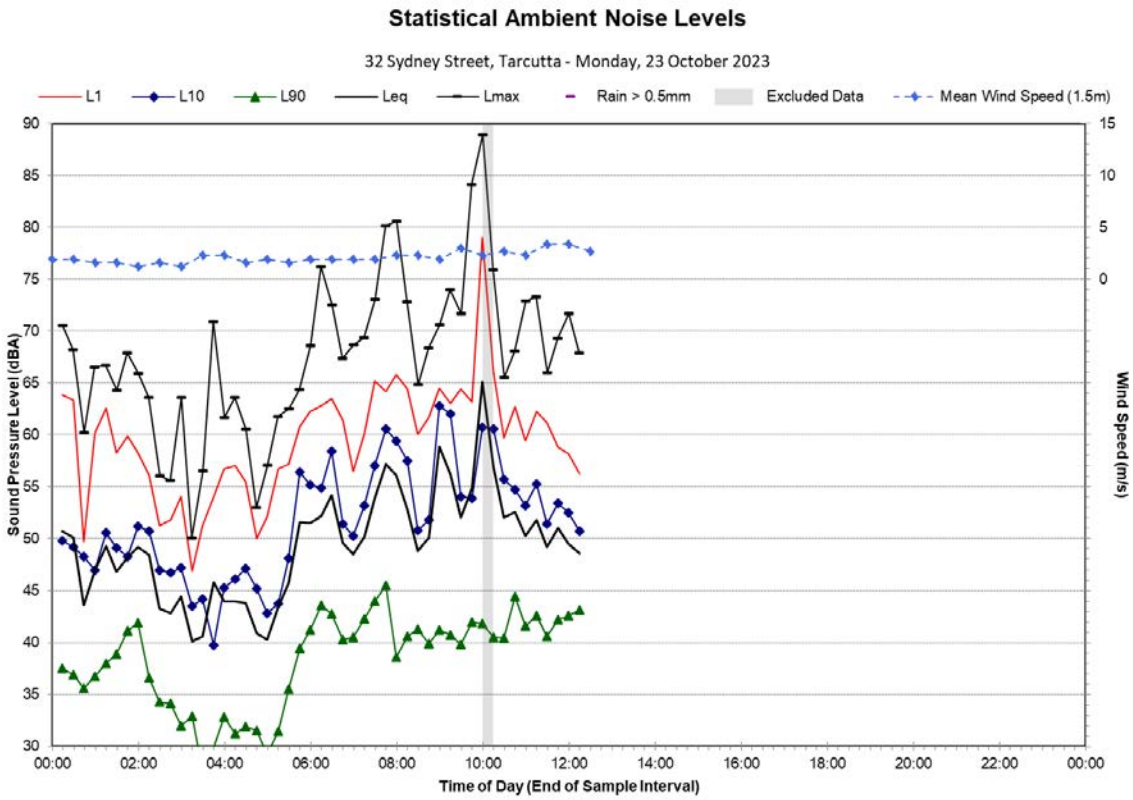

Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Wednesday, 18 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Thursday, 19 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Friday, 20 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Saturday, 21 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Sunday, 22 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
32 Sydney Street, Tarcutta - Monday, 23 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
90
85
80
75
70
65
60
55
50
45
40
35
30
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

Noise Monitoring Location	L.12
Noise Monitoring Address	**113 Faulder Avenue, Yass**

Logger Device Type: Svantek 957, Logger Serial No: 21884

Sound Level Meter Device Type: Rion NA-28, Sound Level Meter Serial No: 1060054

Ambient noise logger deployed at 113 Faulder Avenue, Yass. Logger located on fence line of paddock with view of Faulder Avenue around 30 m to the east. The logger is also in the vicinity of the Hume Highway around 800 m to the north.

Attended noise measurements indicate the ambient noise environment at this location is controlled by road traffic noise. Natural noise sources such as birds and wind also contribute to the L_{Aeq} at this location.

Map of Noise Monitoring Location

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	L_{Aeq}	L10	L1
Daytime	37	50	50	60
Evening	41	51	53	58
Night-time	37	51	53	57

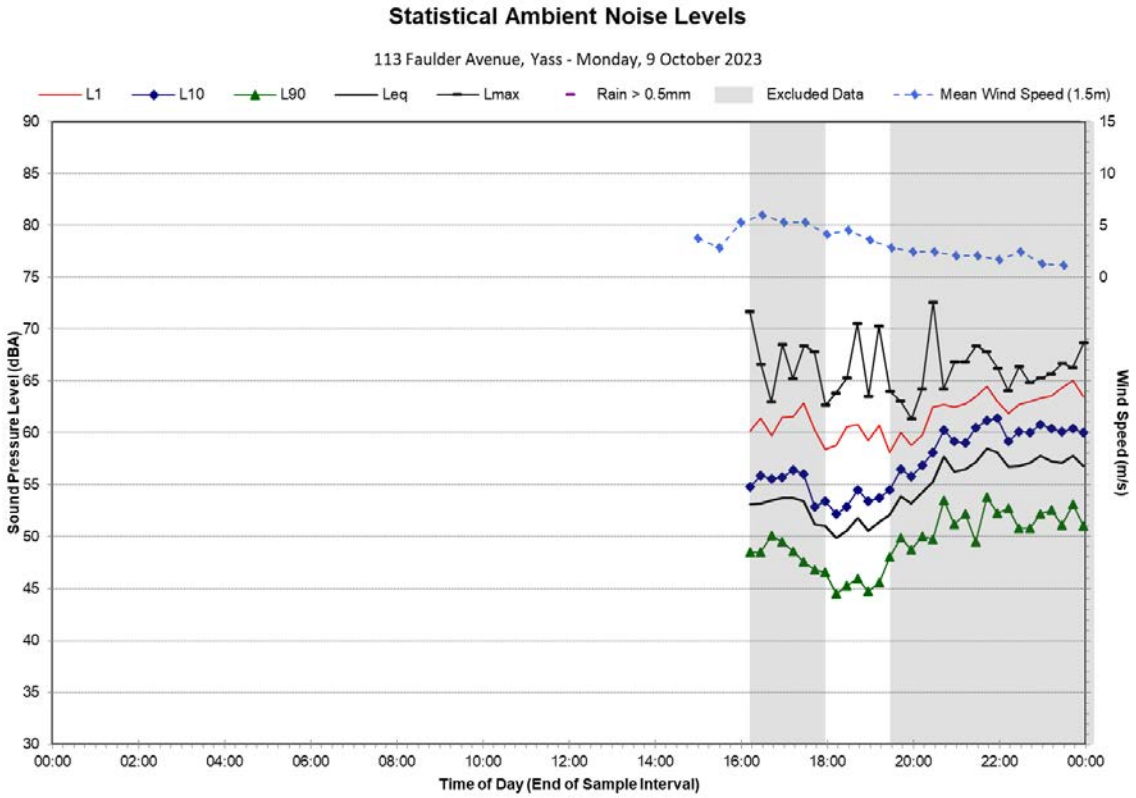
Ambient Noise Logging Results – RNP Defined Time Periods

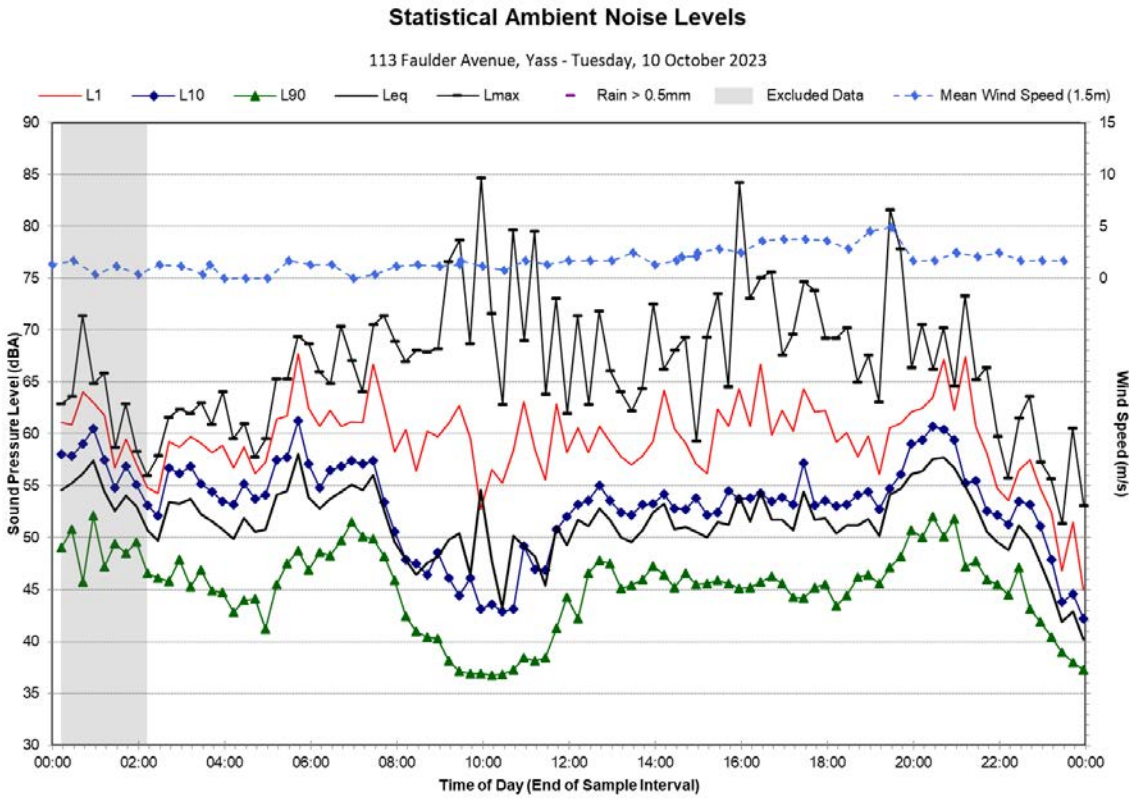
Monitoring Period	Noise Level (dBA)	
	$L_{Aeq(period)}$	$L_{Aeq(1hour)}$
Daytime (7am-10pm)	50	52
Night-time (10pm-7am)	51	52

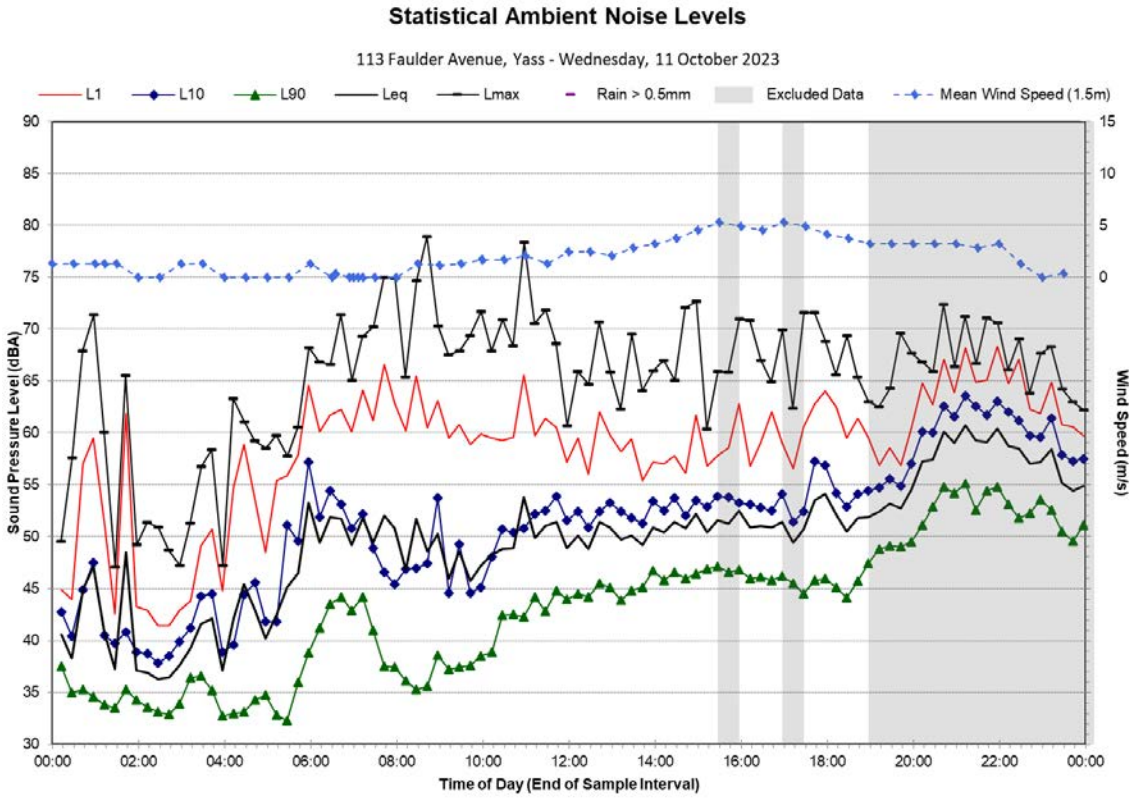
Attended Noise Measurement Results

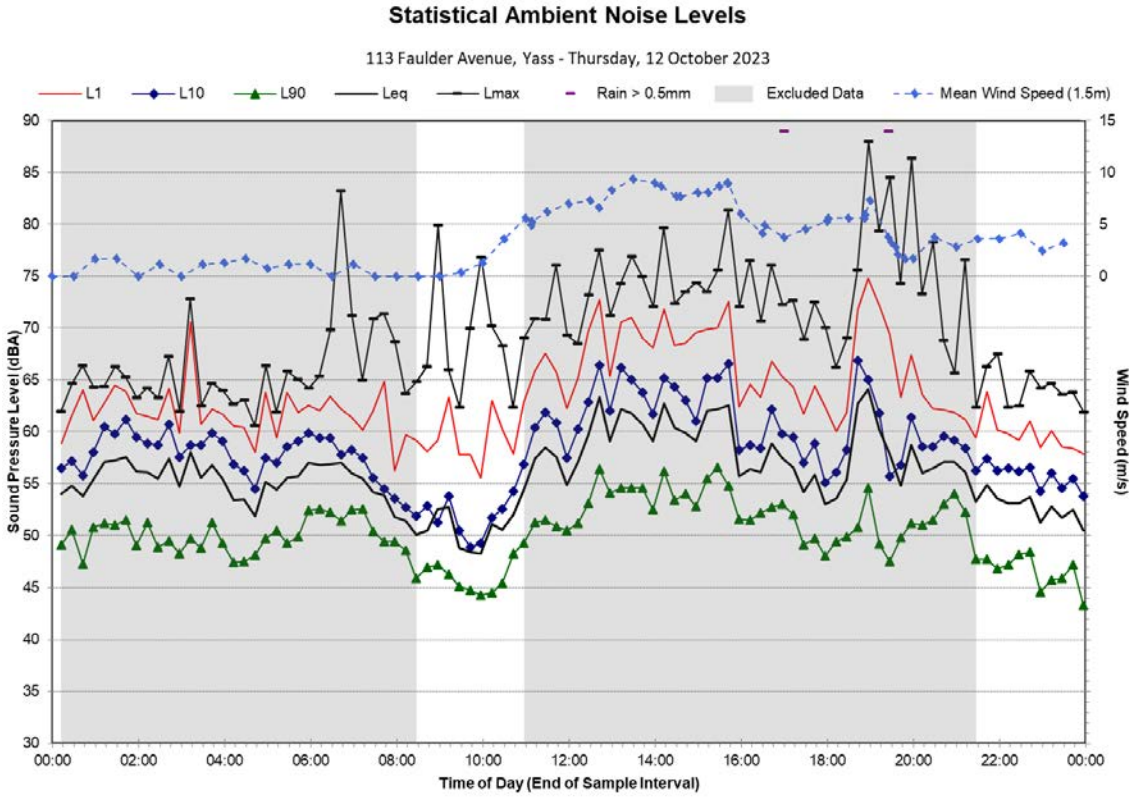
Date	Start Time	Measured Noise Level (dBA)		
		LA90	L_{Aeq}	L_{Amax}
23/10/2023	16:03	48	55	78

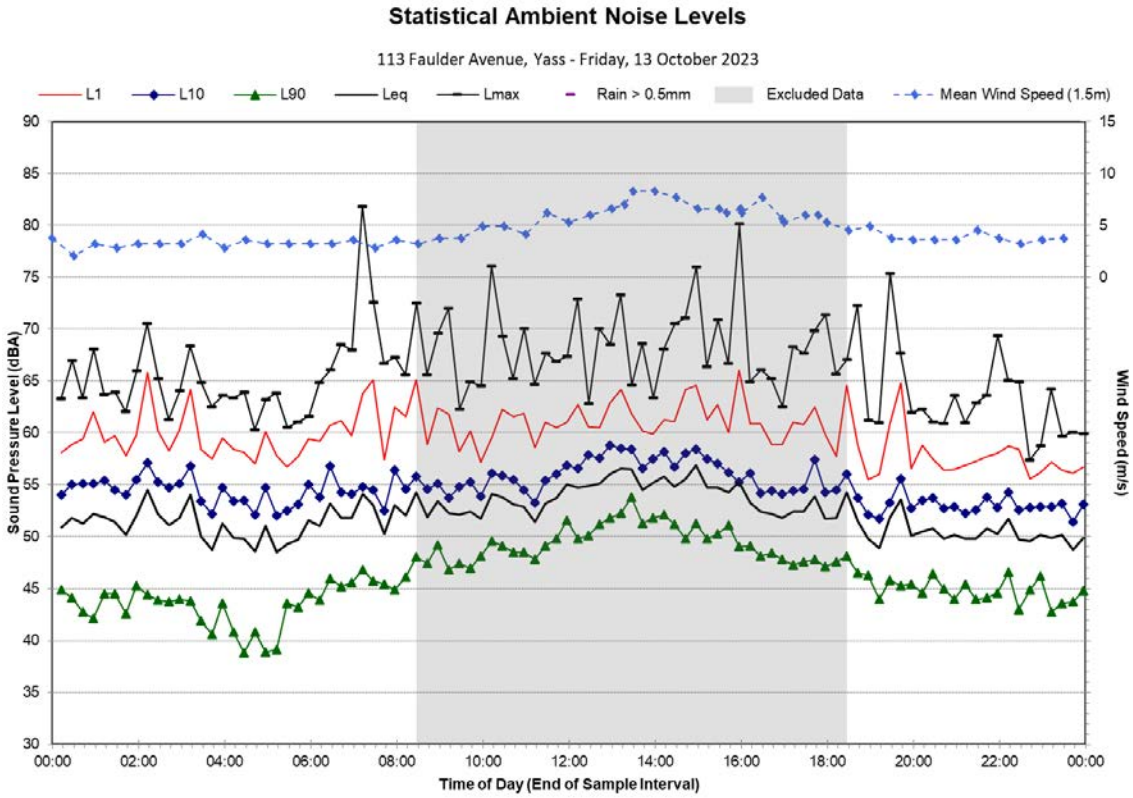
Photo of Noise Monitoring Location

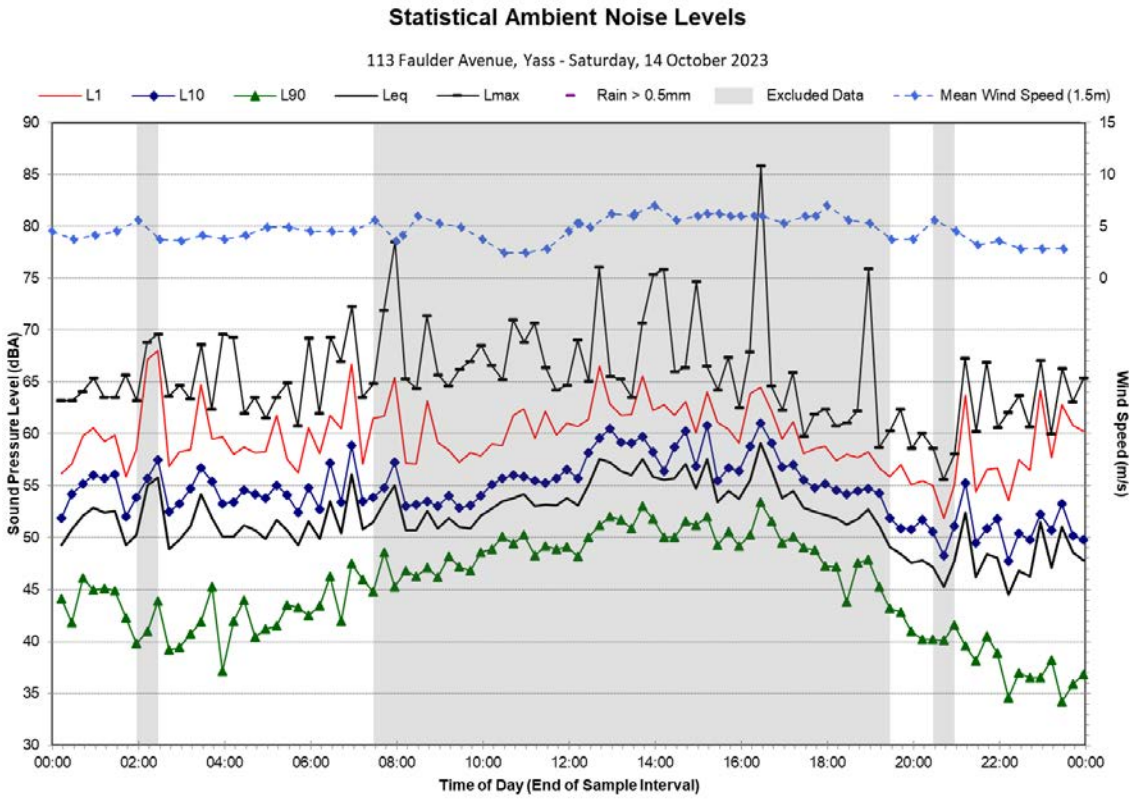

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Monday, 9 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

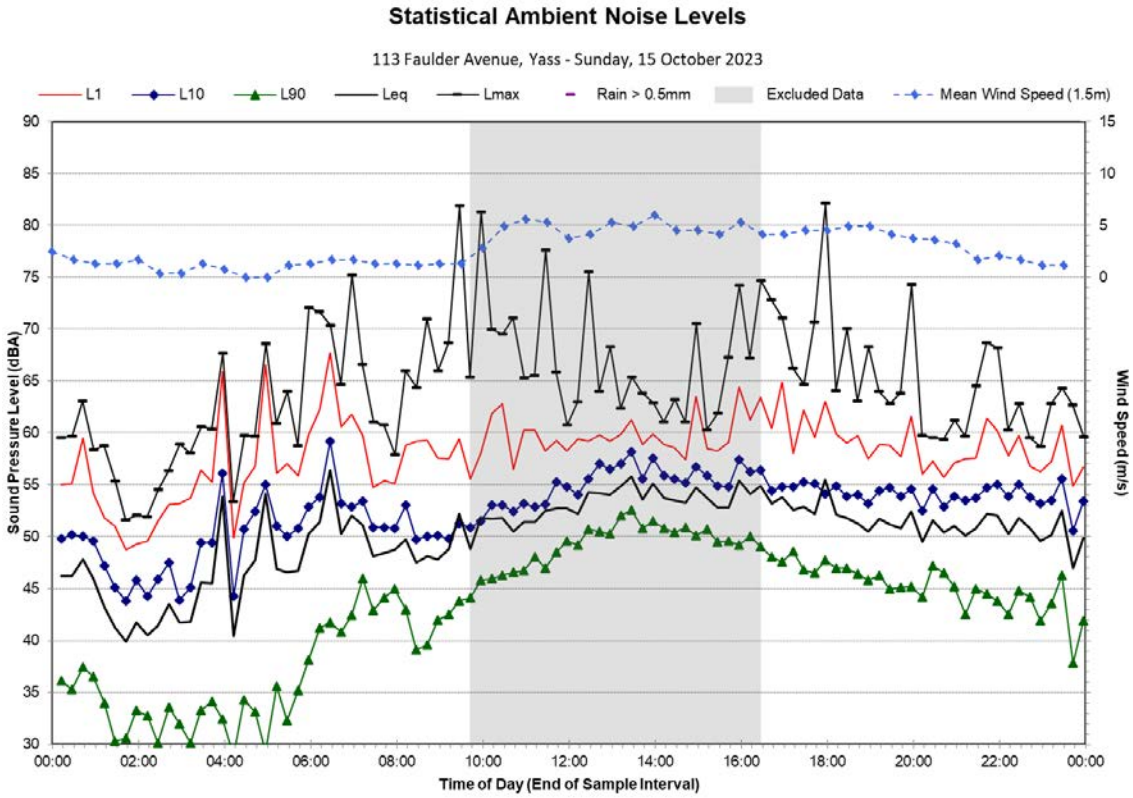

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Tuesday, 10 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

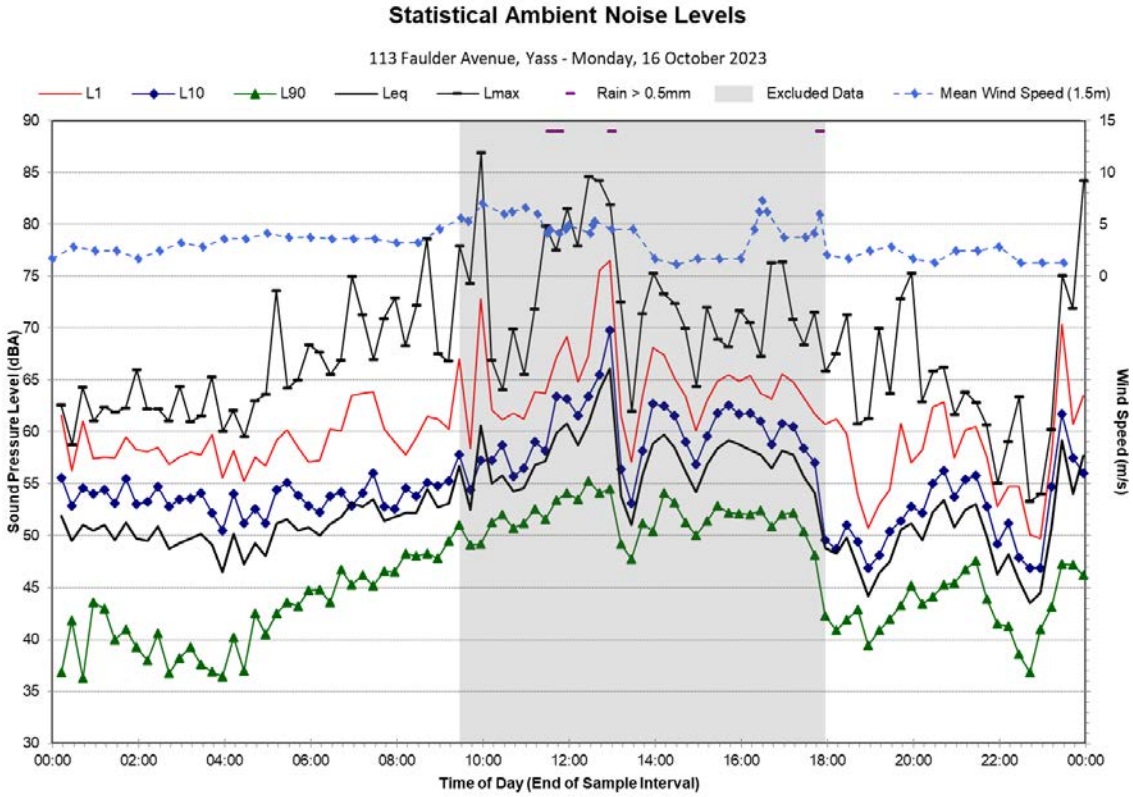

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Wednesday, 11 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

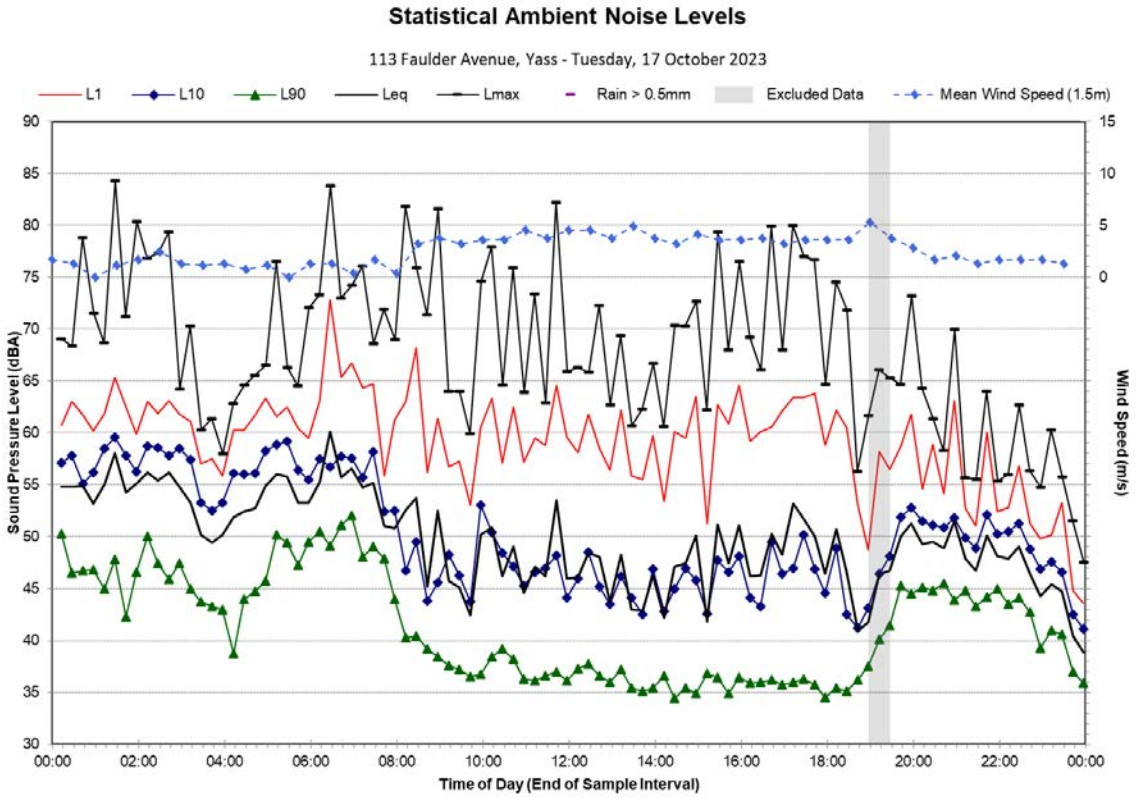

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Thursday, 12 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

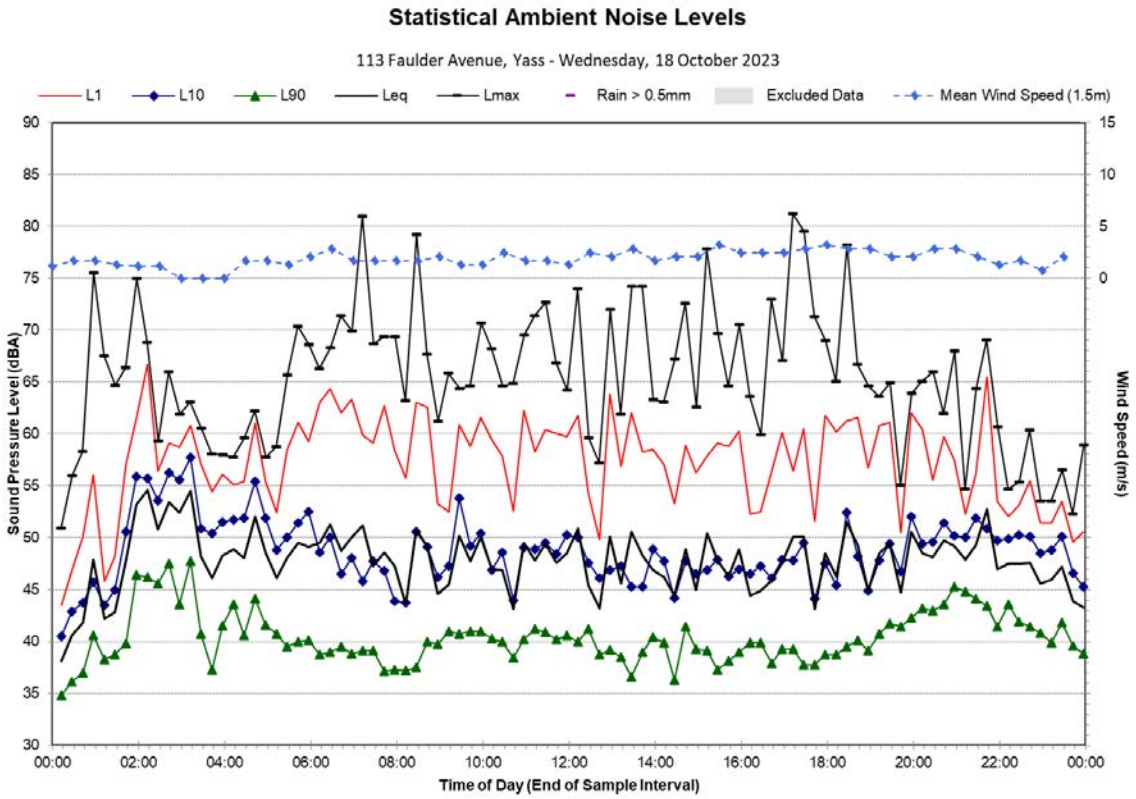

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Friday, 13 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

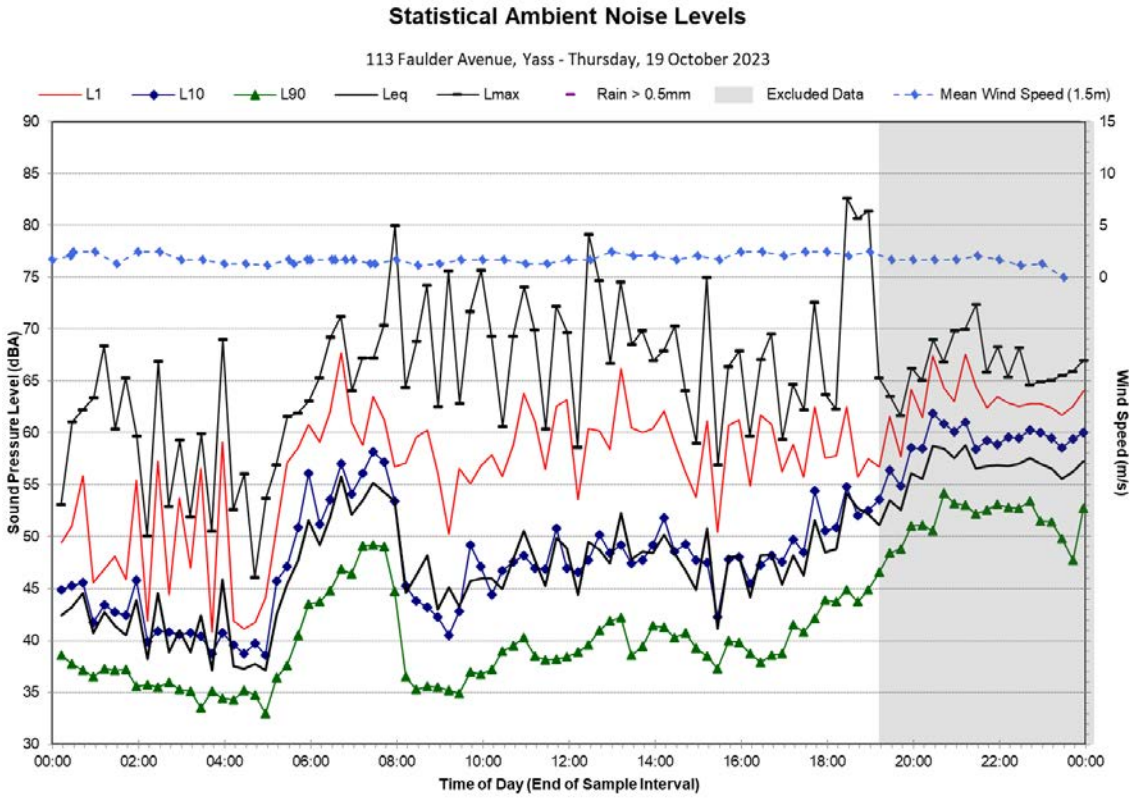

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Saturday, 14 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

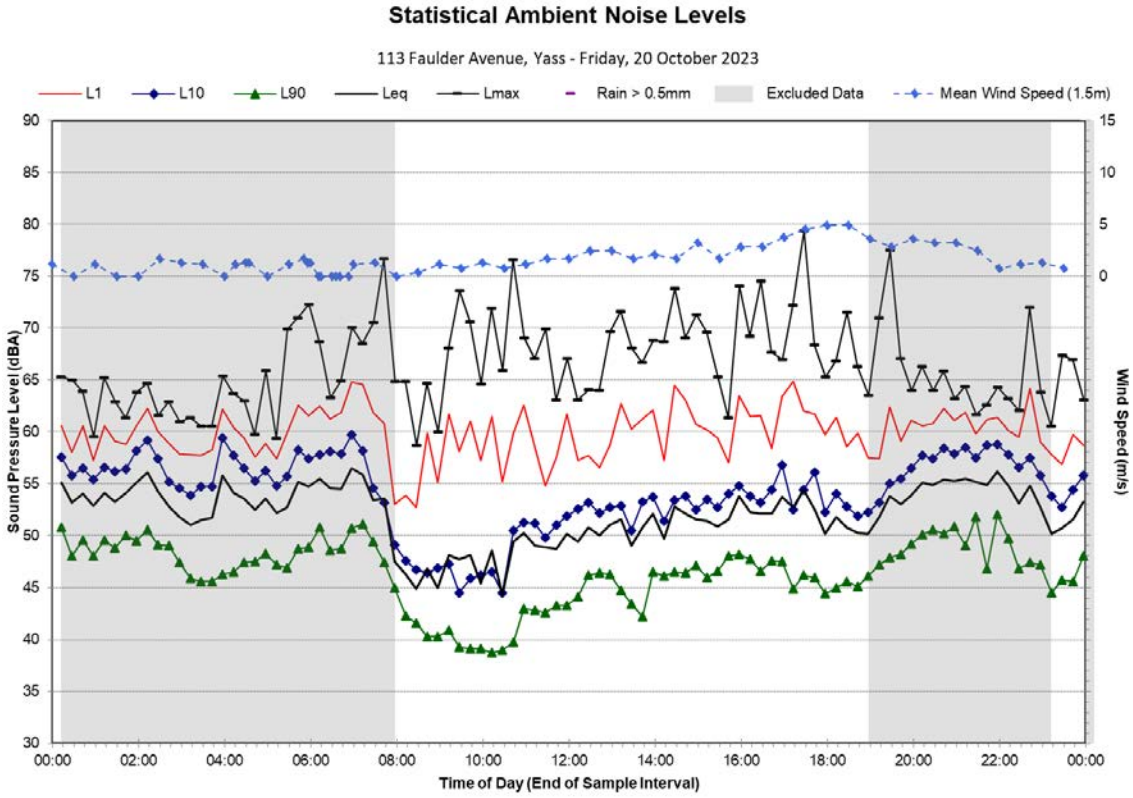

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Sunday, 15 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

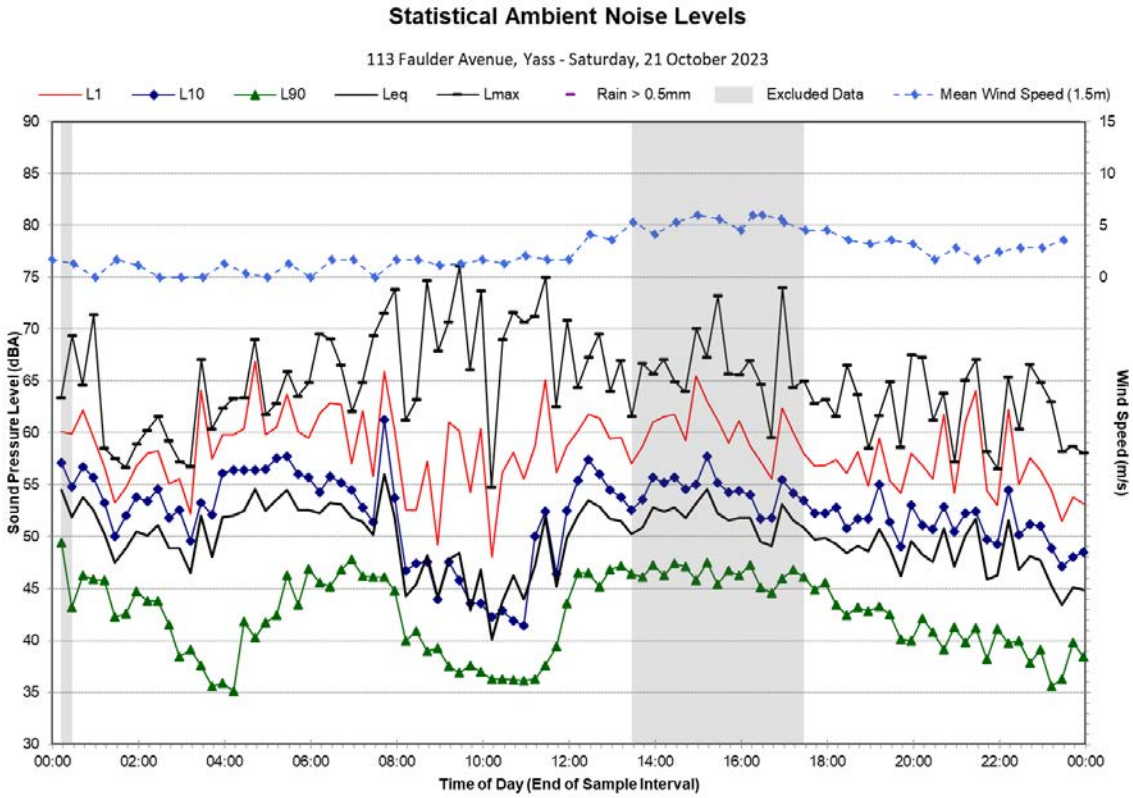

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Monday, 16 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

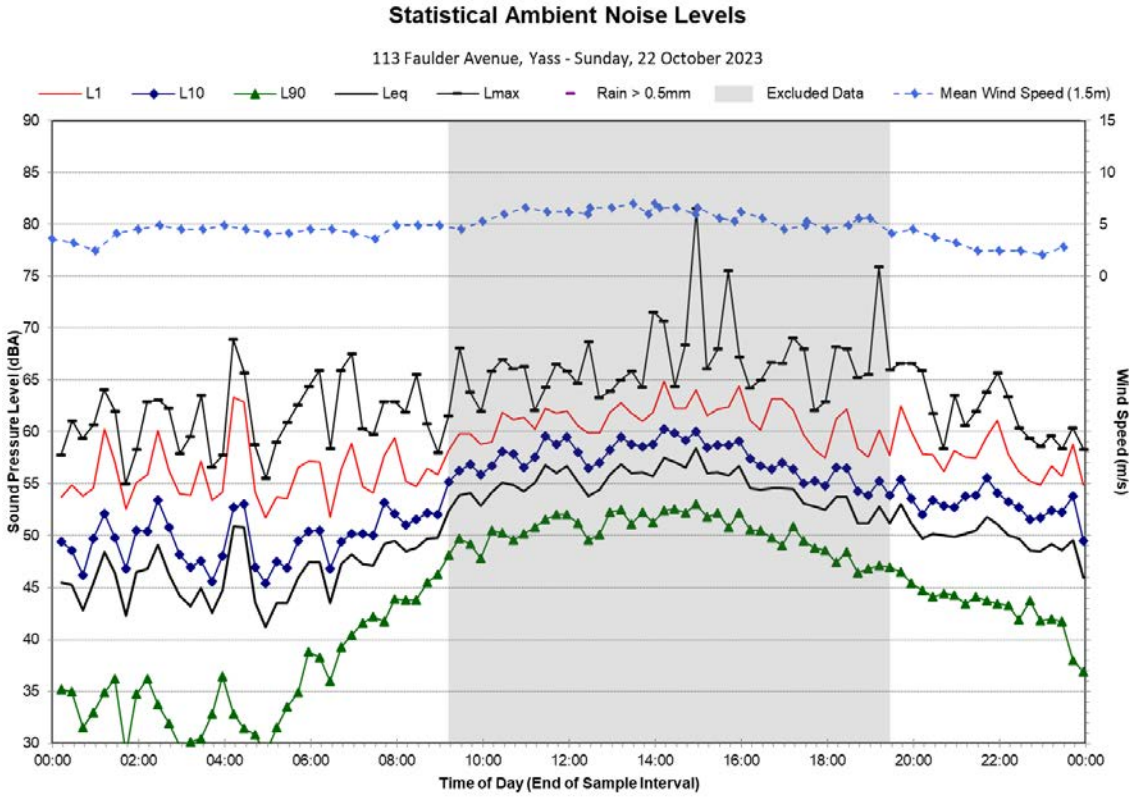

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Tuesday, 17 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

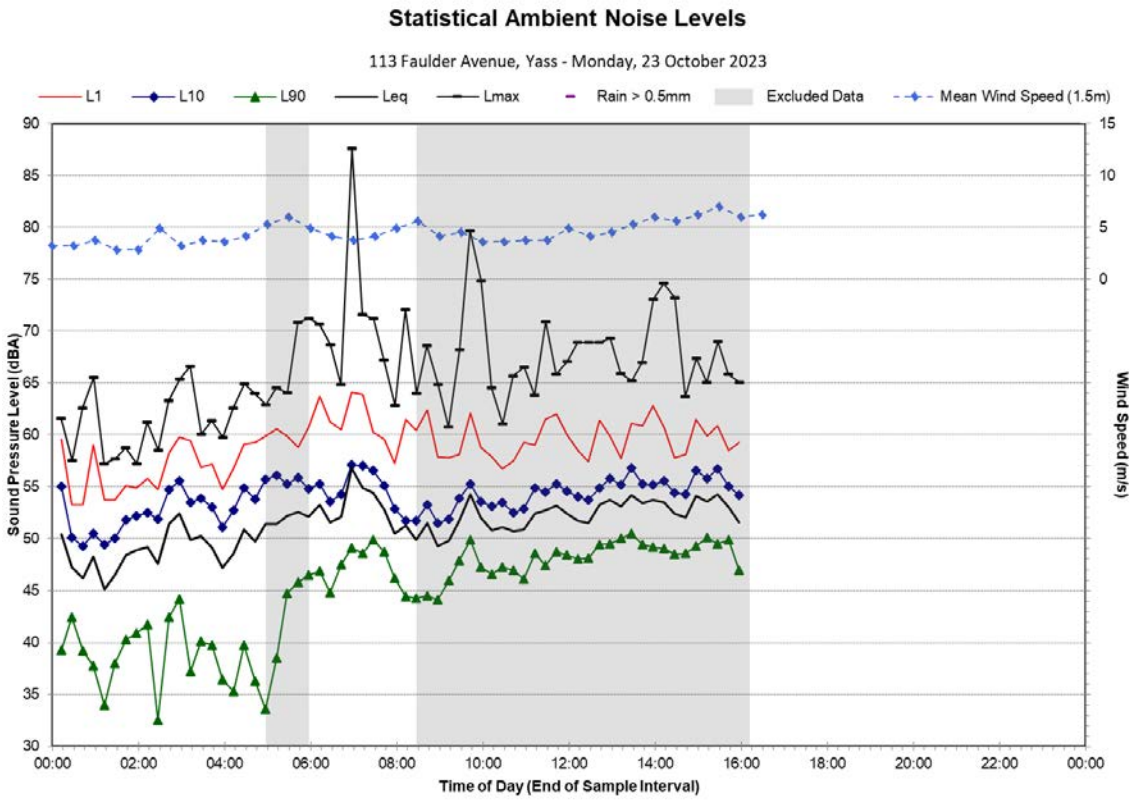

Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Wednesday, 18 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Thursday, 19 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Friday, 20 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Saturday, 21 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Sunday, 22 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue, Yass - Monday, 23 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
90
85
80
75
70
65
60
55
50
45
40
35
30
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

Noise Monitoring Location	L.13
Noise Monitoring Address	**113 Faulder Avenue (Wargeila Road), Yass**

Logger Device Type: Svantek 957, Logger Serial No: 27578

Sound Level Meter Device Type: Rion NA-28, Sound Level Meter Serial No: 1060054

Ambient noise logger deployed at 113 Faulder Avenue, Yass. Logger located on fence line of paddock around 100 m west of Wargeila Road and around 150 m north of Yass Vallye way.

Attended noise measurements indicate the ambient noise environment at this location is controlled by road traffic noise. Natural noise sources such as birds and wind also contribute to the L_{Aeq} at this location.

Map of Noise Monitoring Location

Ambient Noise Logging Results – ICNG Defined Time Periods

Monitoring Period	Noise Level (dBA)			
	RBL	LAeq	L10	L1
Daytime	36	46	47	53
Evening	38	47	49	54
Night-time	34	46	48	53

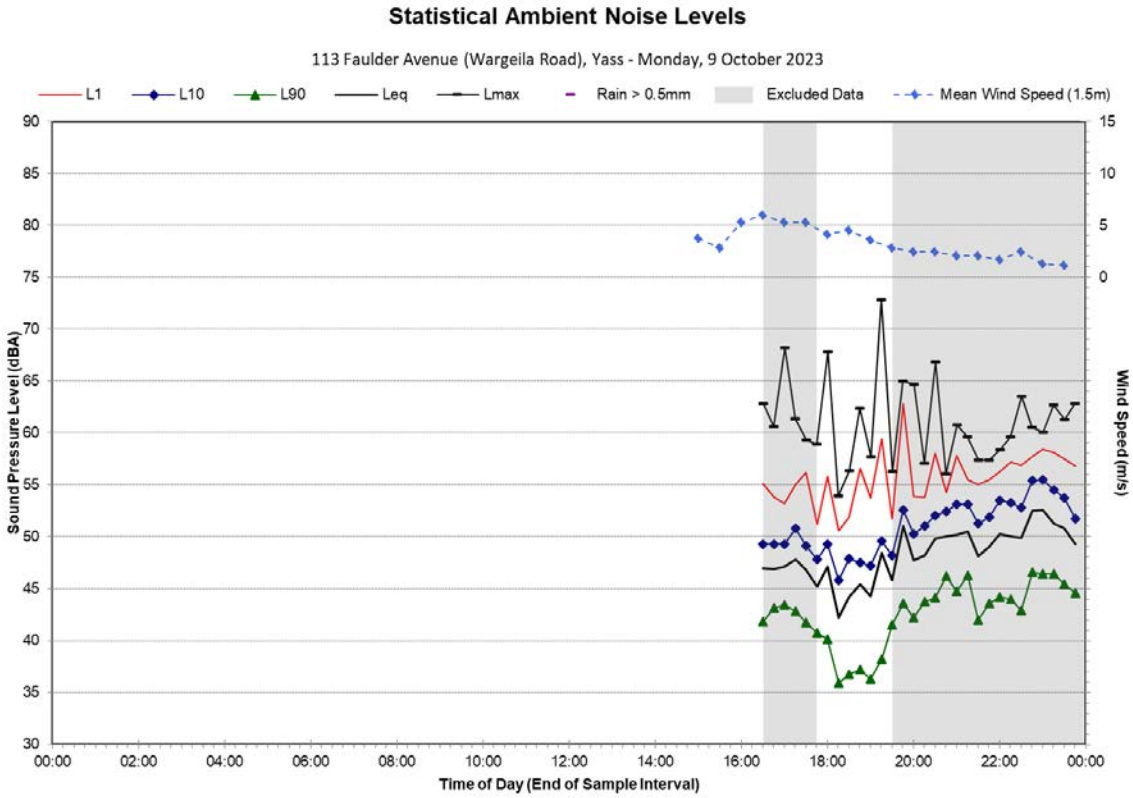
Ambient Noise Logging Results – RNP Defined Time Periods

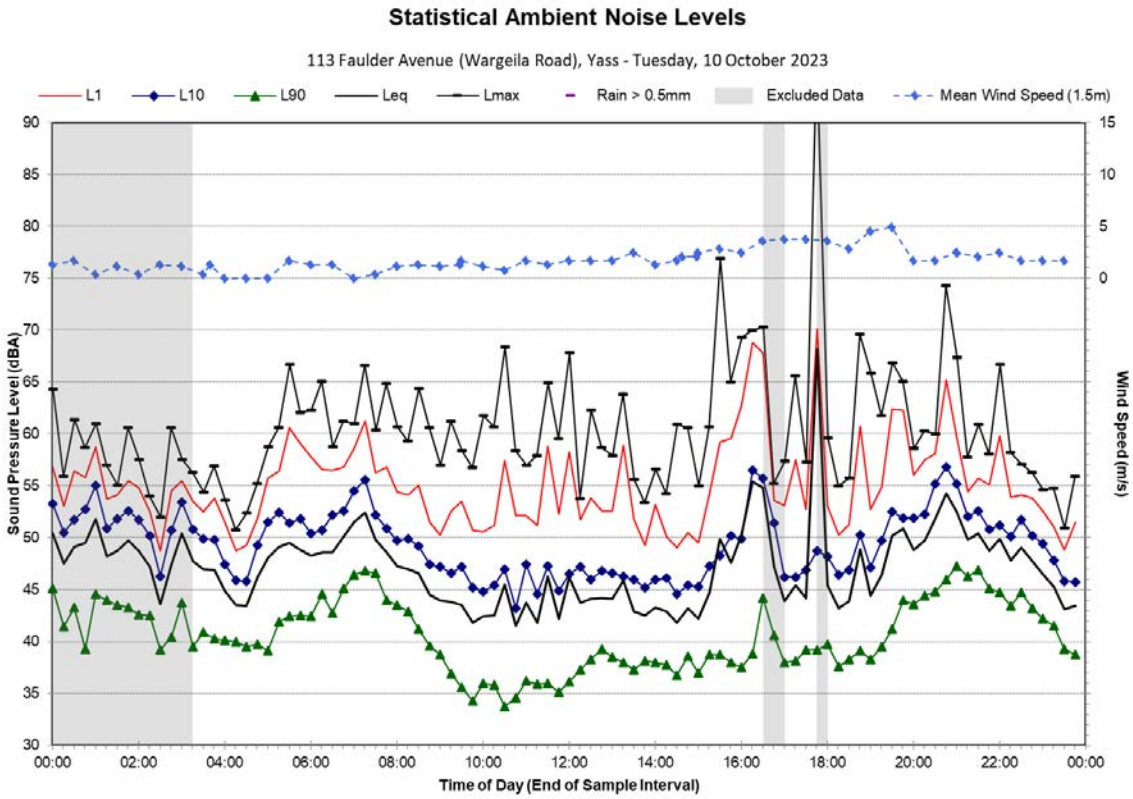
Monitoring Period	Noise Level (dBA)	
	LAeq(period)	LAeq(1hour)
Daytime (7am-10pm)	47	49
Night-time (10pm-7am)	46	48

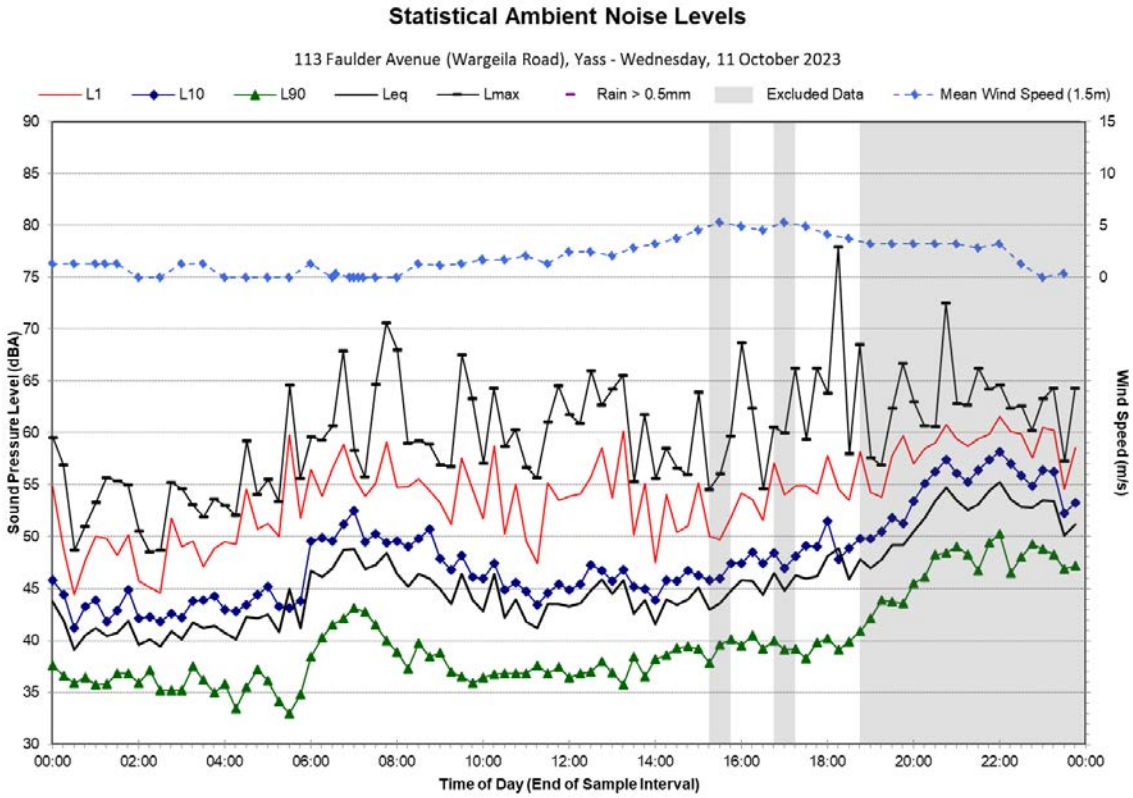
Attended Noise Measurement Results

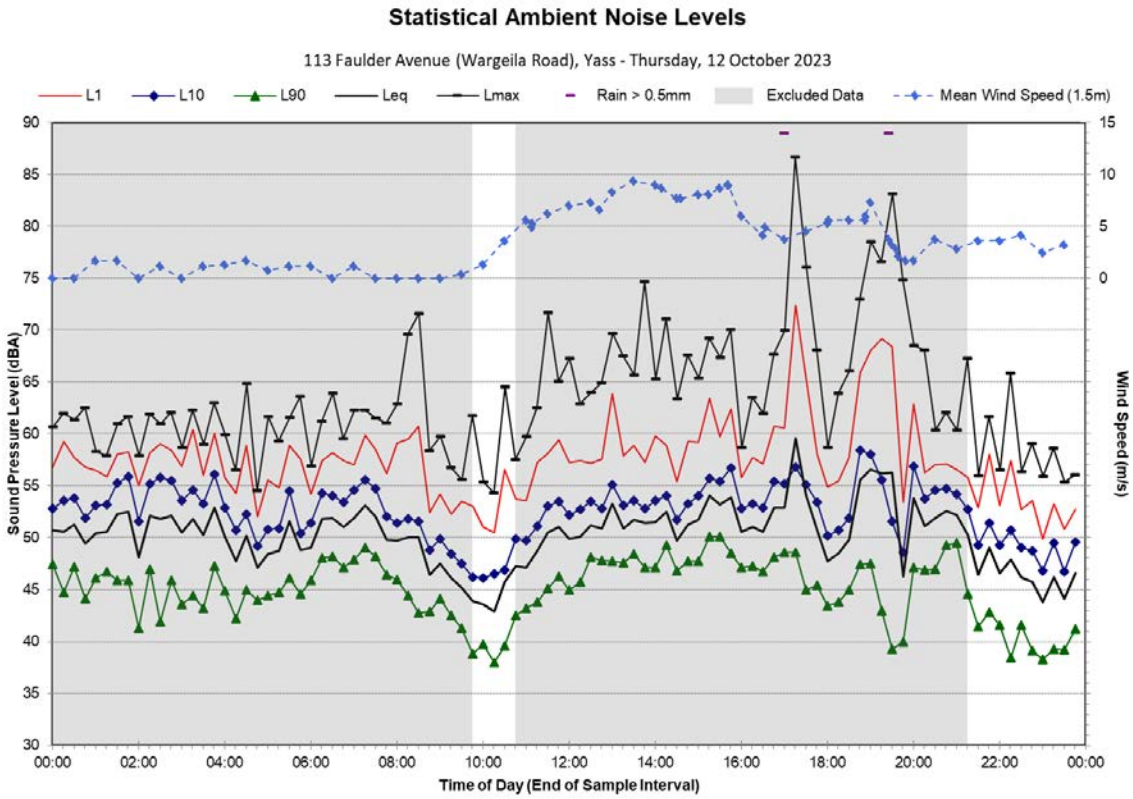
Date	Start Time	Measured Noise Level (dBA)		
		LA90	LAeq	LAmax
23/10/2023	16:30	42	52	76

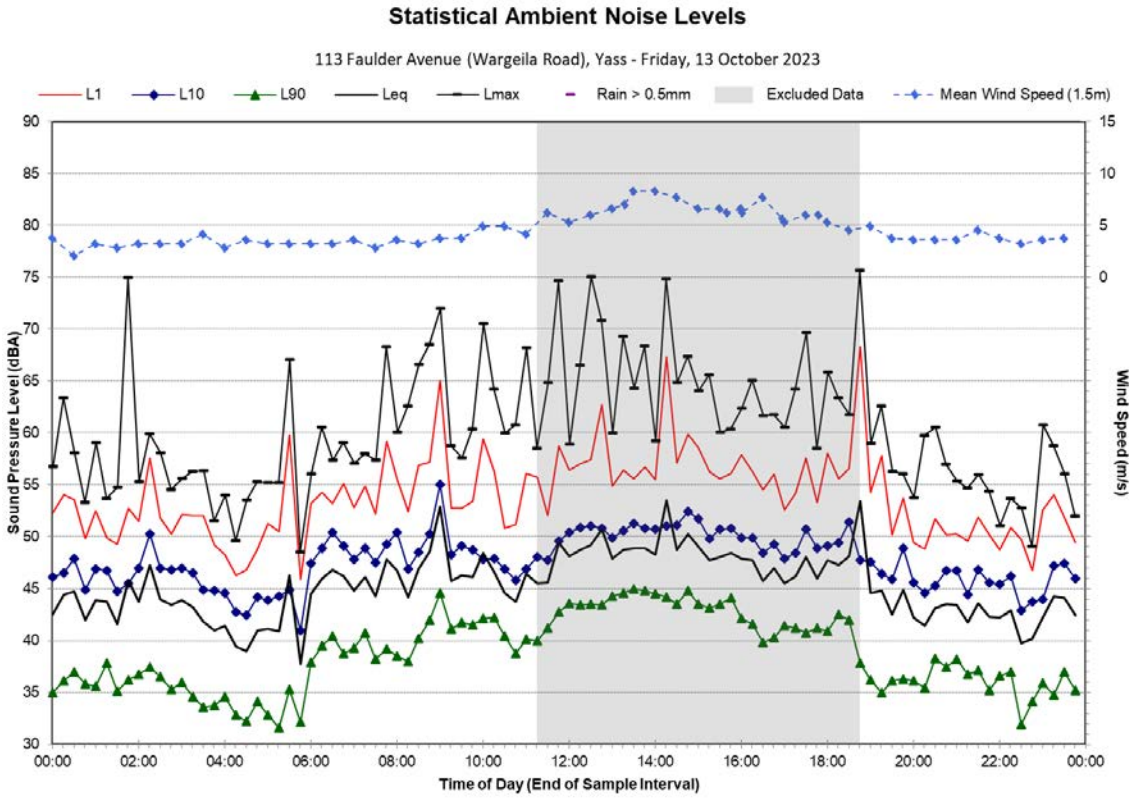
Photo of Noise Monitoring Location

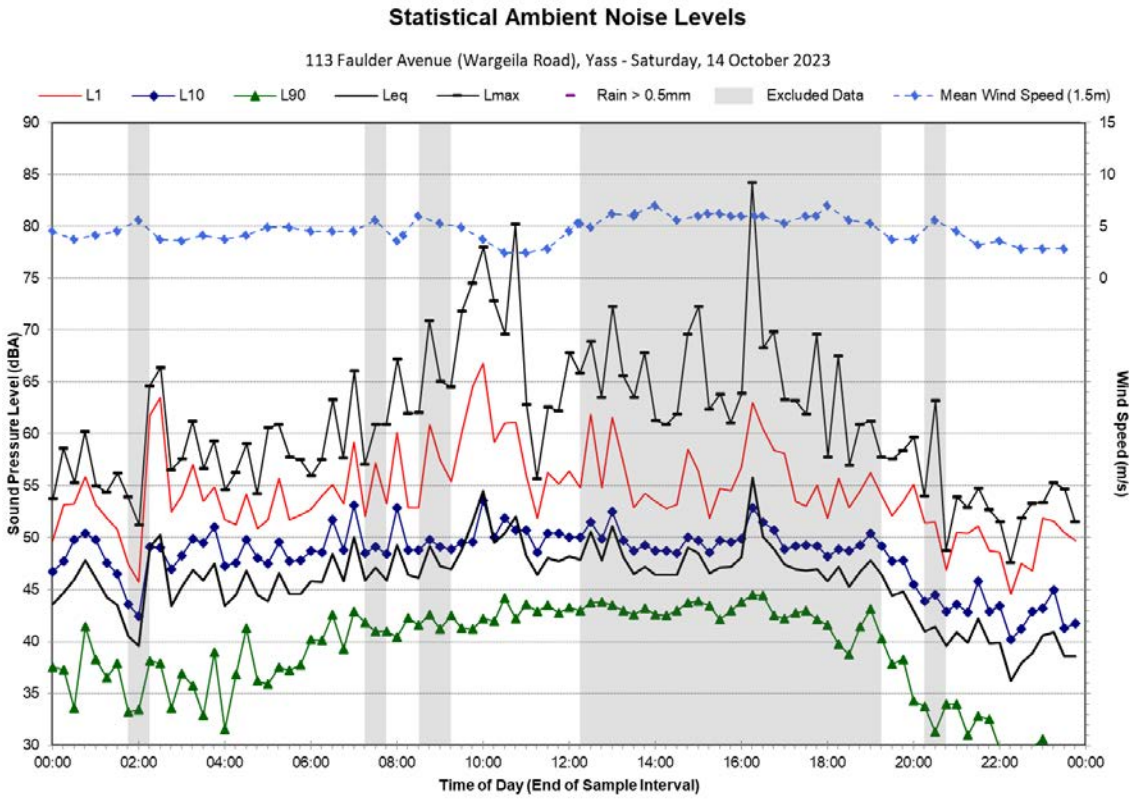

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Monday, 9 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

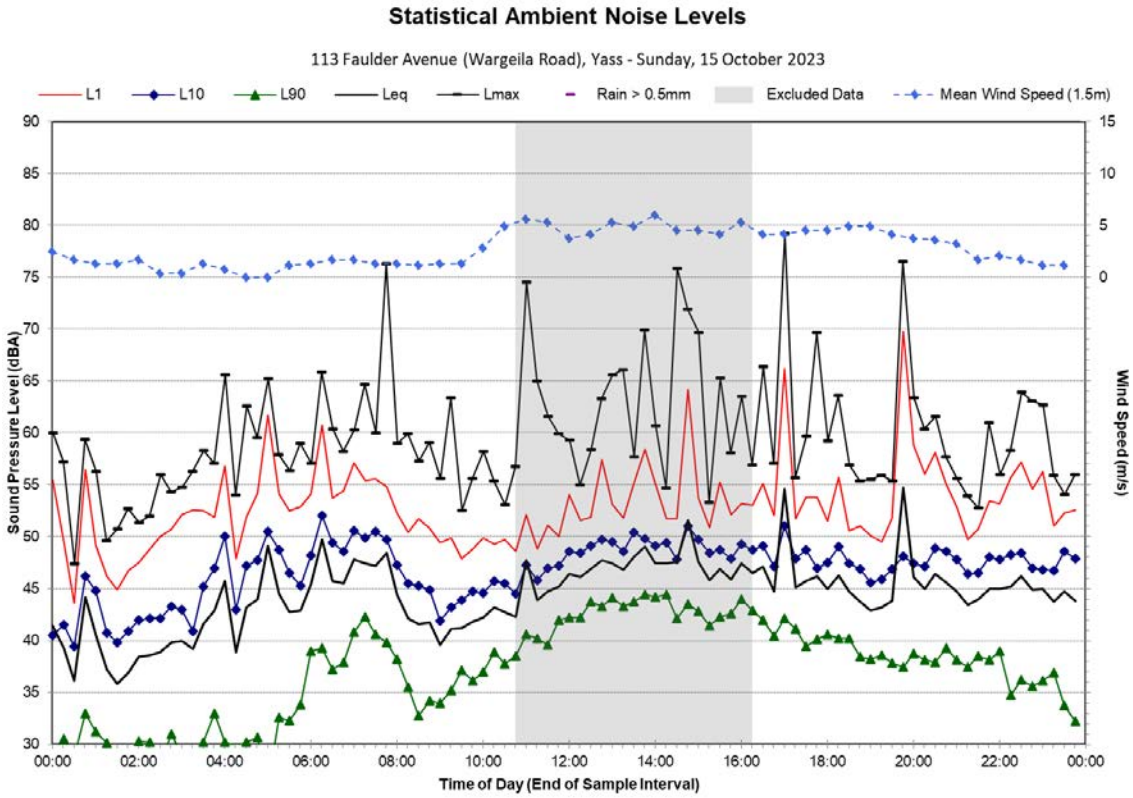

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Tuesday, 10 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

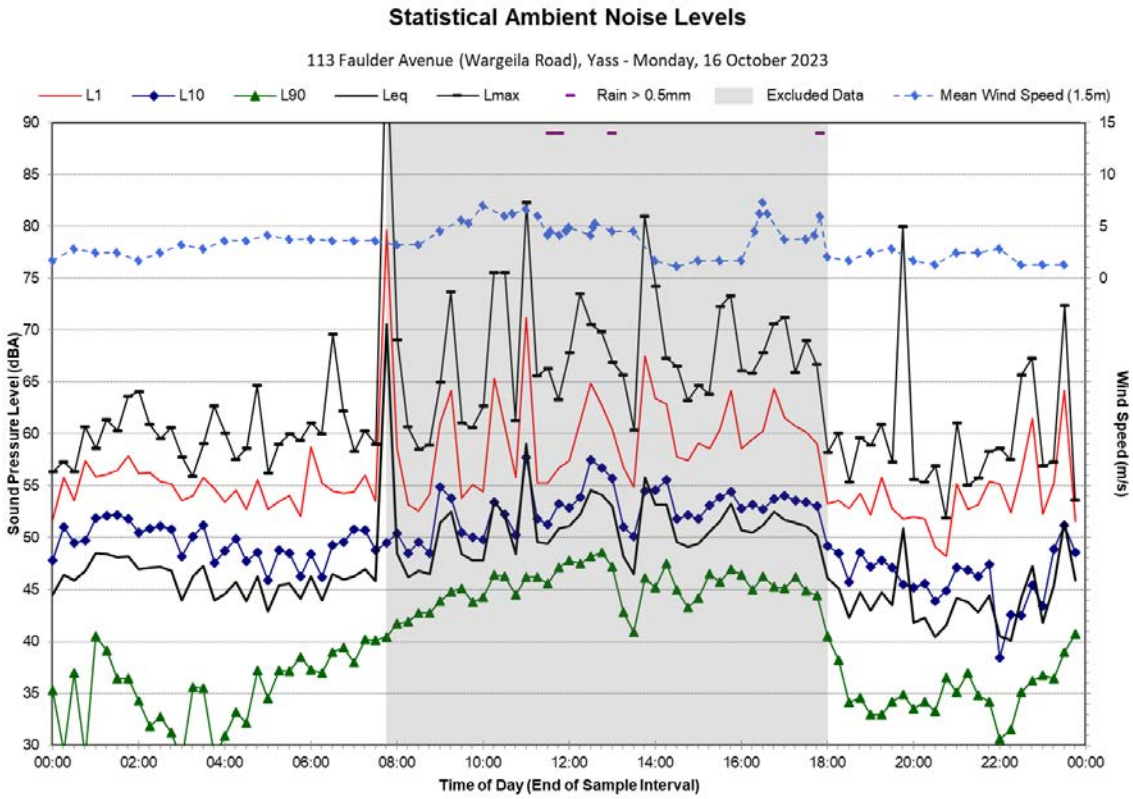

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Wednesday, 11 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

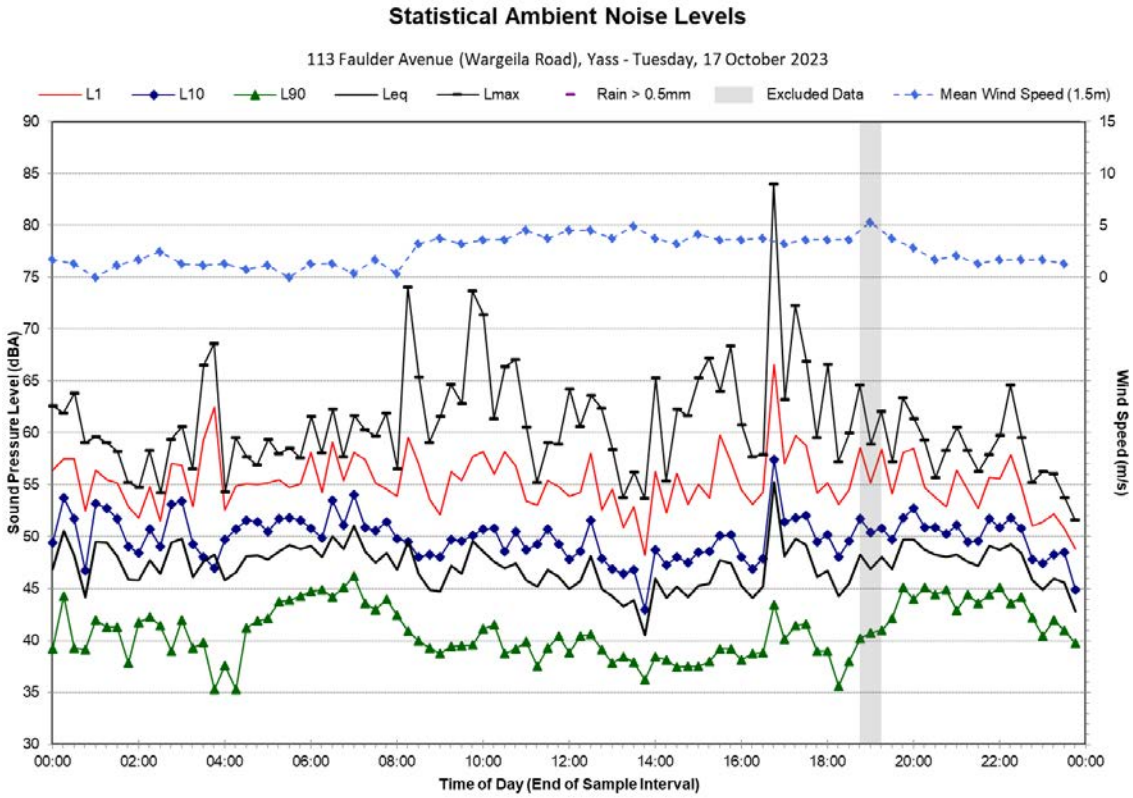

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Thursday, 12 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

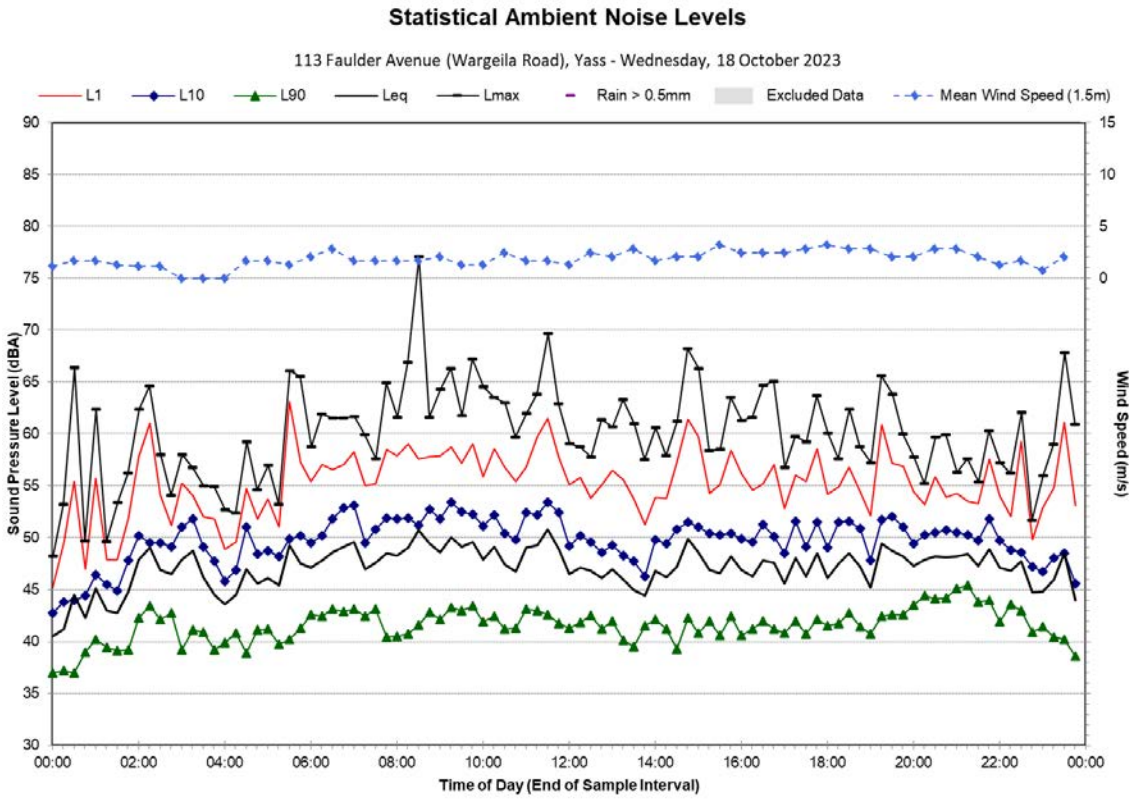

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Friday, 13 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

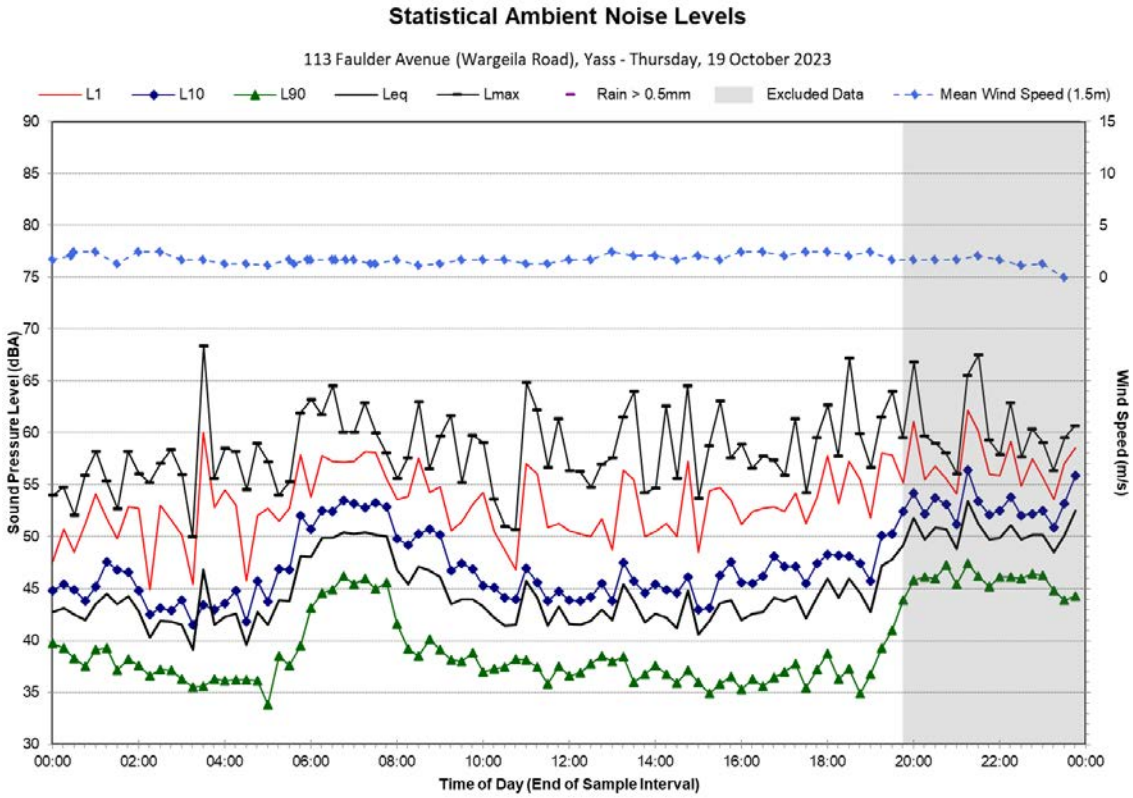

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Saturday, 14 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

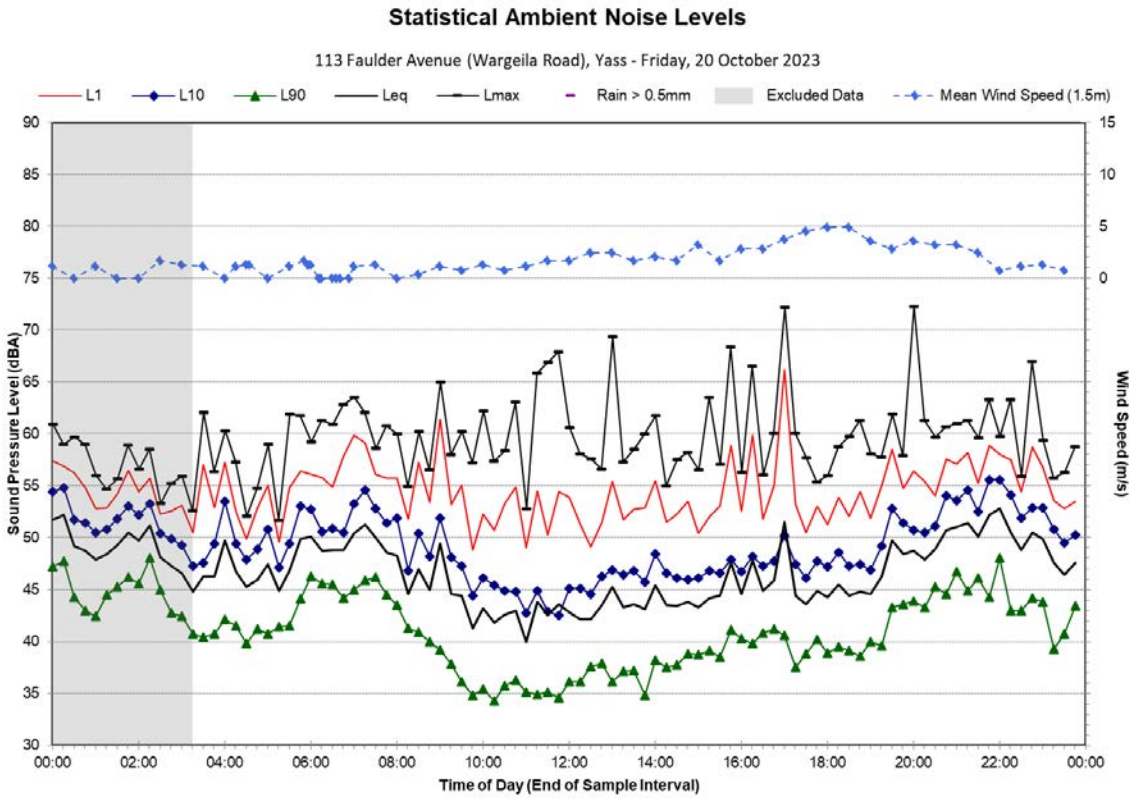

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Sunday, 15 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

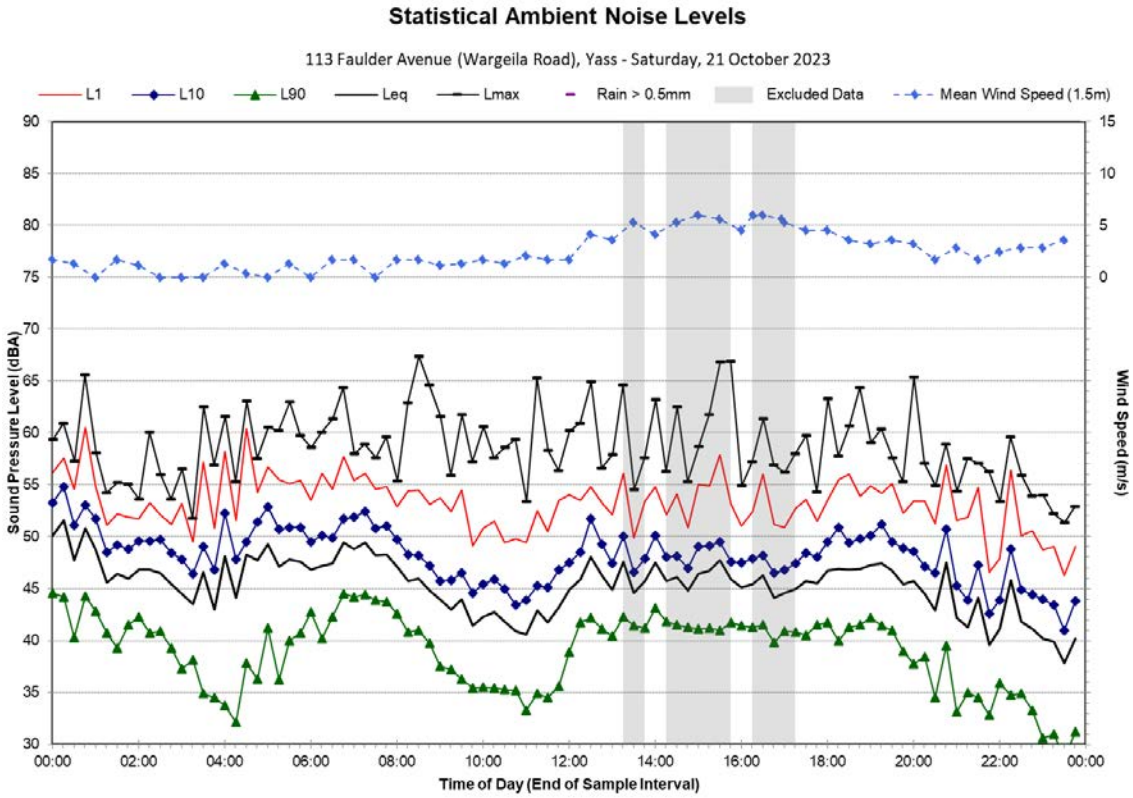

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Monday, 16 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

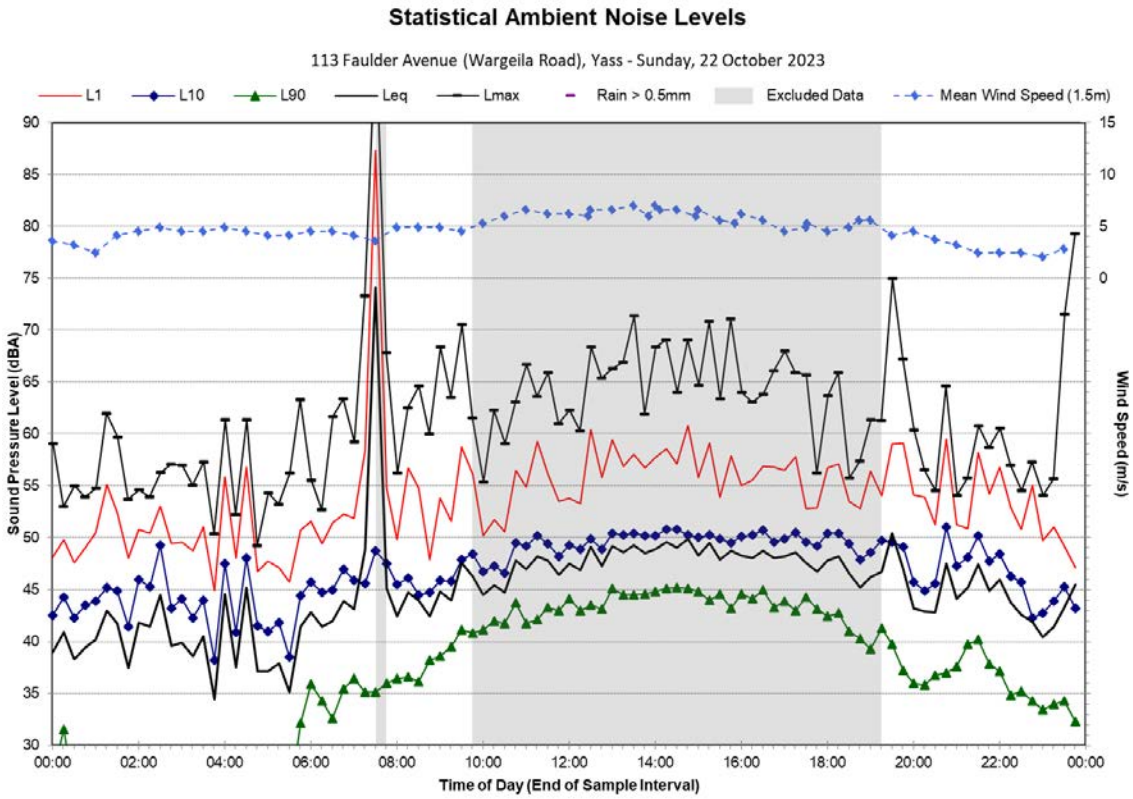

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Tuesday, 17 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

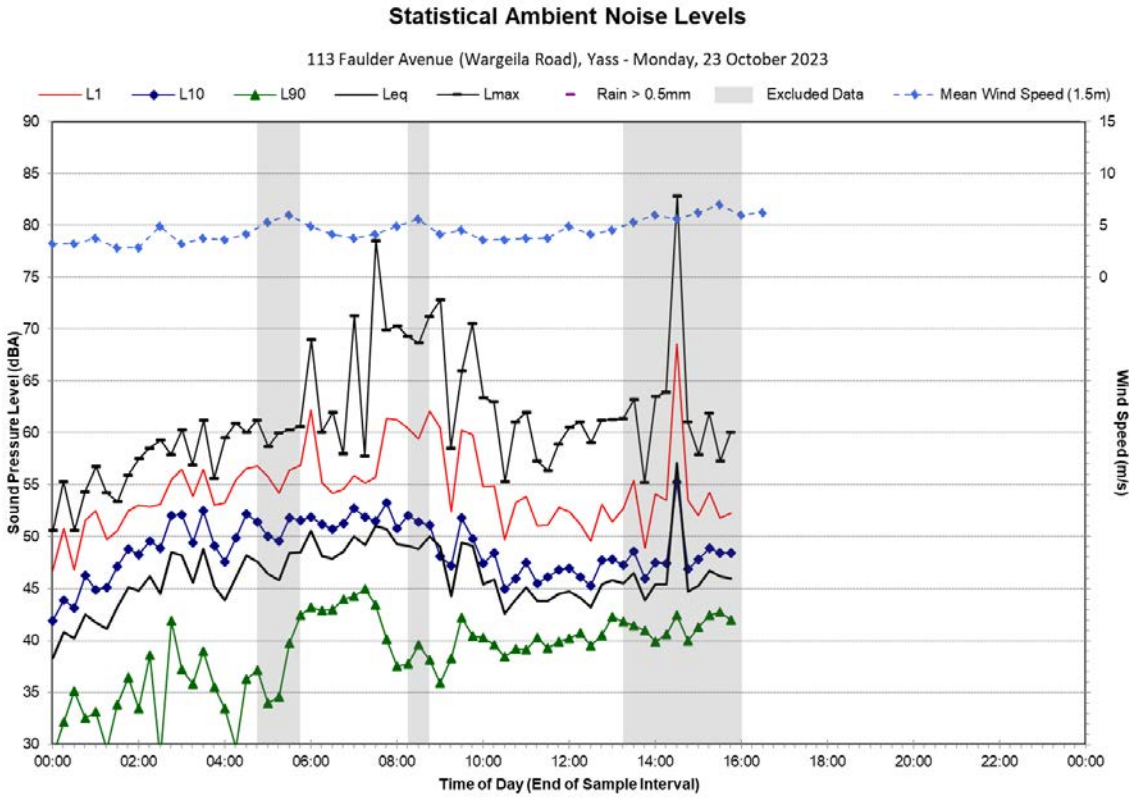

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Wednesday, 18 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Thursday, 19 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Friday, 20 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

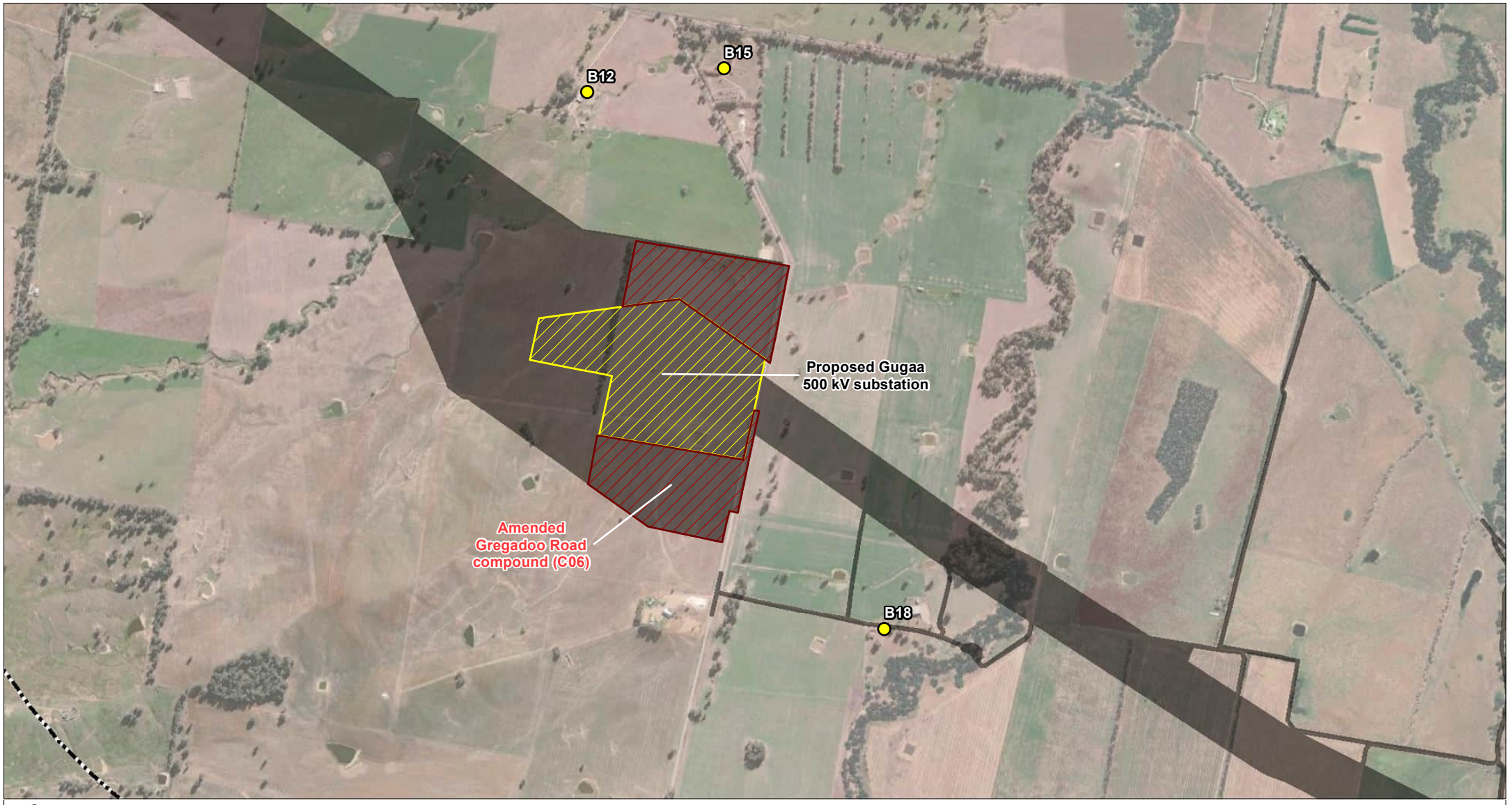

Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Saturday, 21 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Sunday, 22 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
113 Faulder Avenue (Wargeila Road), Yass - Monday, 23 October 2023
L1
L10
L90
Leq
Lmax
Rain > 0.5mm
Excluded Data
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
90
85
80
75
70
65
60
55
50
45
40
35
30
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

Attachment G Construction noise impact mapping

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum



0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

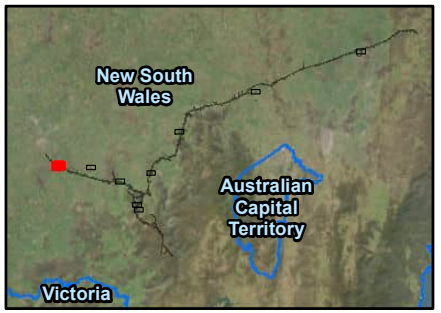
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
- >20 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
C06

ATTACHMENT G.1

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G1_Worst-case Compound Noise Impacts (Day).mxd

0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

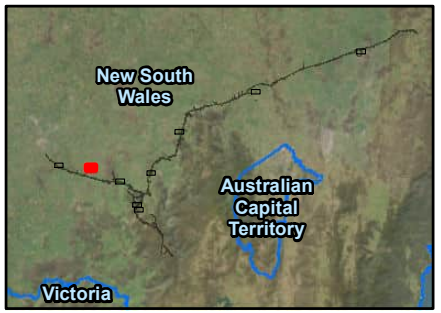
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
- >20 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
AC03
PAGE 2 OF 10

ATTACHMENT G.1

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0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

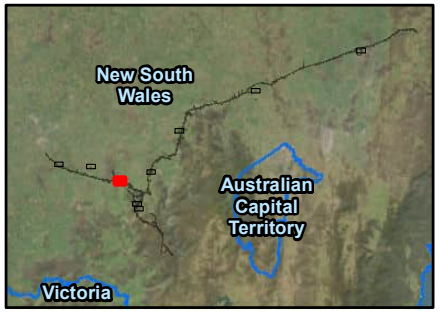
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
- >20 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
C21
PAGE 3 OF 10

ATTACHMENT G.1

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G1_Worst-case Compound Noise Impacts (Day).mxd

0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
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- Amended study area

Noise Impacts

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Project Components

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- Amended project footprint
- Construction compound
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- Telecommunications connection
- Potential controlled blasting area

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
C17
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ATTACHMENT G.1

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G1_Worst-case Compound Noise Impacts (Day).mxd

0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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Project Components

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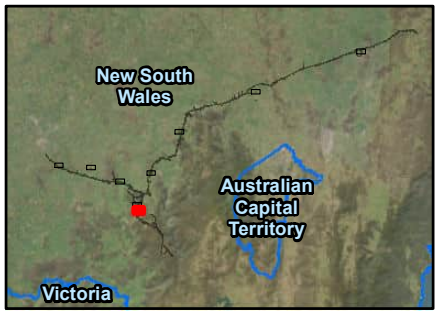
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
AC07
PAGE 5 OF 10

ATTACHMENT G.1

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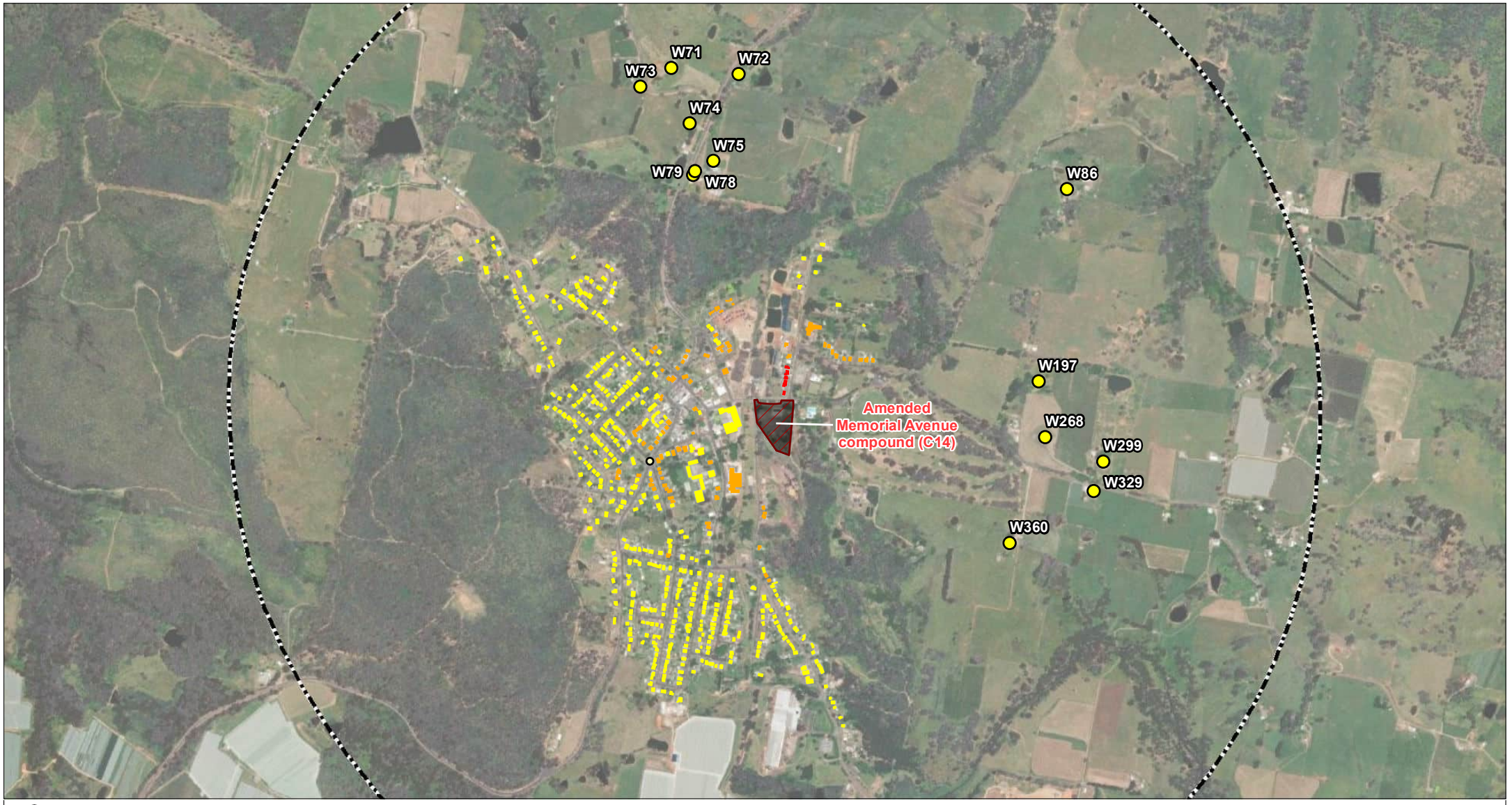

0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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Project Components

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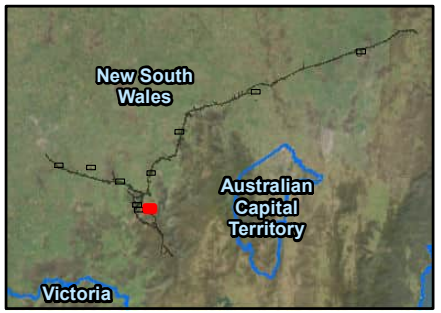
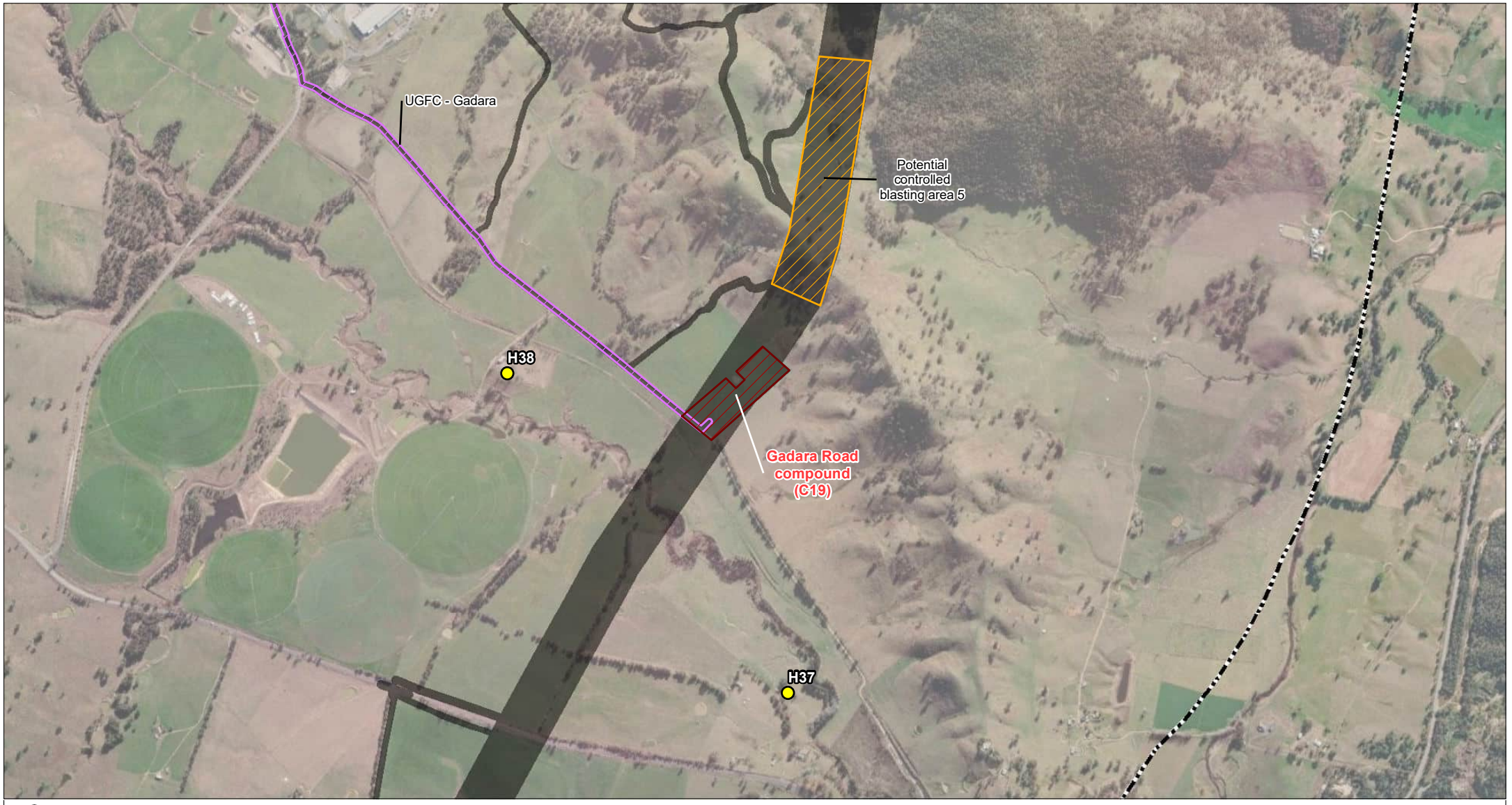
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
C14

ATTACHMENT G.1



0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

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- >20 dB (Highly intrusive)

Project Components

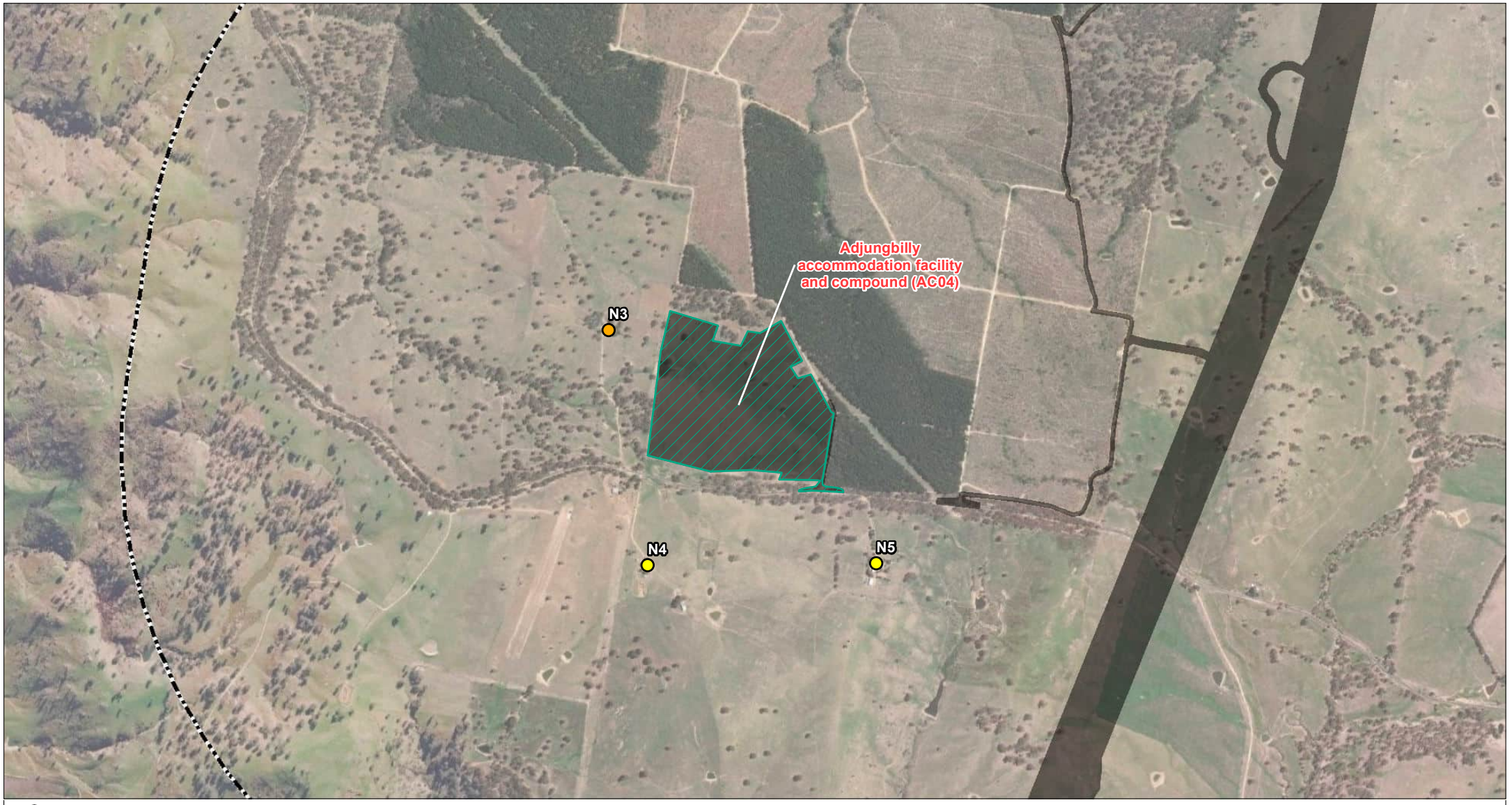
- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
C19
PAGE 7 OF 10

ATTACHMENT G.1

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G1_Worst-case Compound Noise Impacts (Day).mxd



0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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Noise Impacts

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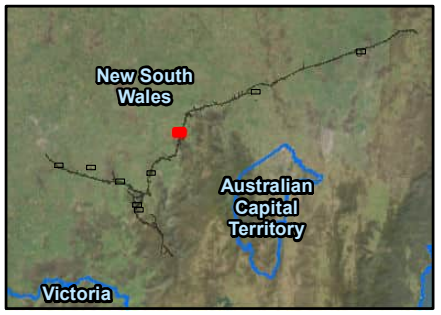
Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area

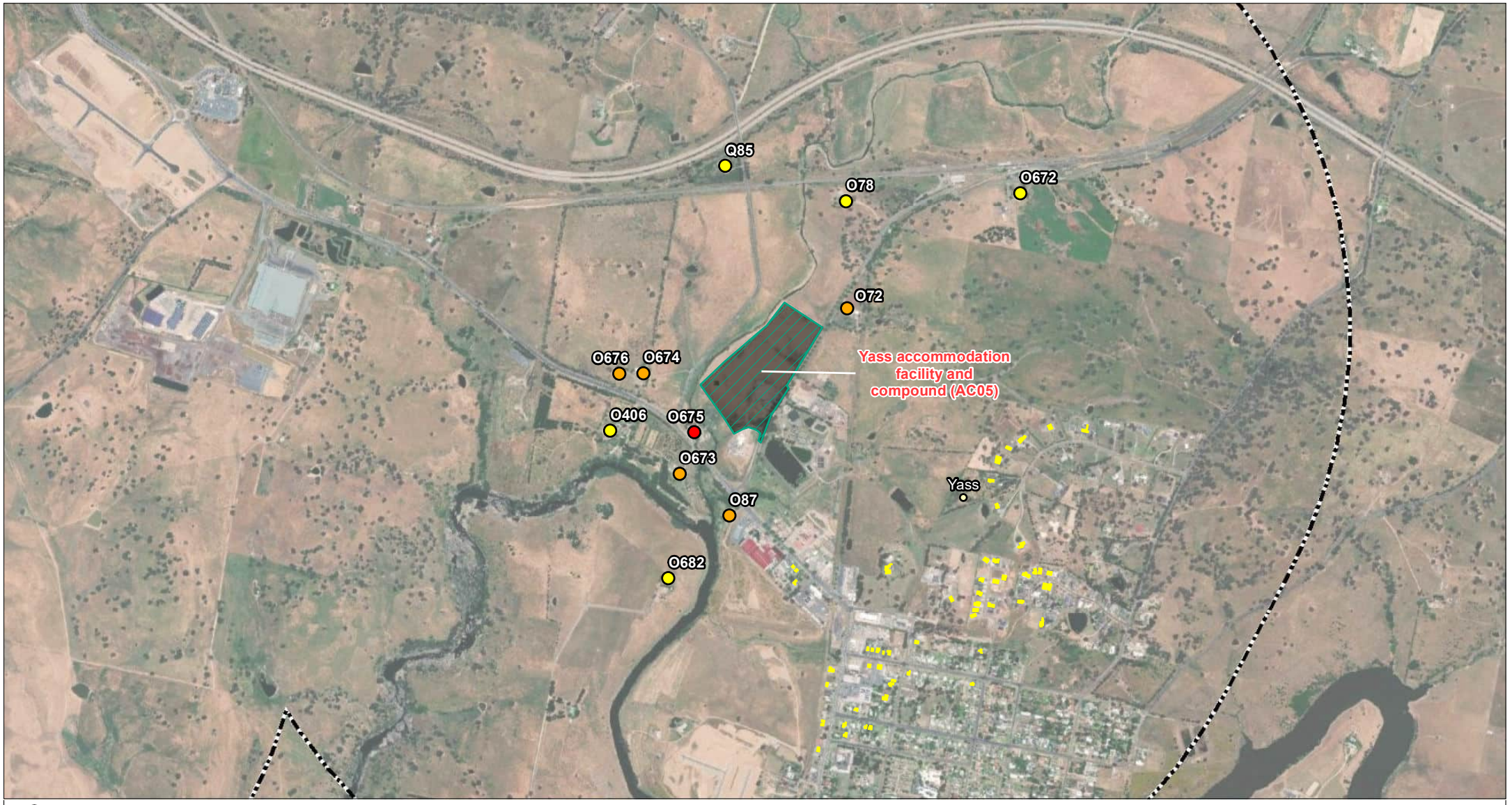


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
AC04
PAGE 8 OF 10

ATTACHMENT G.1

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G1_Worst-case Compound Noise Impacts (Day).mxd



0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

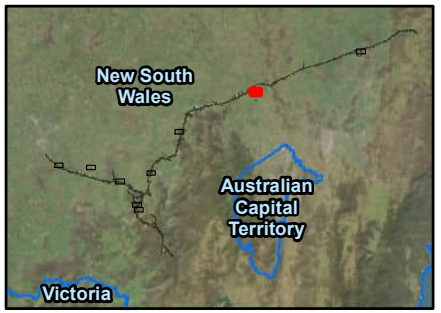
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
- >20 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
AC05
PAGE 9 OF 10

ATTACHMENT G.1

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0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

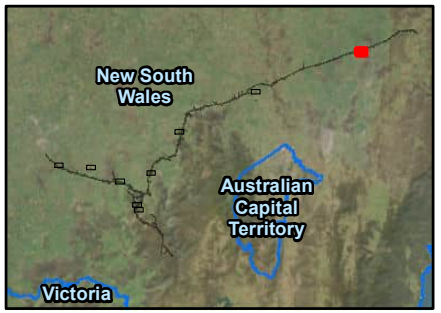
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
- >20 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAYTIME COMPOUND CONSTRUCTION NOISE IMPACTS
AC06
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ATTACHMENT G.1

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0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

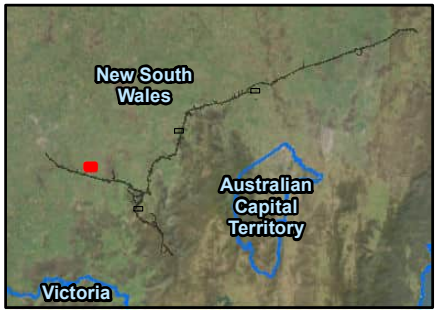
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 5 dB (Noticeable)
- 6 – 15 dB (Clearly audible)
- 16 – 25 dB (Moderately intrusive)
- >25 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE NIGHT-TIME COMPOUND AND ACCOMMODATION FACILITY CONSTRUCTION NOISE IMPACTS
AC03
PAGE 1 OF 4

ATTACHMENT G.2

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G2_Worst-case Compound Noise Impacts (Night).mxd

0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

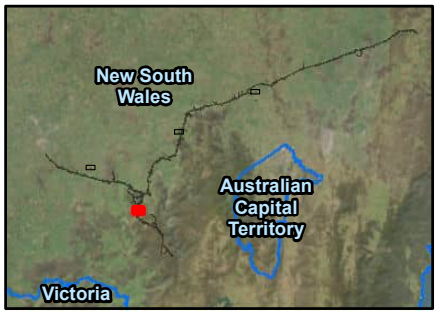
- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 5 dB (Noticeable)
- 6 – 15 dB (Clearly audible)
- 16 – 25 dB (Moderately intrusive)
- >25 dB (Highly intrusive)

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area

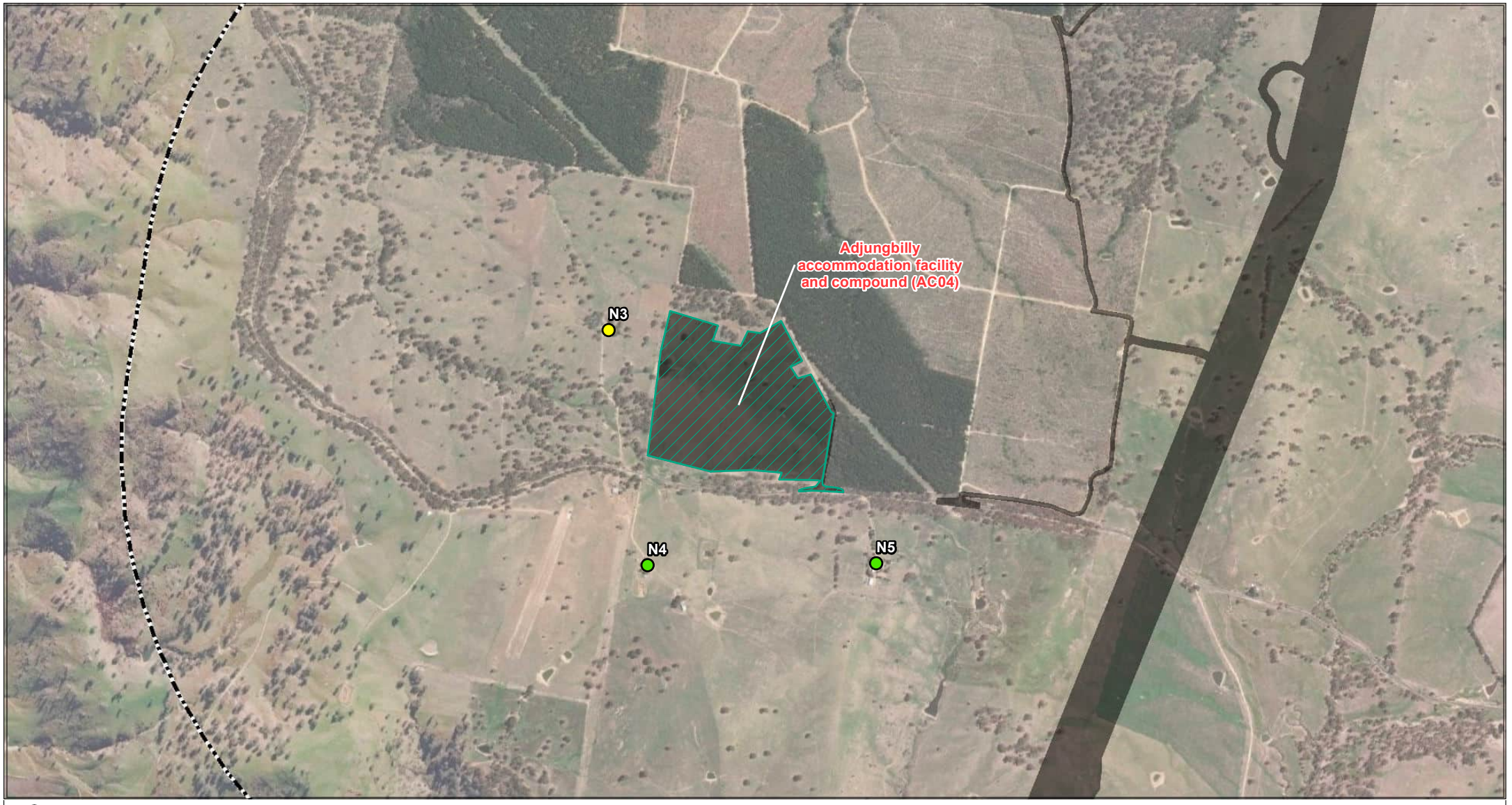


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE NIGHT-TIME COMPOUND AND ACCOMMODATION FACILITY CONSTRUCTION NOISE IMPACTS
AC07
PAGE 2 OF 4

ATTACHMENT G.2

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G2_Worst-case Compound Noise Impacts (Night).mxd



0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
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Noise Impacts

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Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE NIGHT-TIME COMPOUND AND ACCOMMODATION FACILITY CONSTRUCTION NOISE IMPACTS
AC04
PAGE 3 OF 4

ATTACHMENT G.2

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G2_Worst-case Compound Noise Impacts (Night).mxd

0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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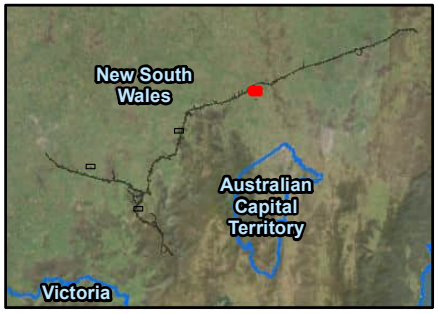
Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area

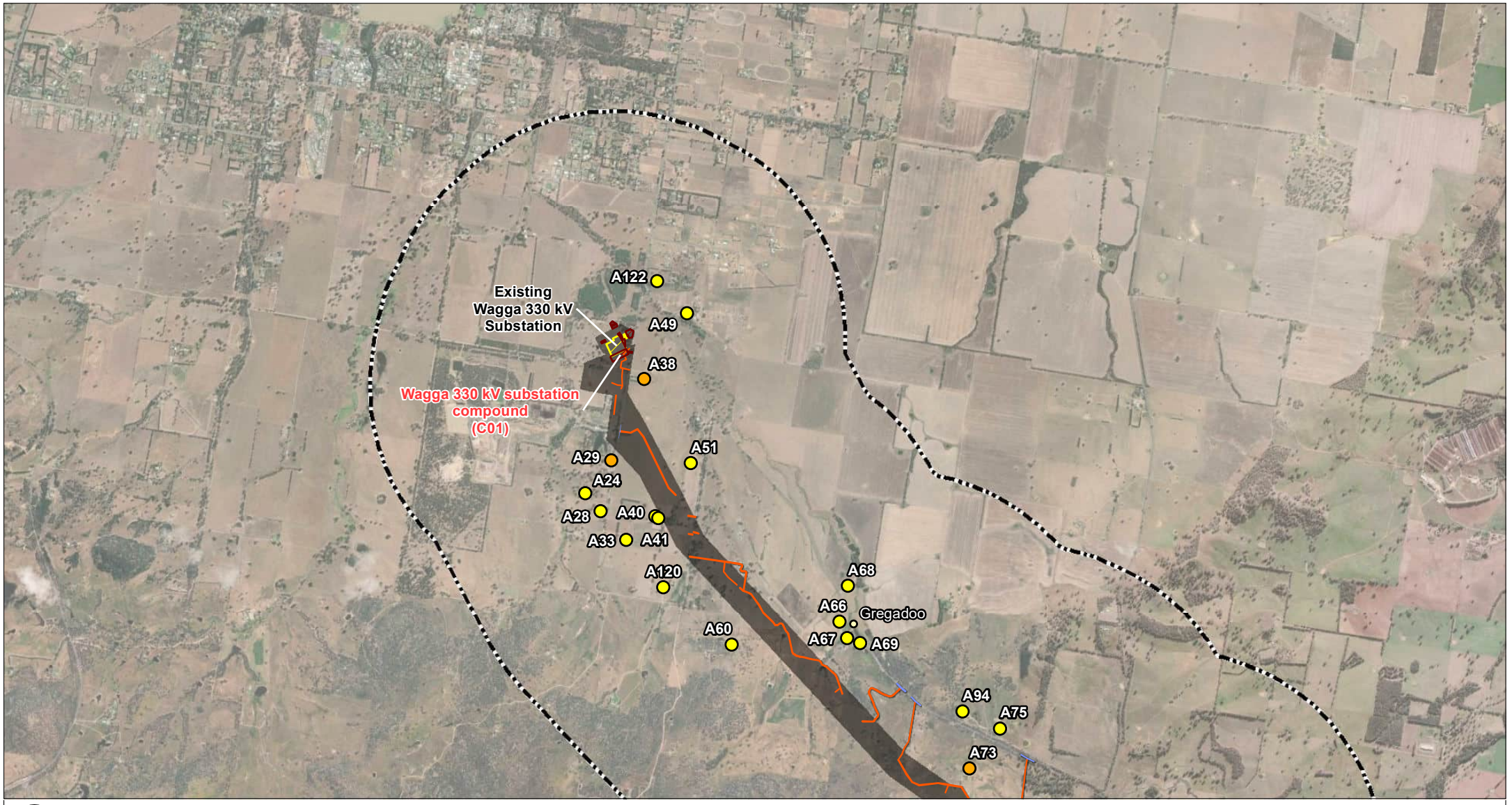


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE NIGHT-TIME COMPOUND AND ACCOMMODATION FACILITY CONSTRUCTION NOISE IMPACTS
AC05
PAGE 4 OF 4

ATTACHMENT G.2

\\au.slr.local\Corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G2_Worst-case Compound Noise Impacts (Night).mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

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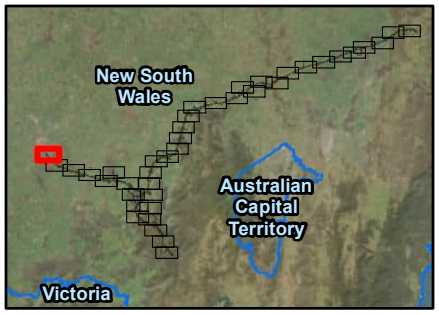
- >20 dB (Highly intrusive)

Project components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area
- Intersections
- Access track - New
- Access track - Upgrade



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAY-TIME ACCESS TRACK CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

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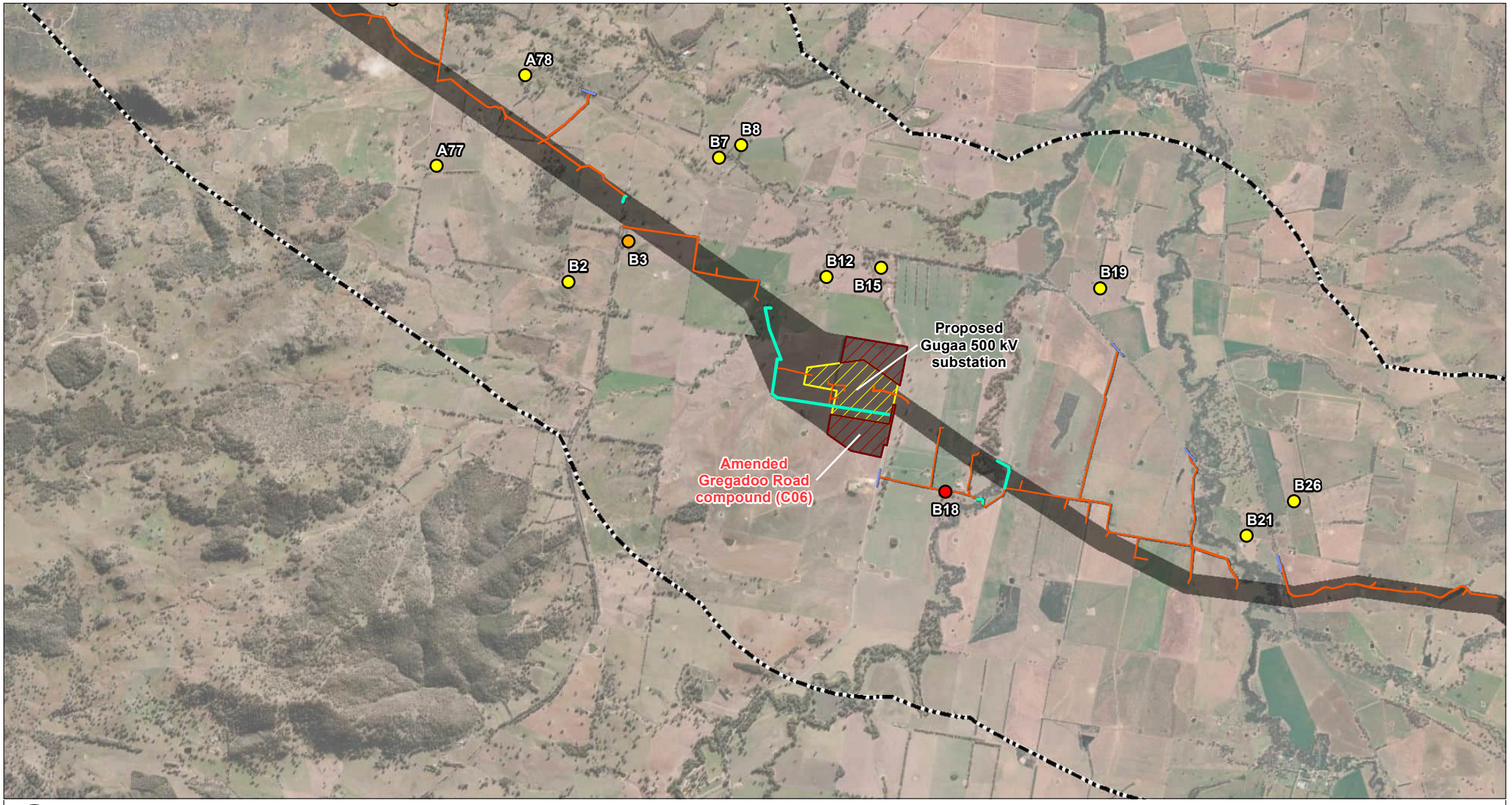

0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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Noise Impacts

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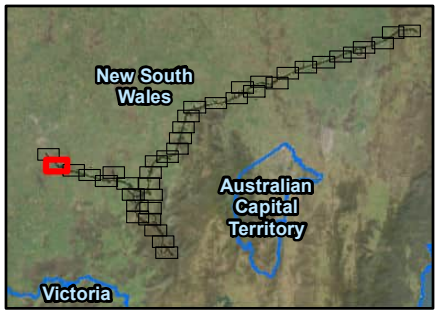
Project components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area
- Intersections
- Access track - New
- Access track - Upgrade



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAY-TIME ACCESS TRACK CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

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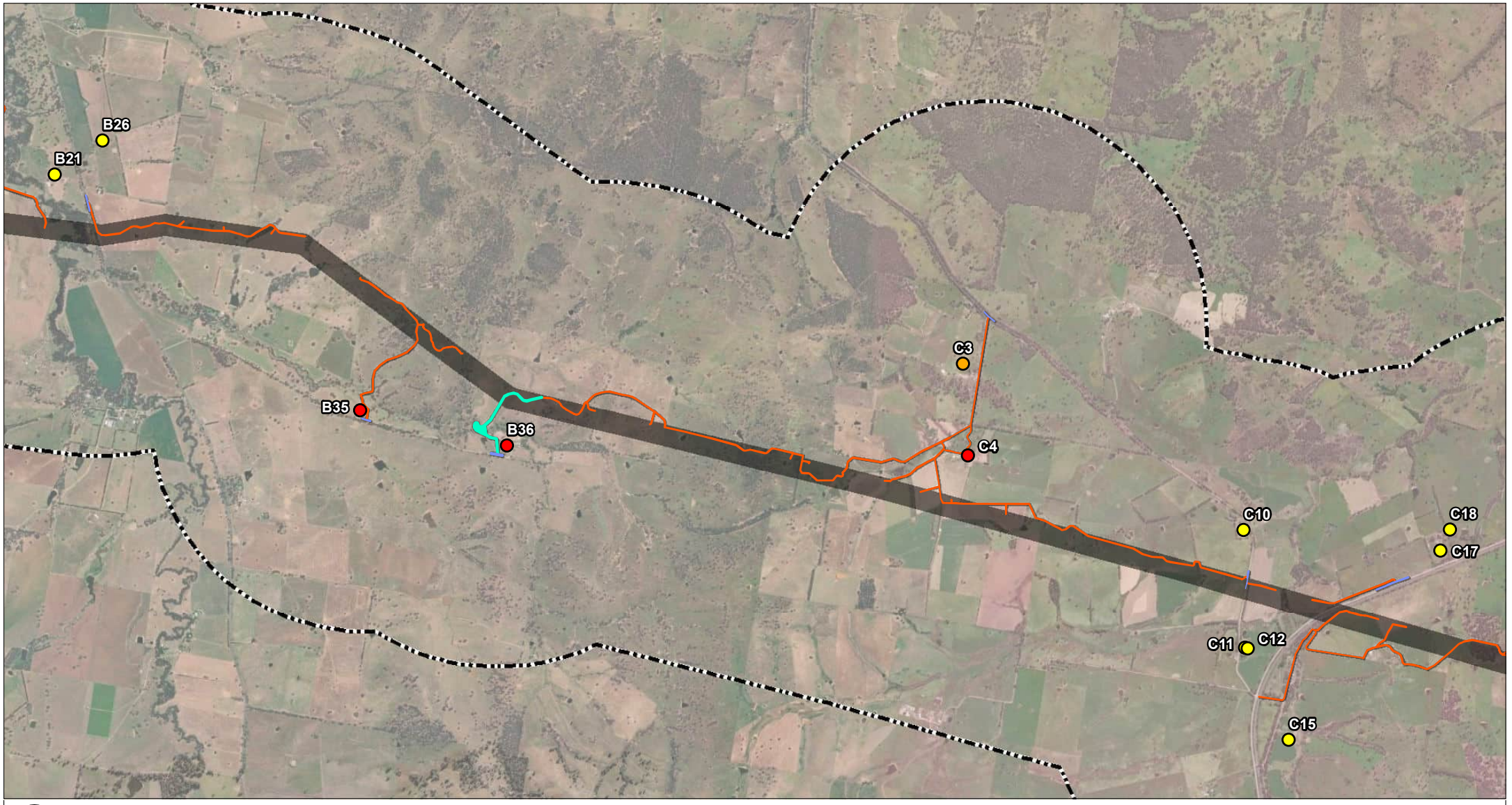

0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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- Construction compound
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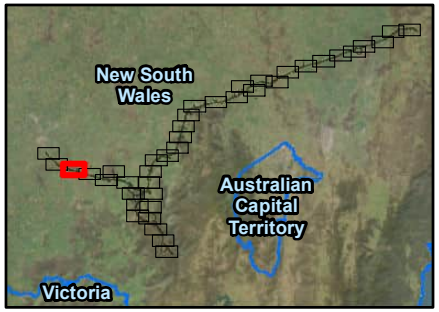
- Telecommunications connection
- Potential controlled blasting area
- Intersections
- Access track - New
- Access track - Upgrade

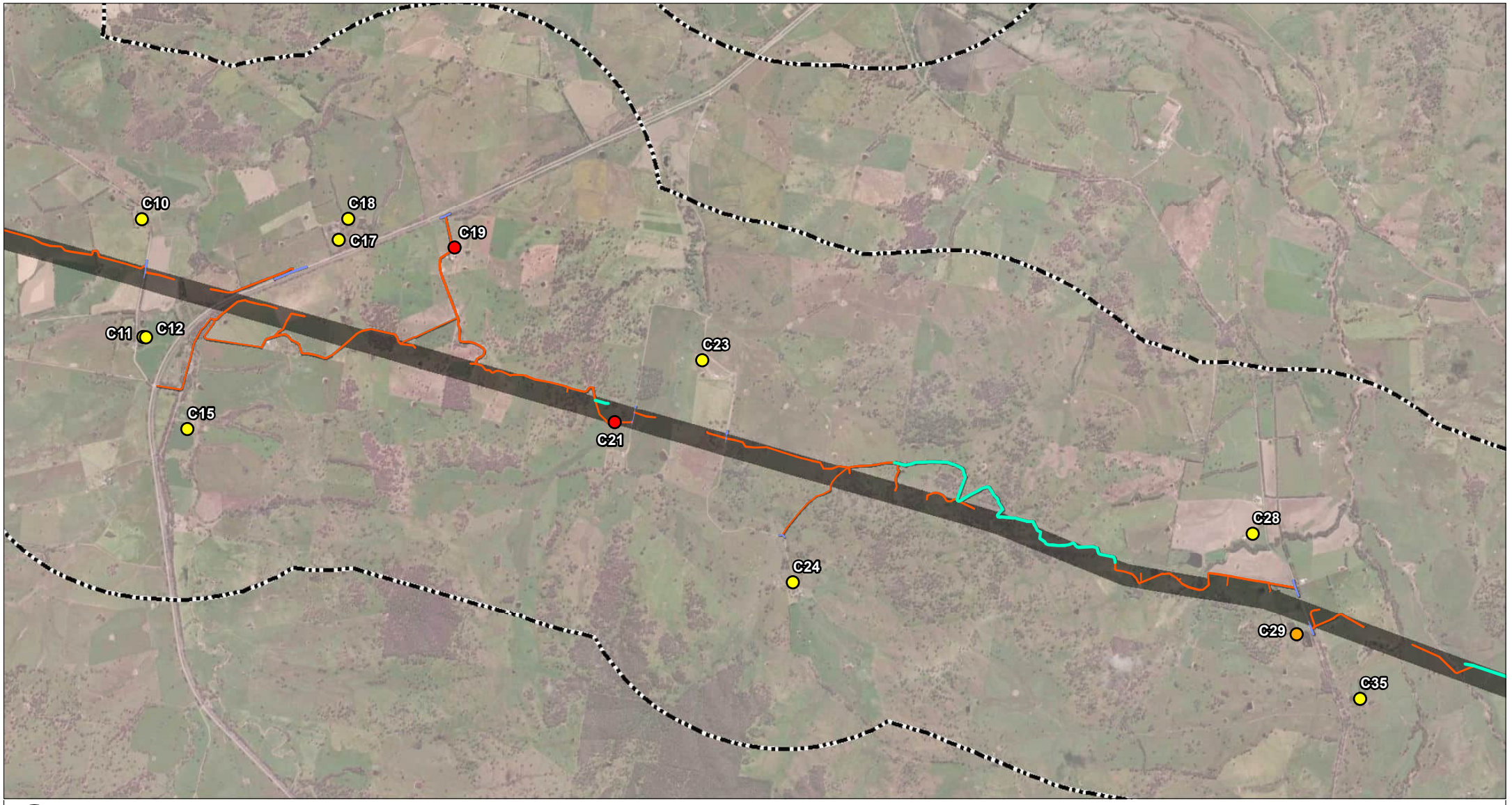


HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAY-TIME ACCESS TRACK CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G3_Worst-case day-time access track construction noise impacts.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
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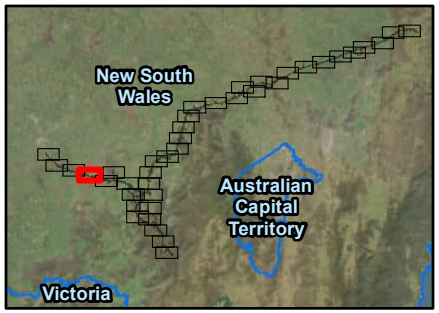

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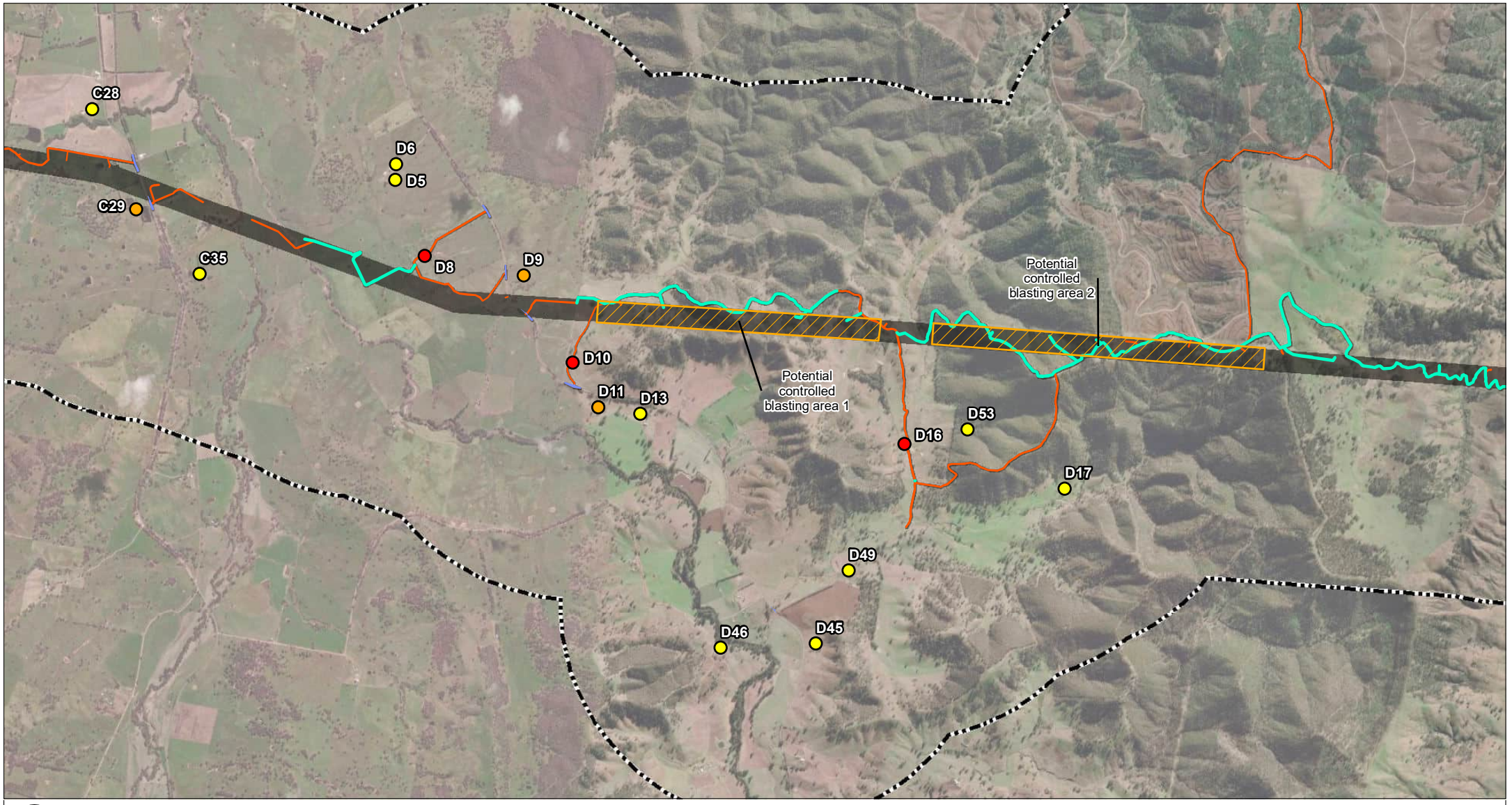

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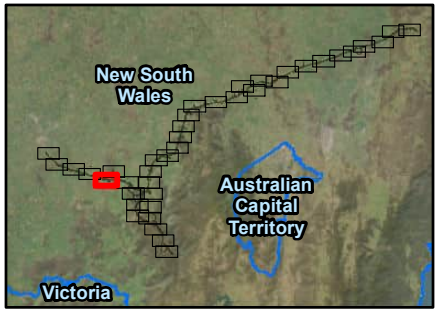

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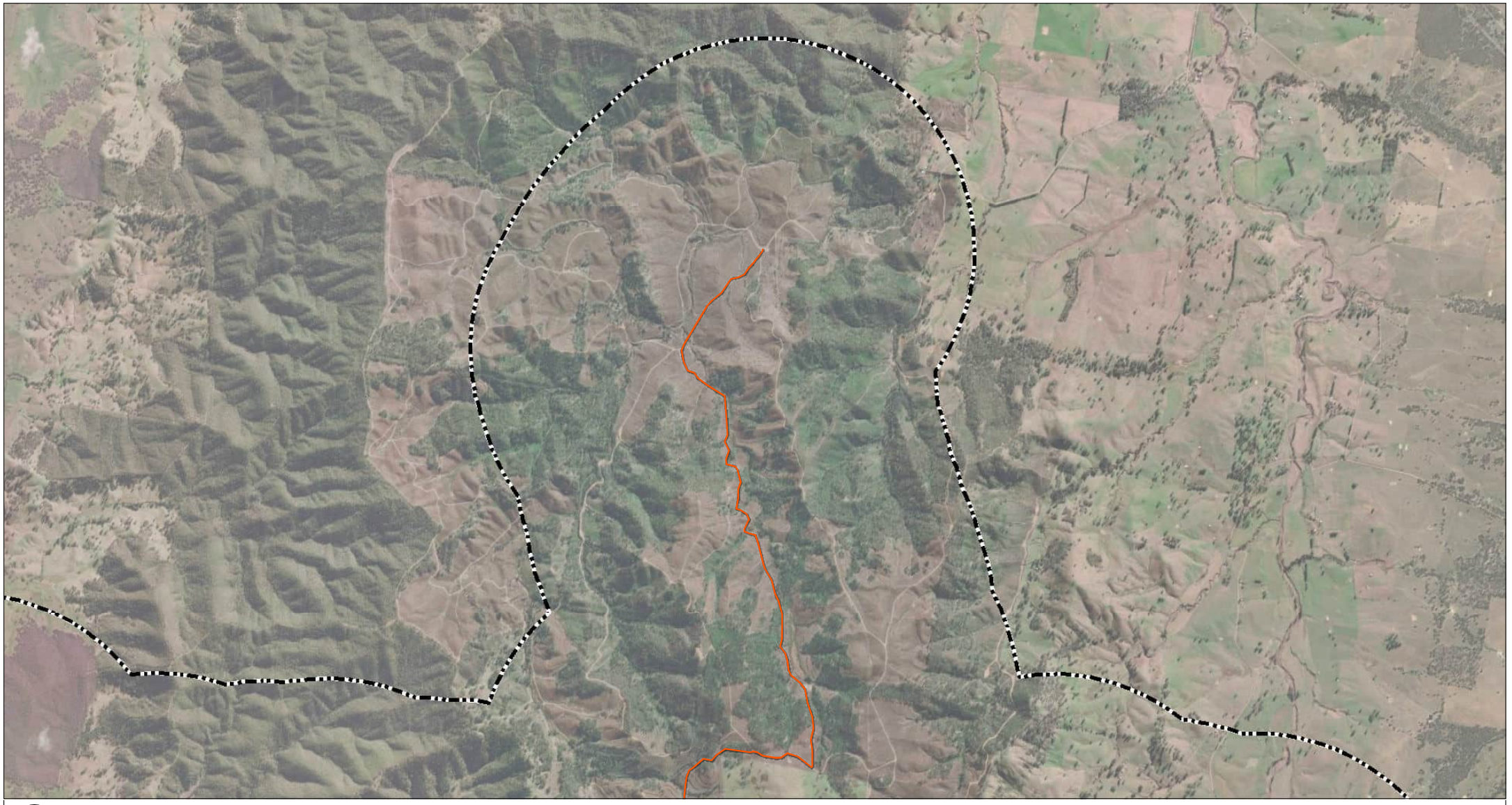

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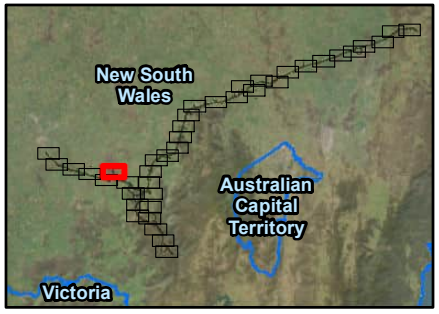

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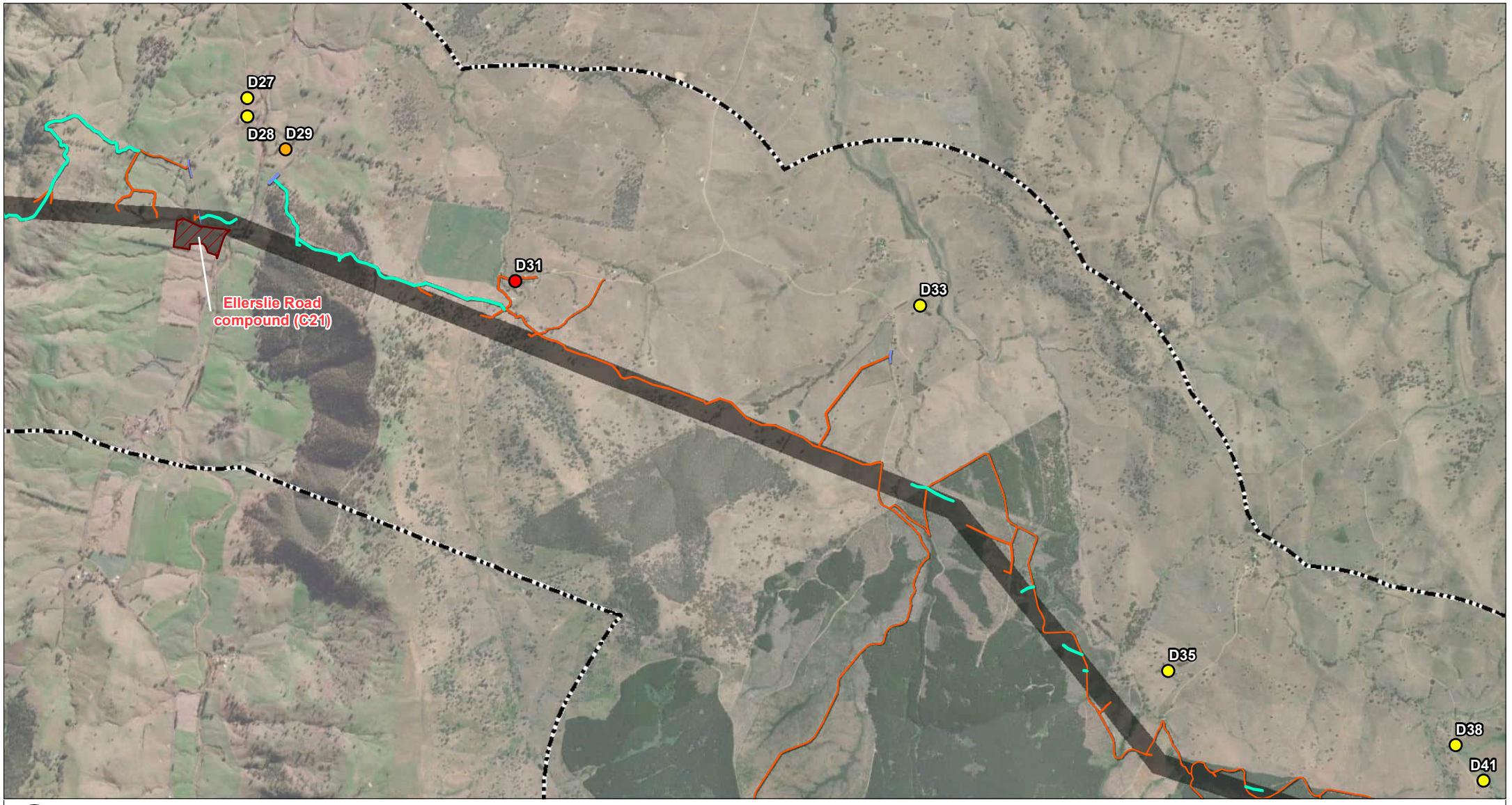

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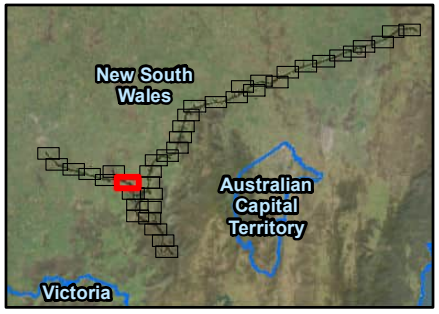

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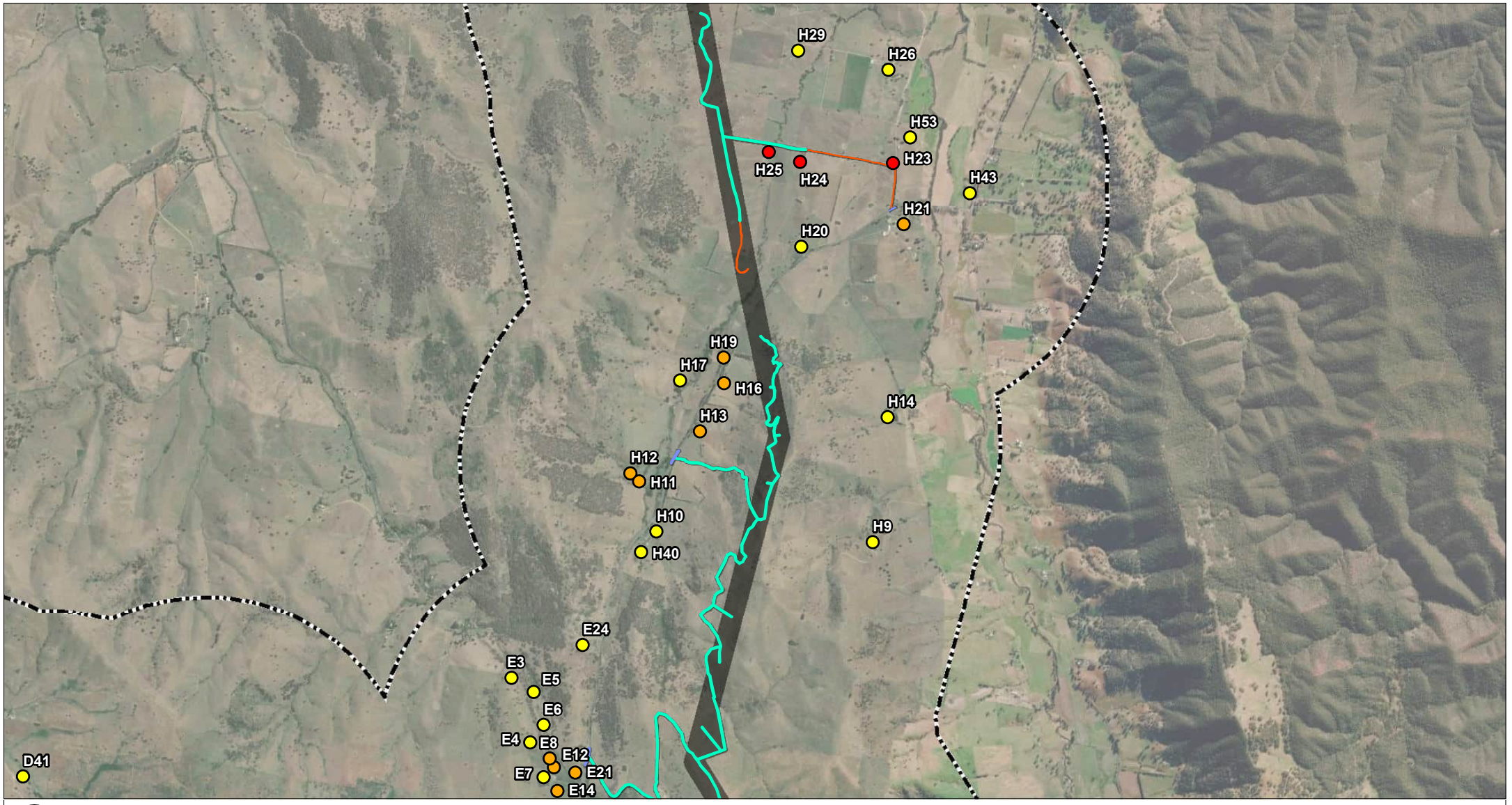

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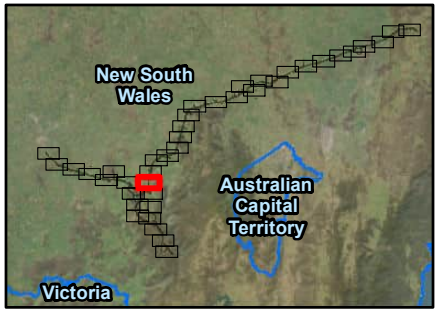

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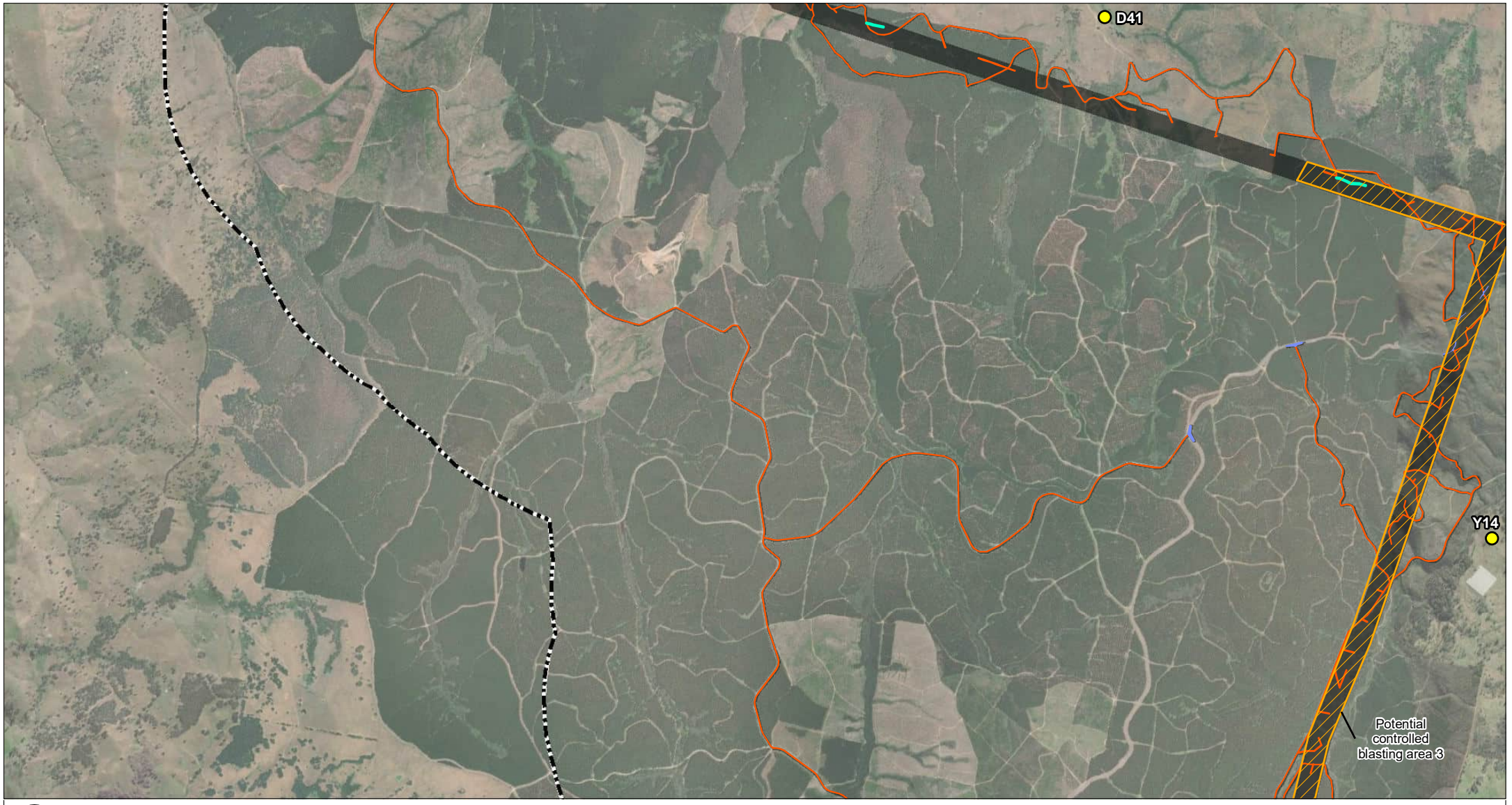

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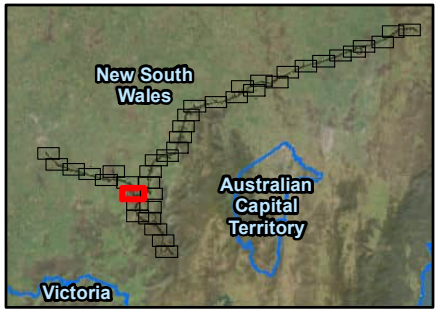

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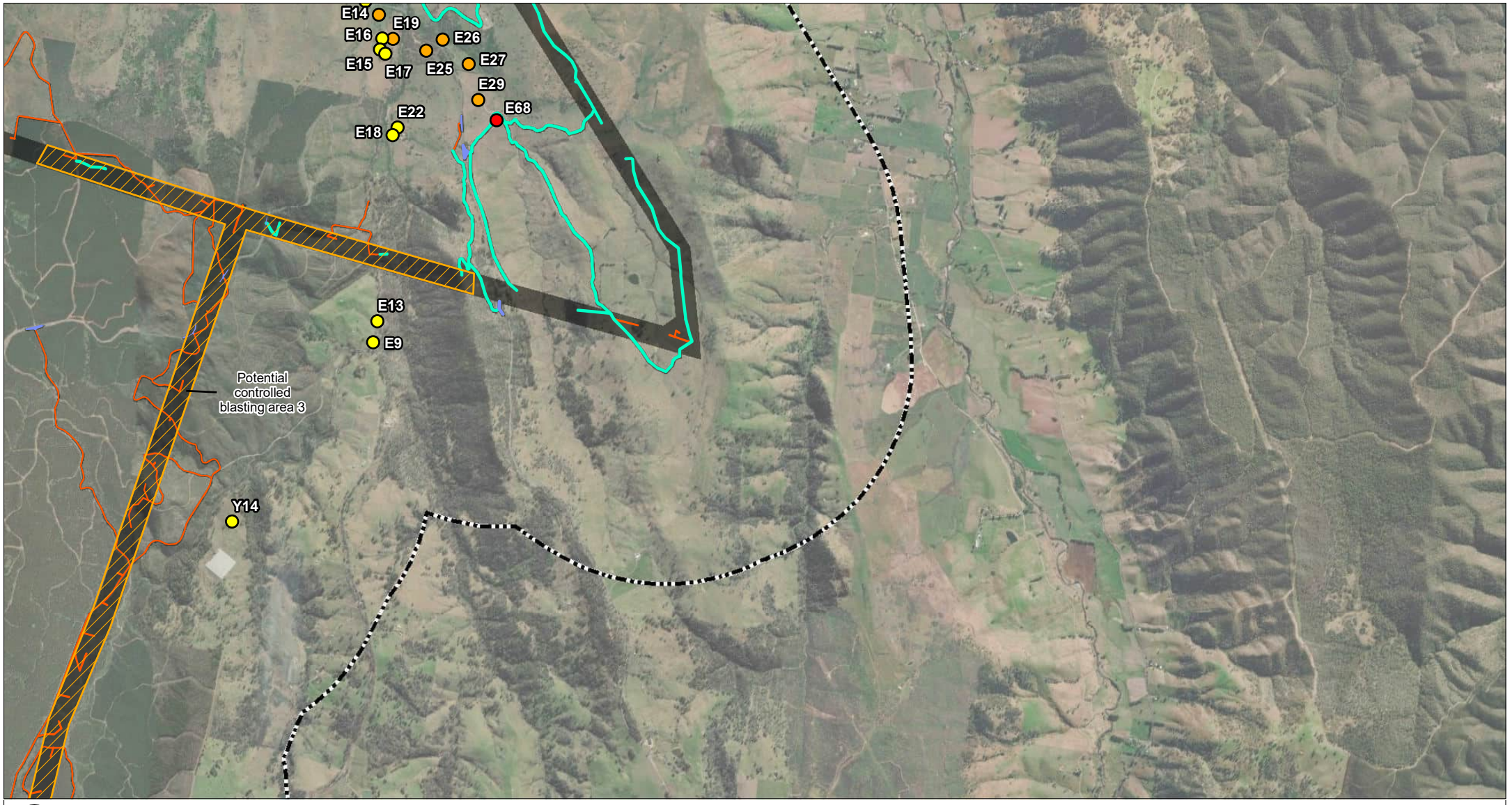

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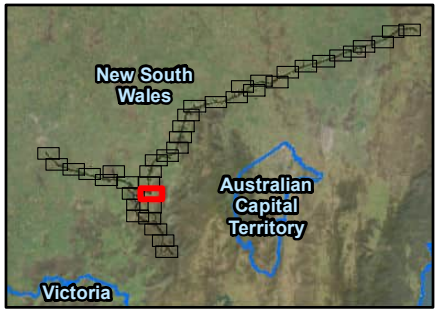

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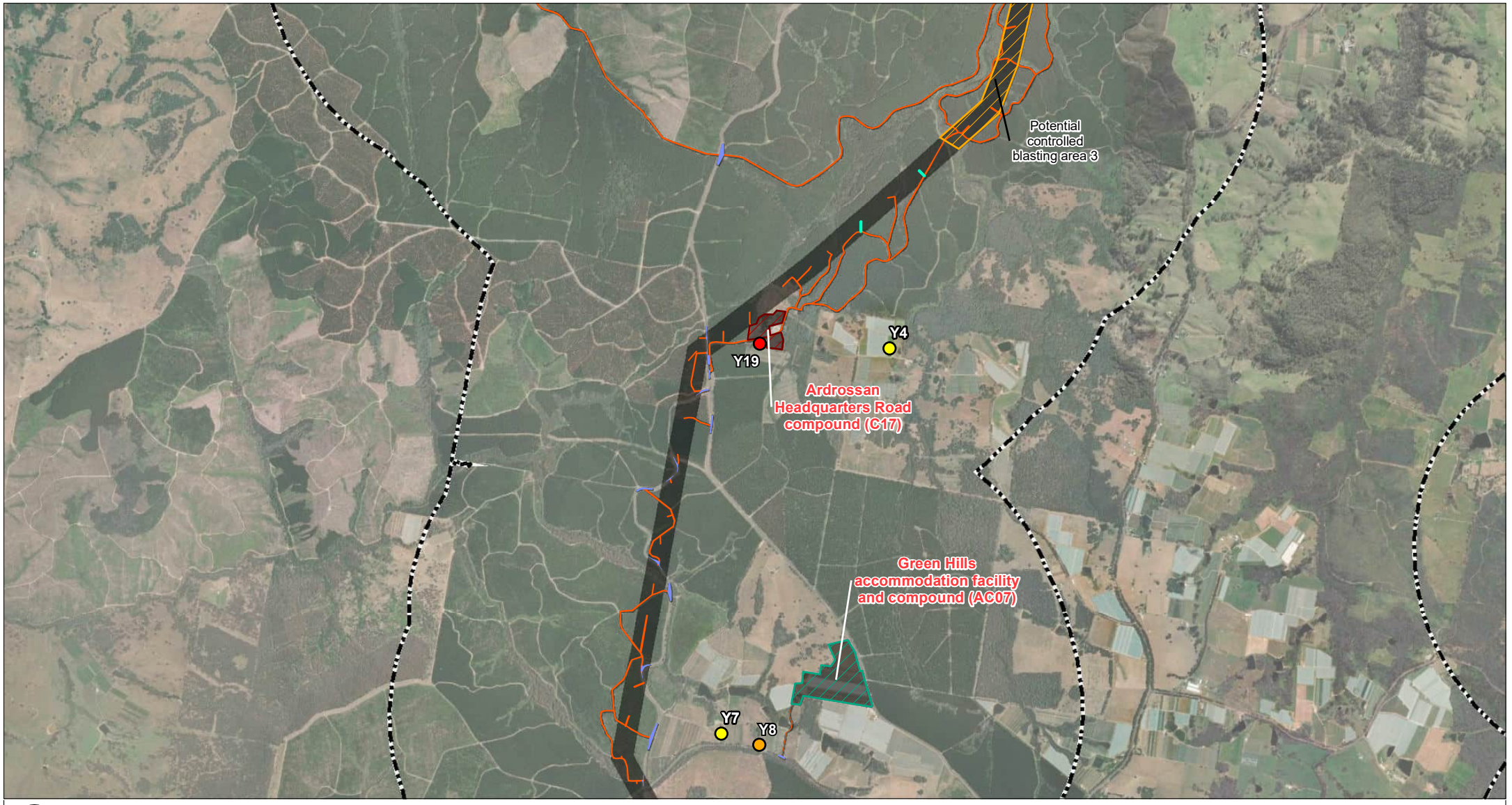

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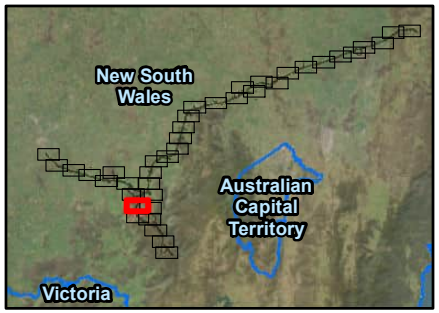

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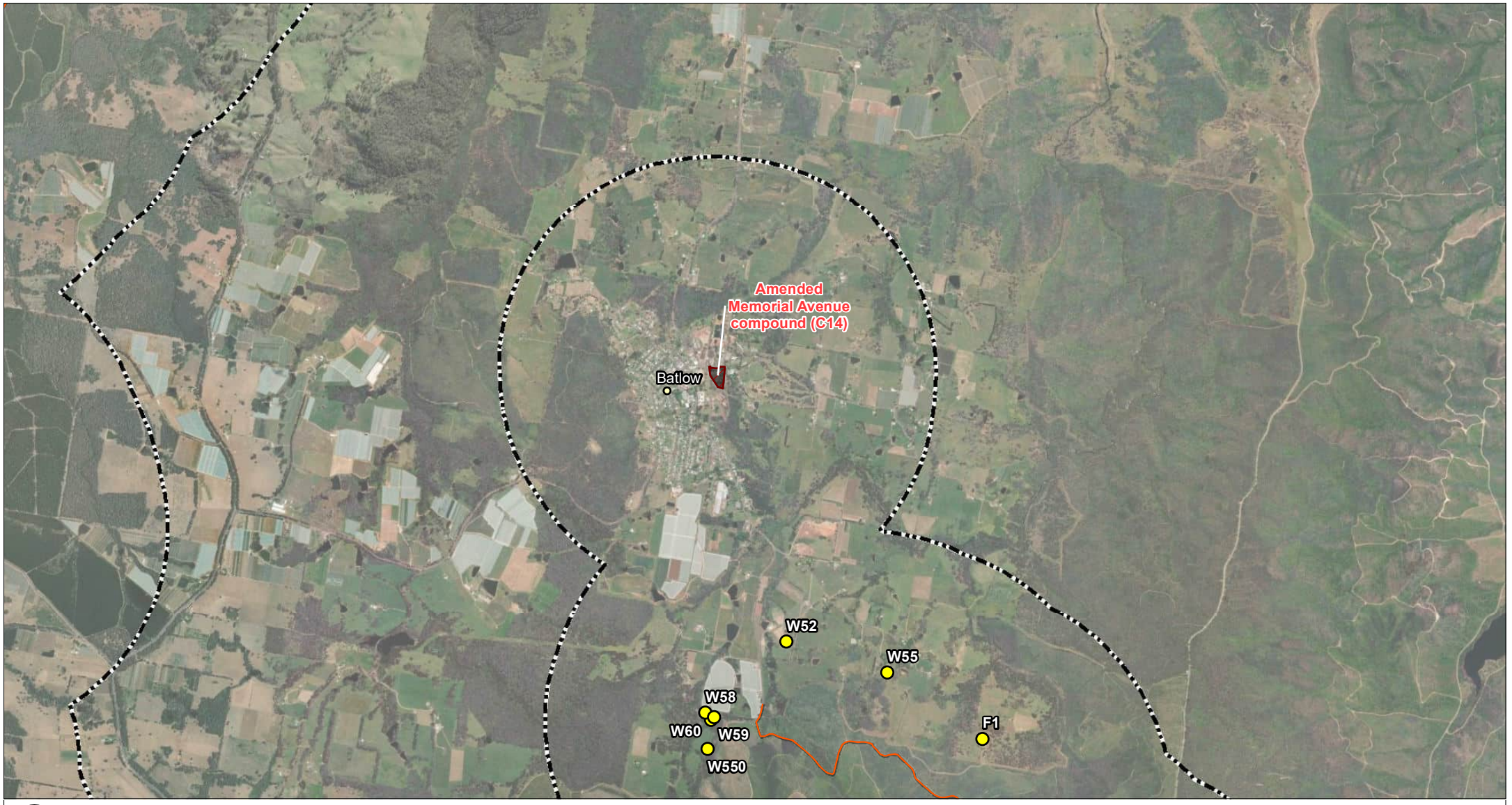

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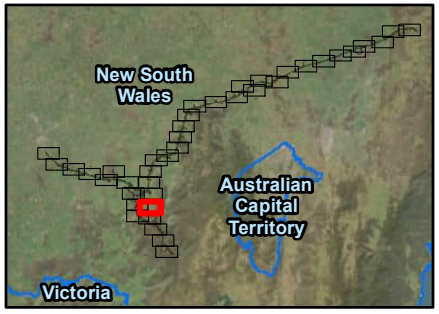

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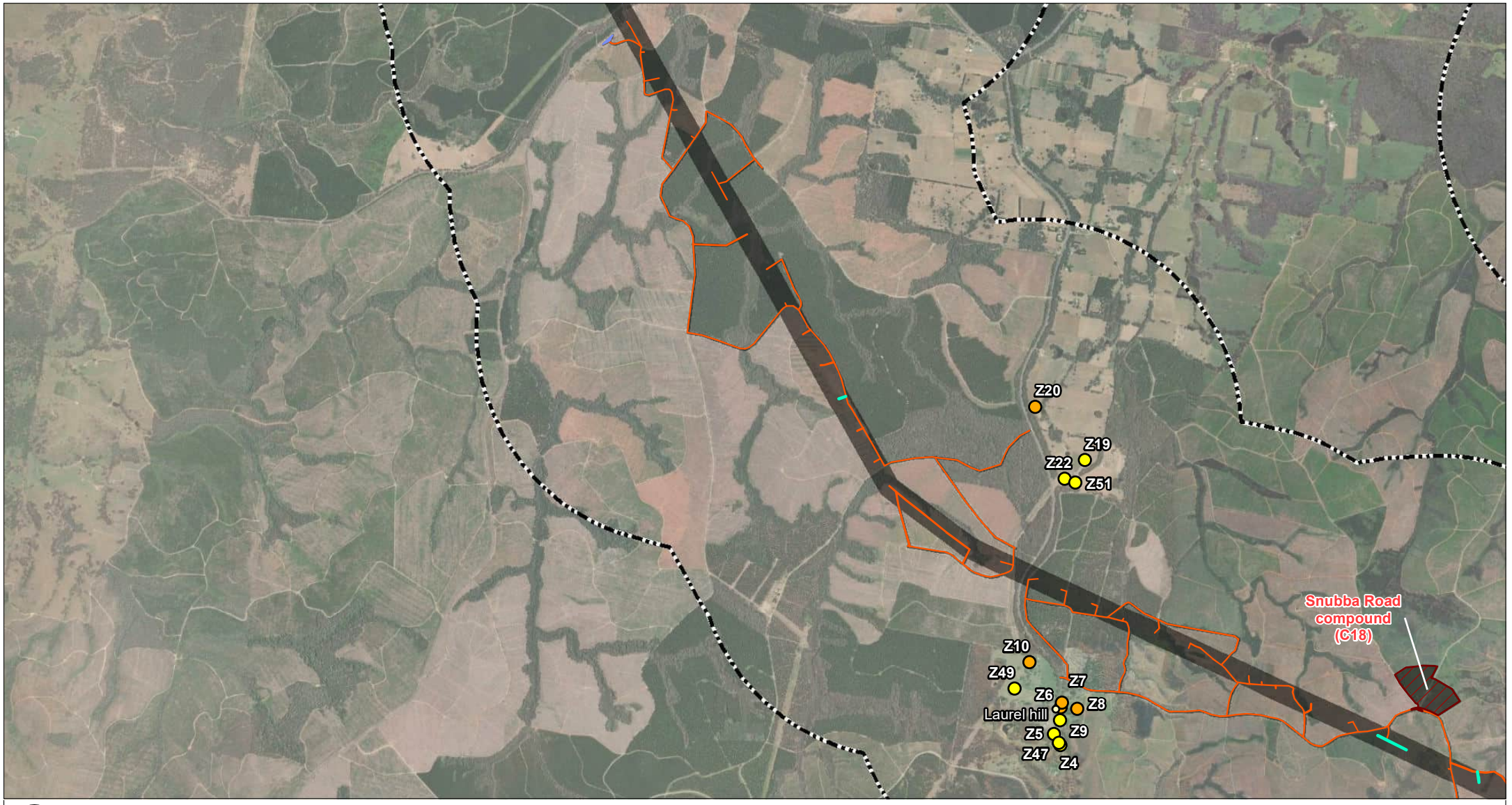

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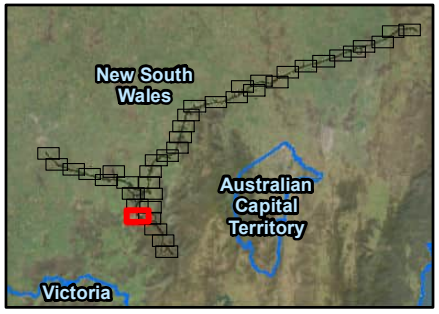

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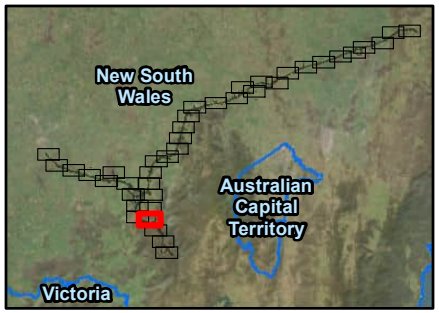

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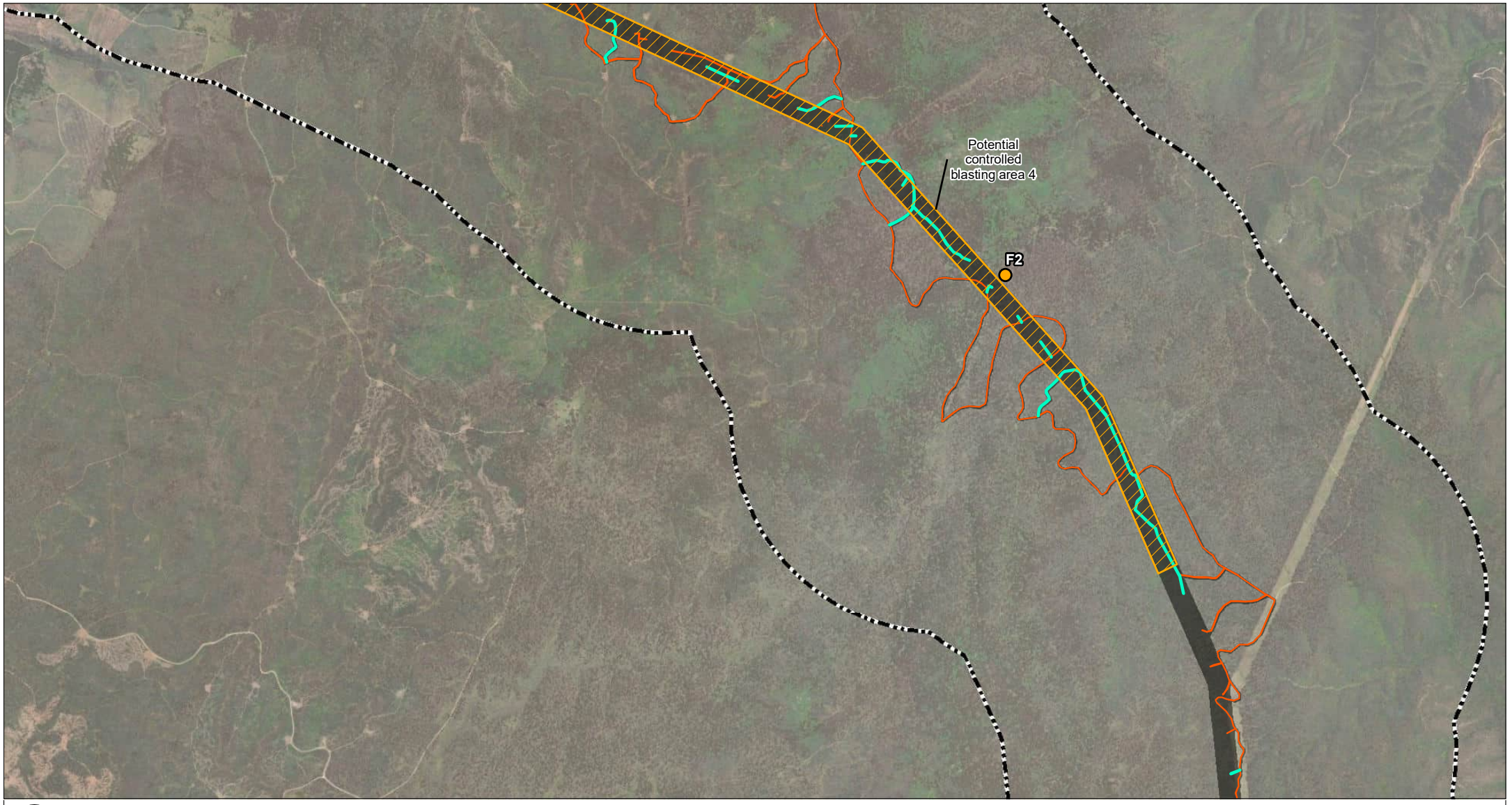

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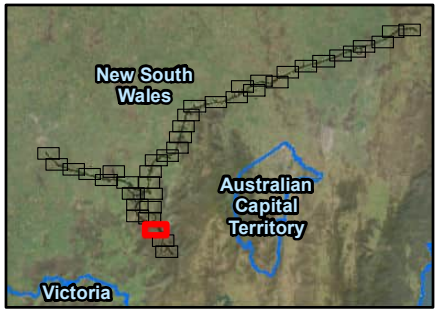

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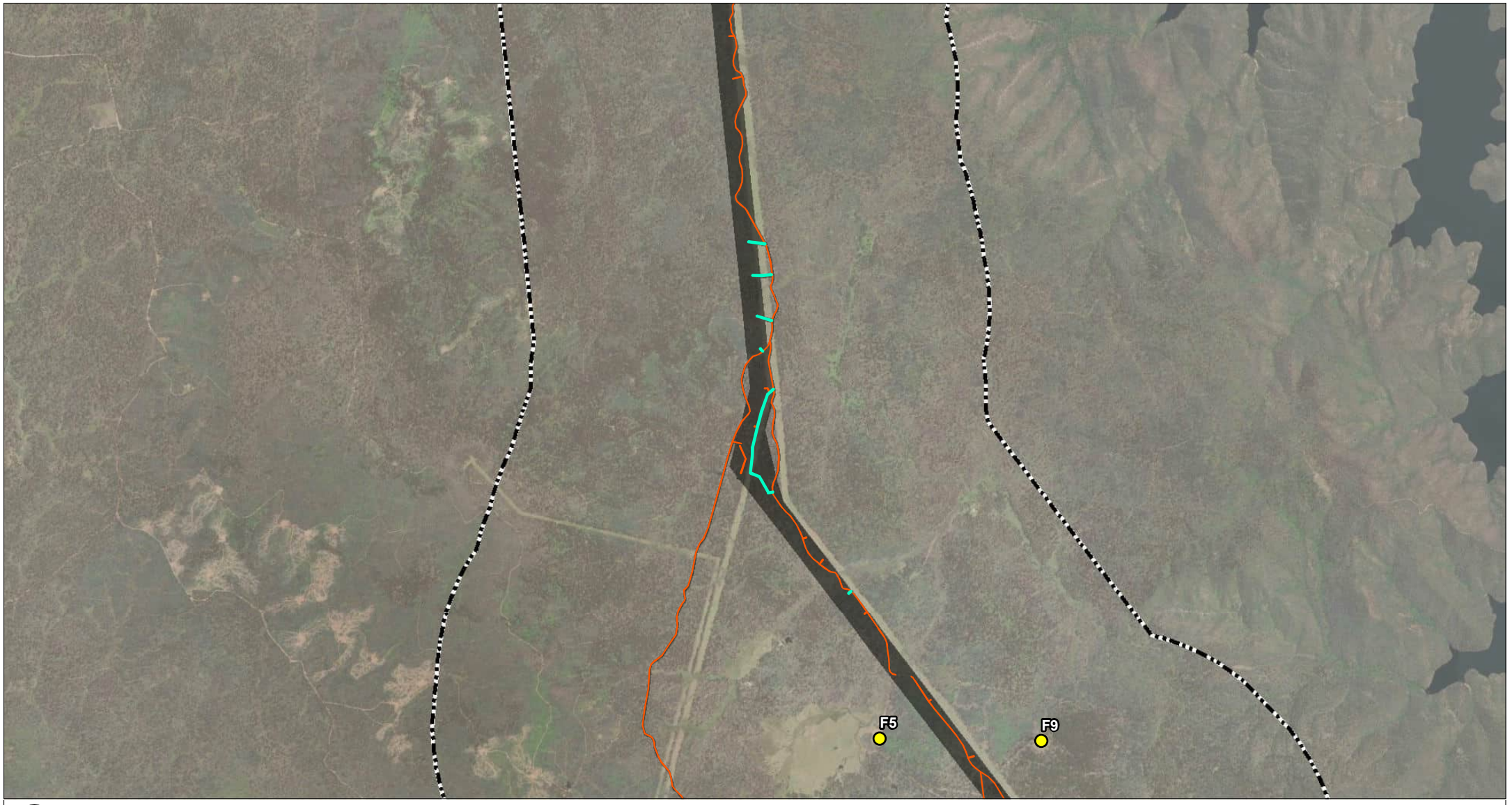

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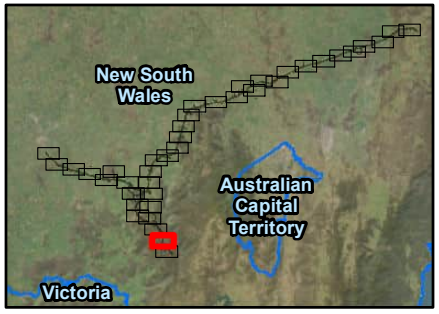

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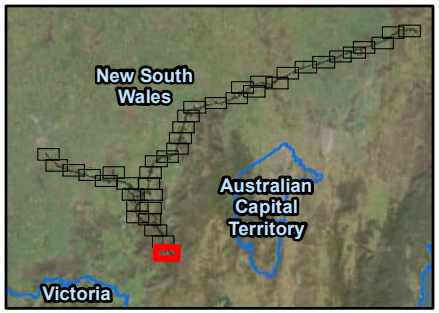

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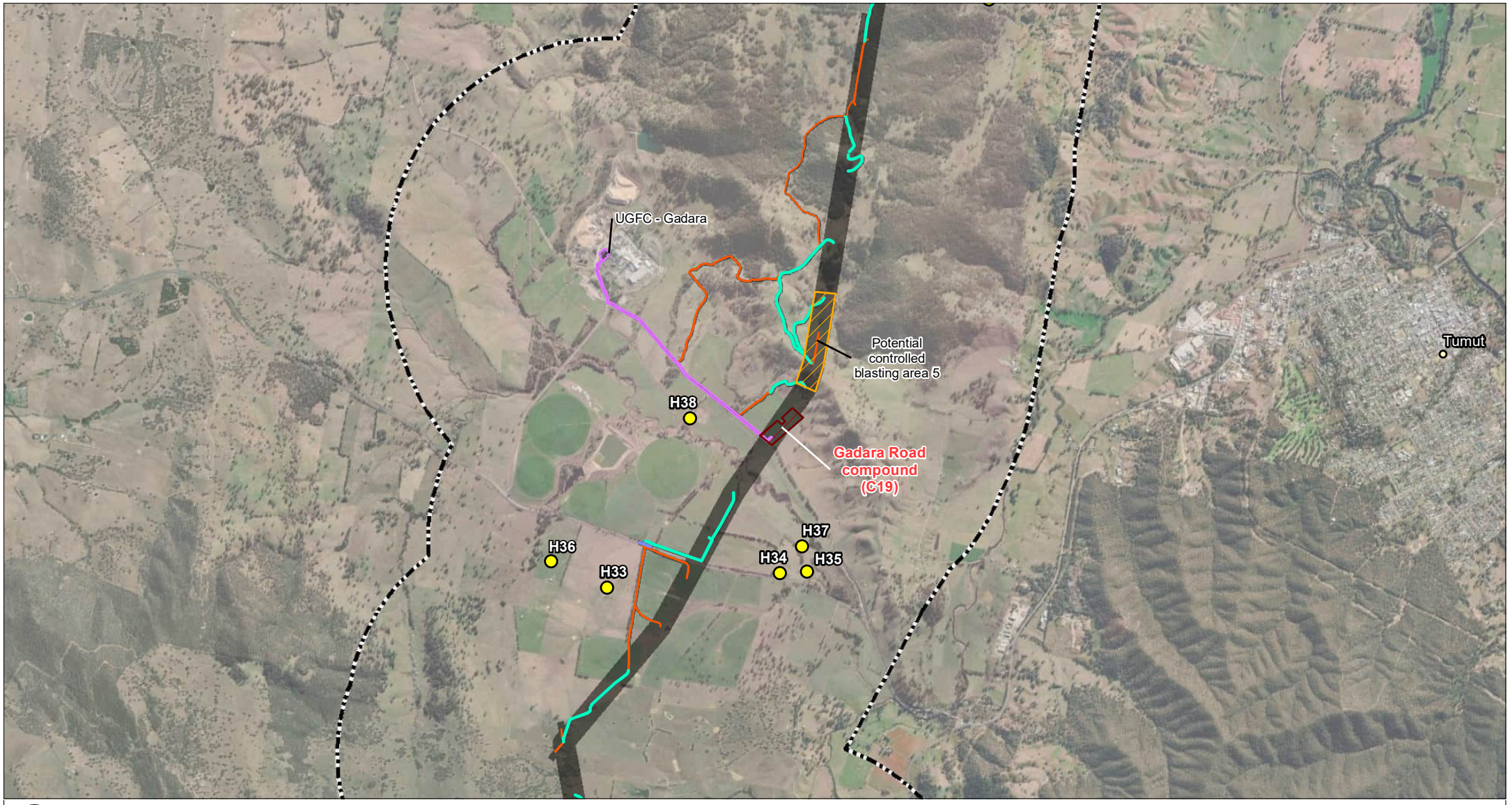
WORST-CASE DAY-TIME ACCESS TRACK CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G3_Worst-case day-time access track construction noise impacts.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
- >20 dB (Highly intrusive)

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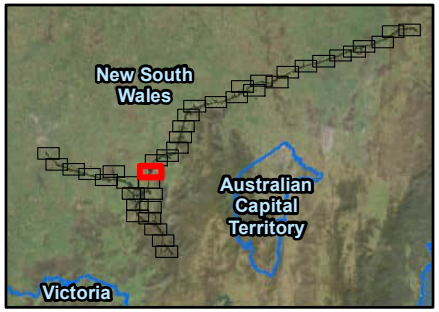

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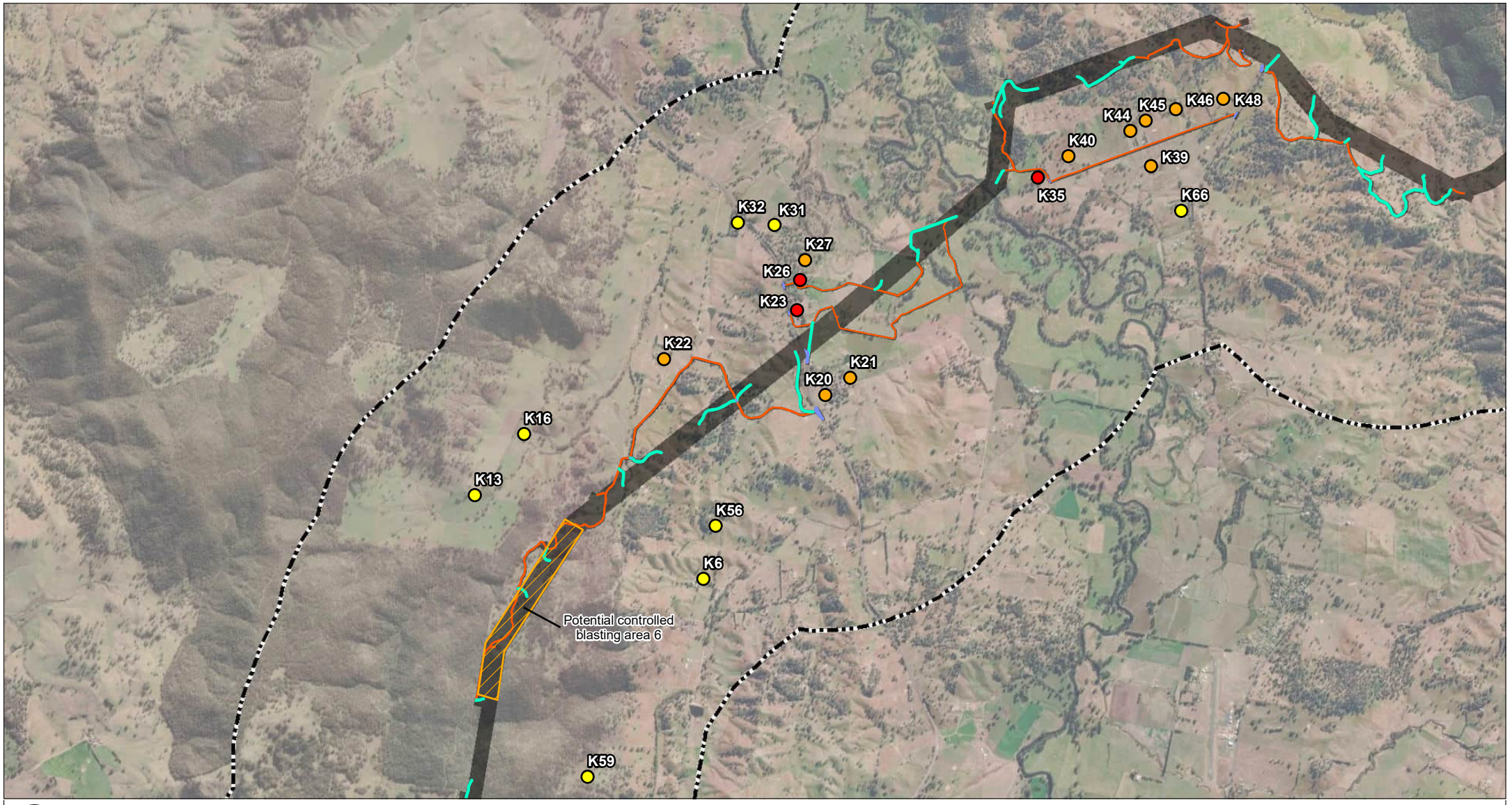

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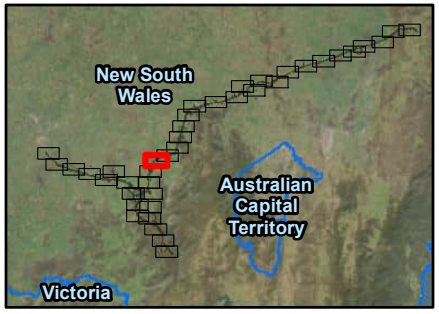

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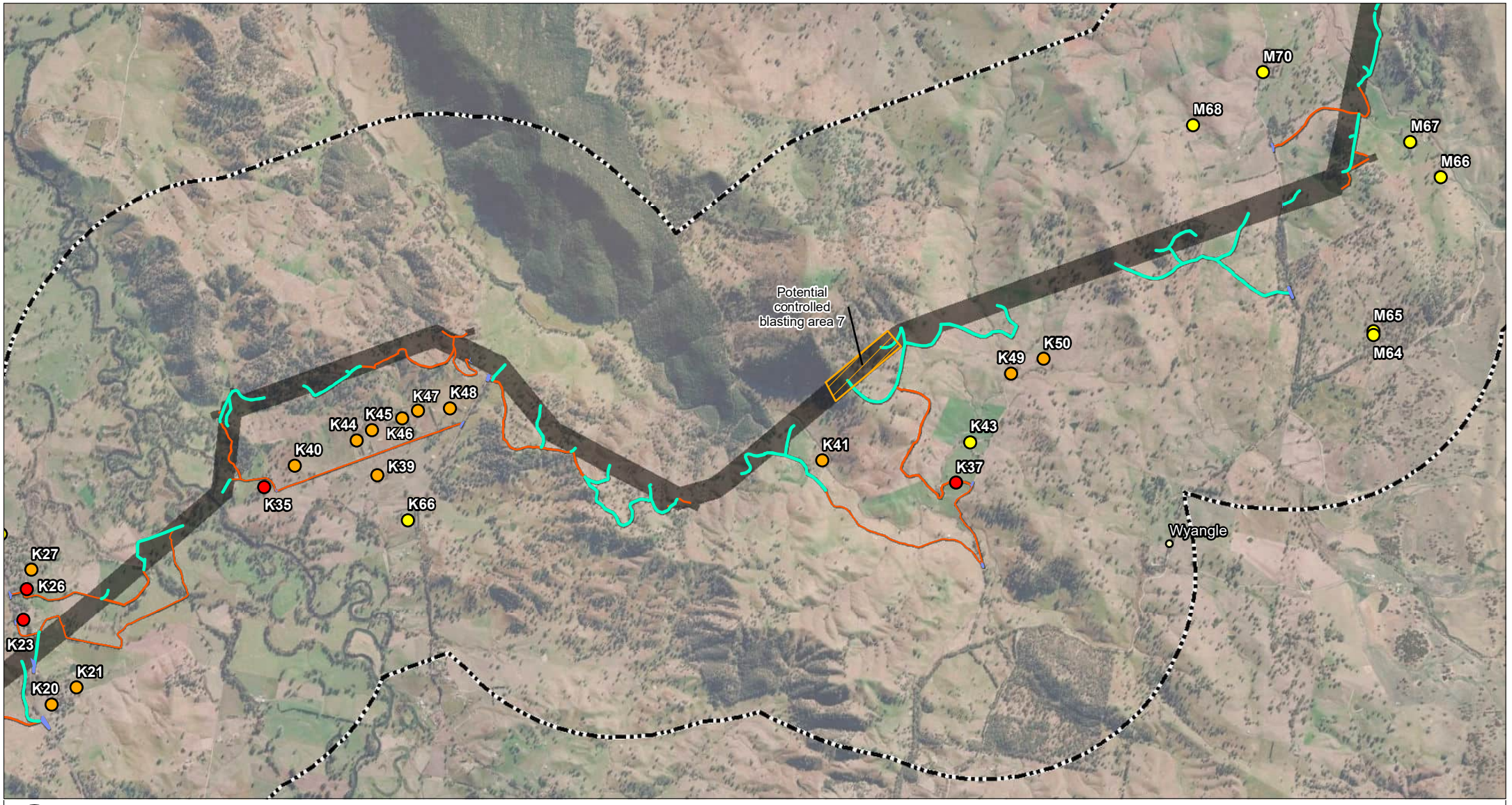

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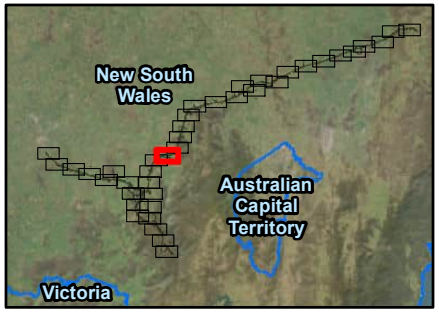

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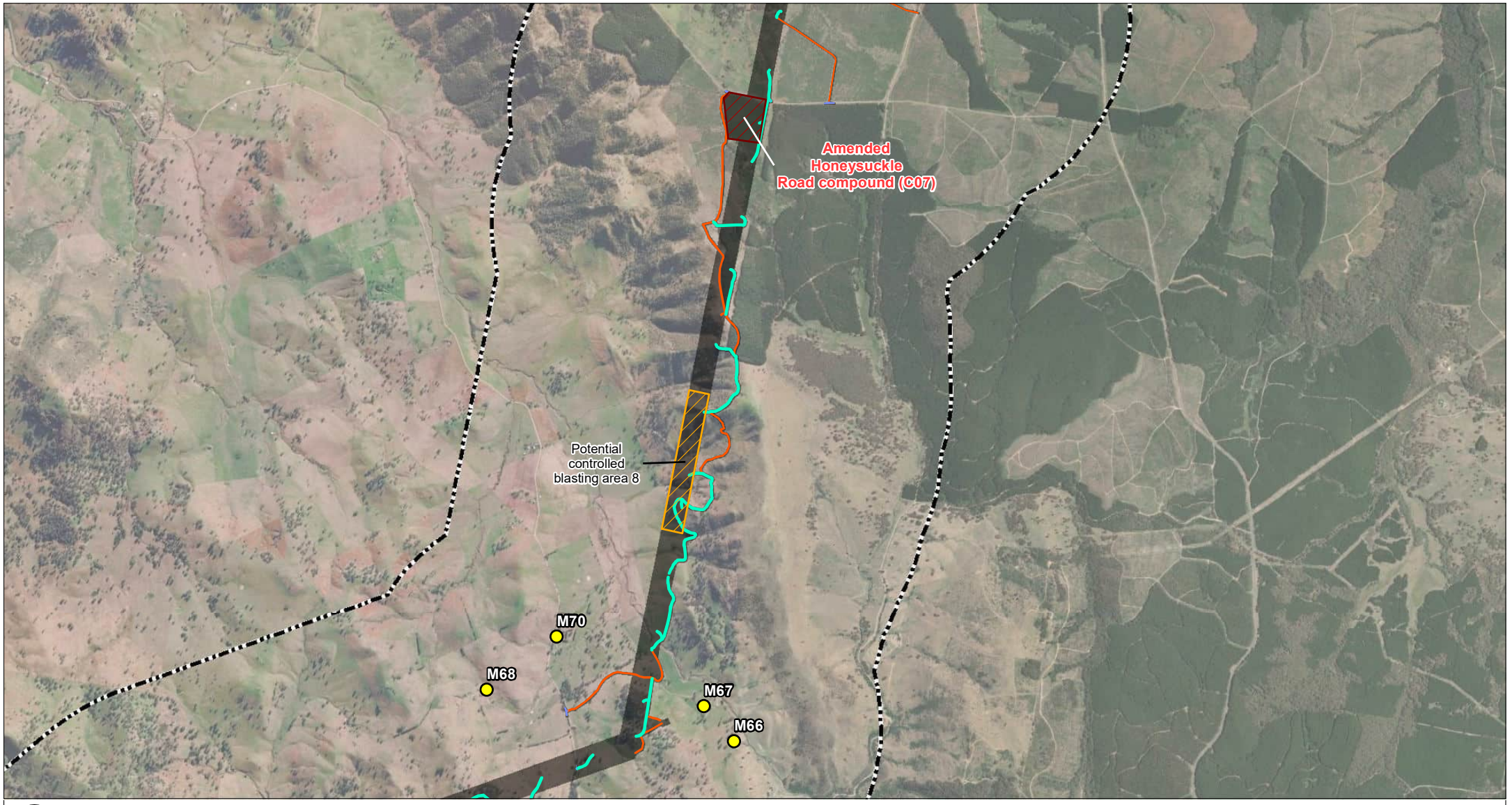

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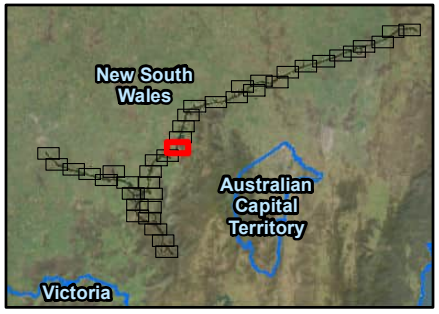

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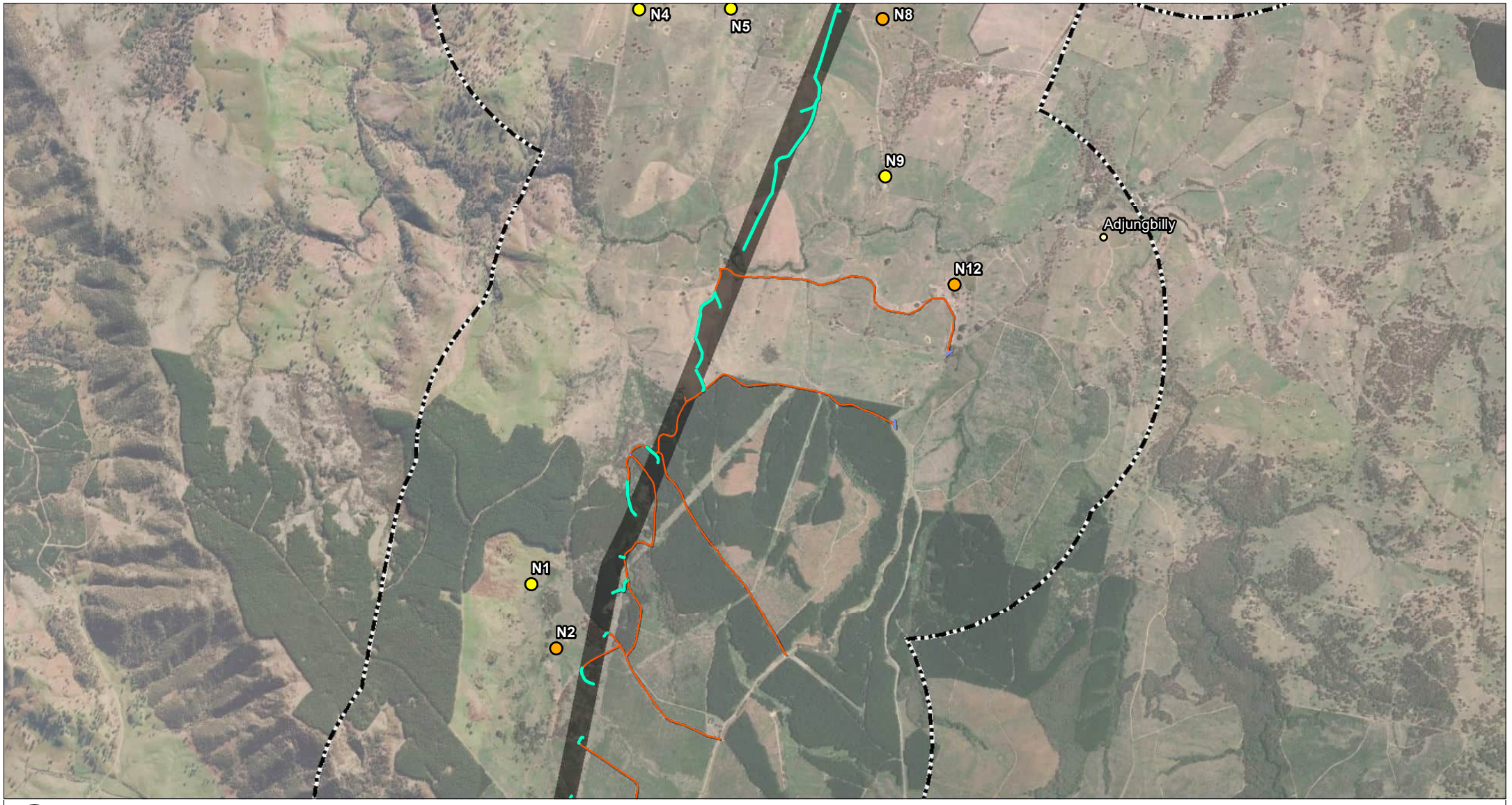

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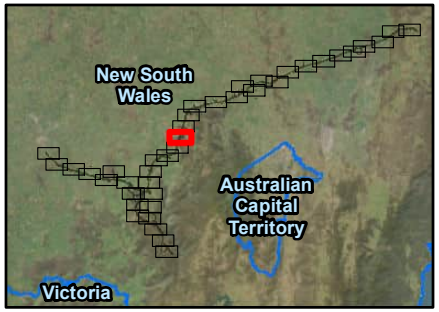

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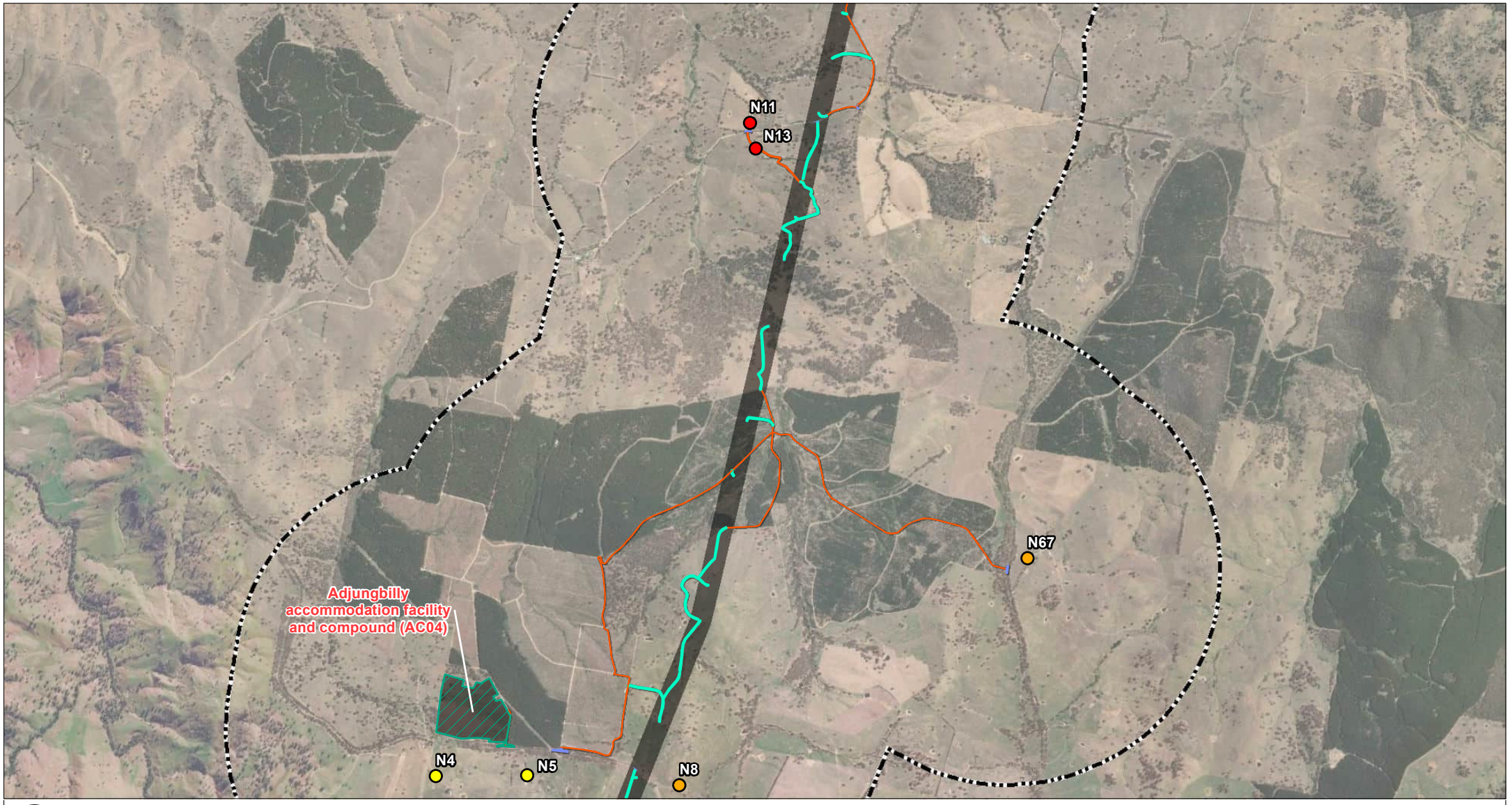

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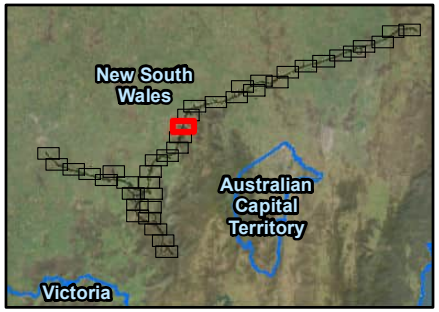

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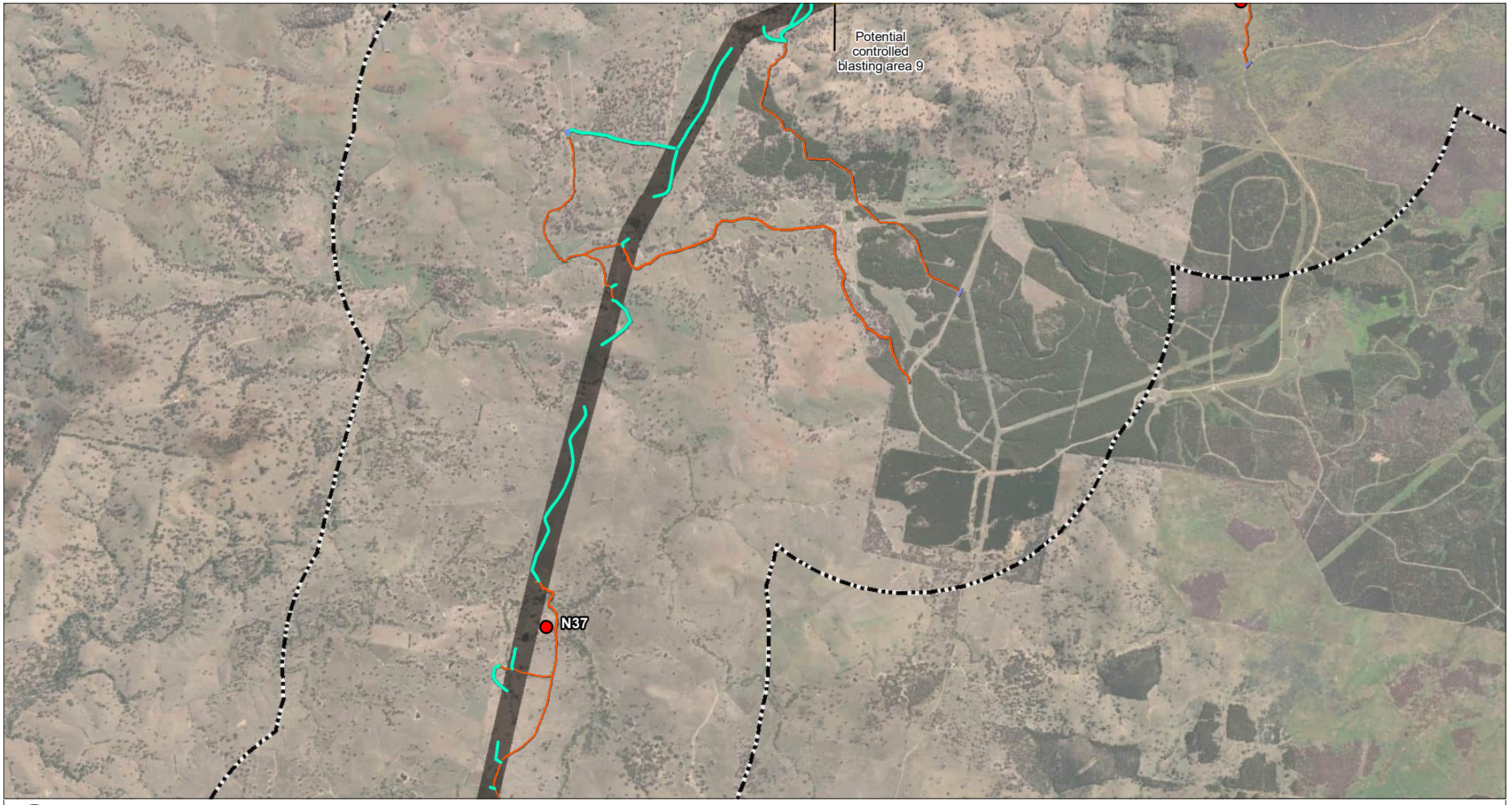

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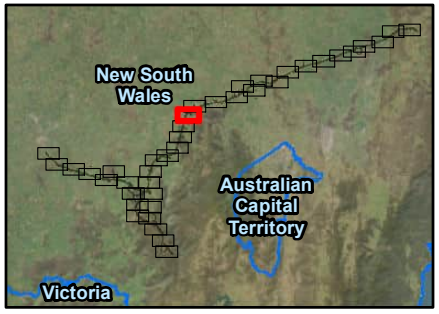

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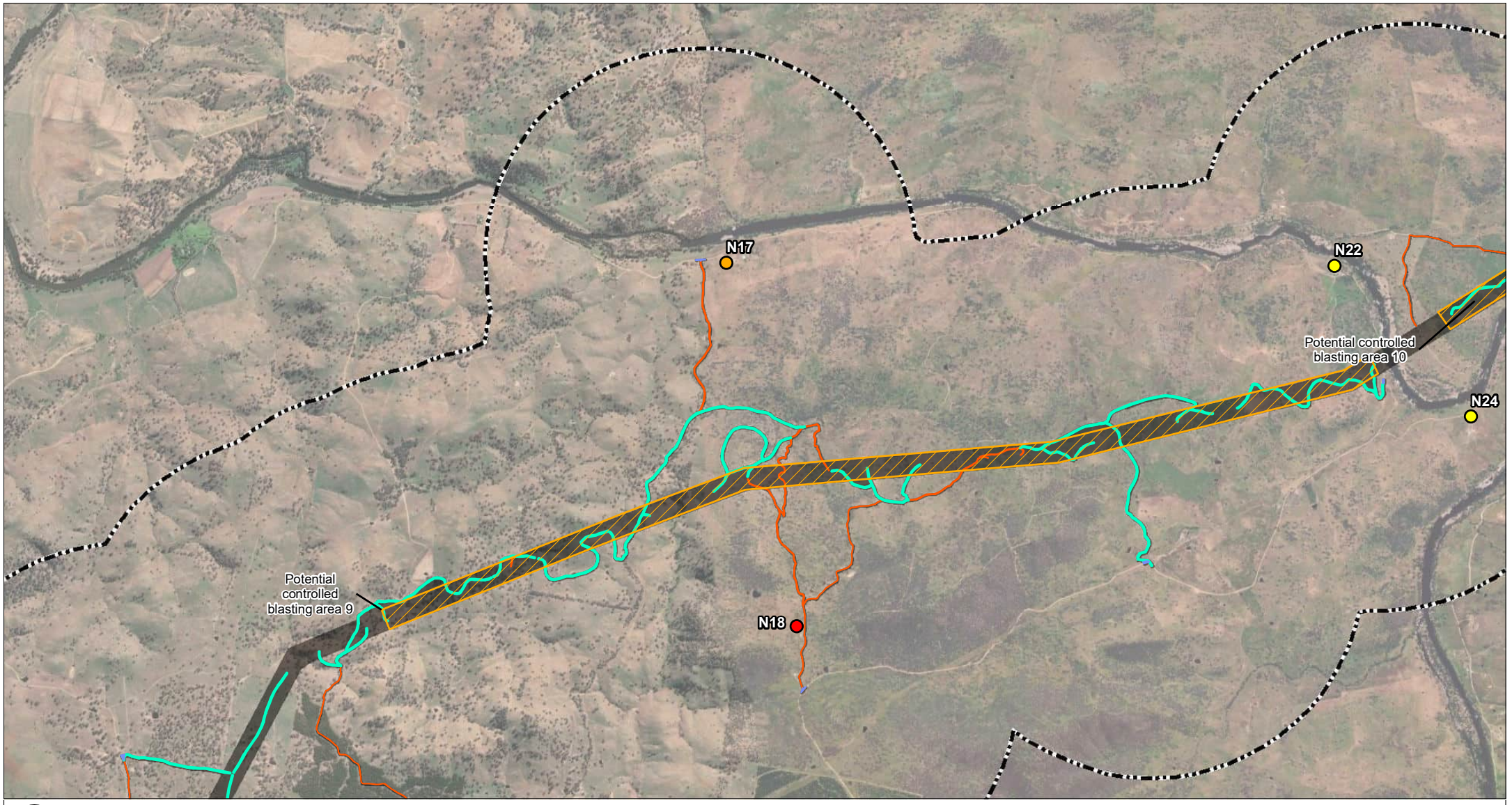

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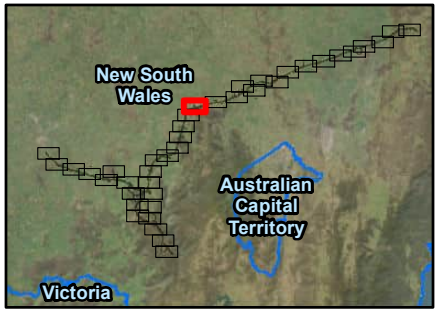

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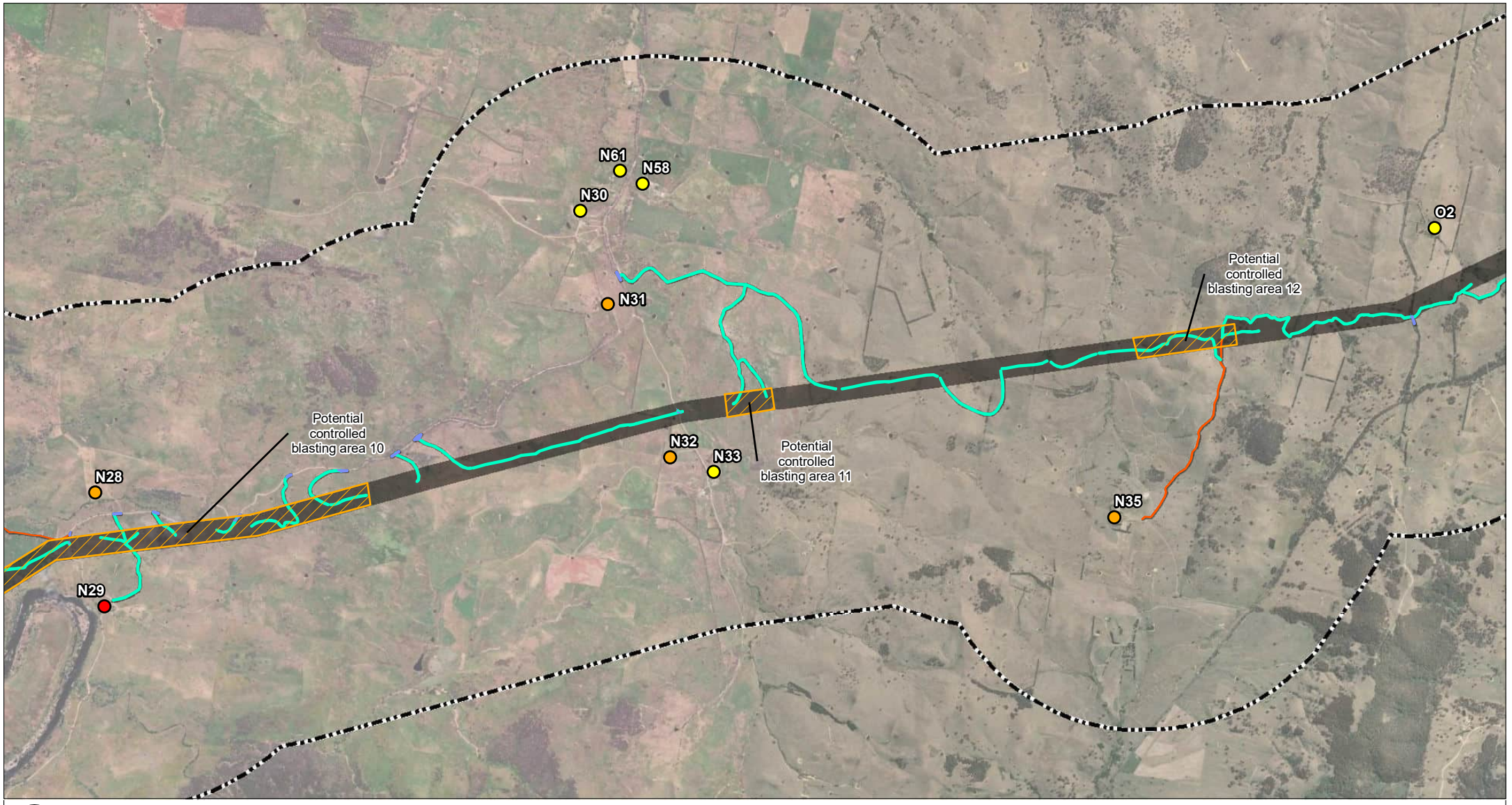

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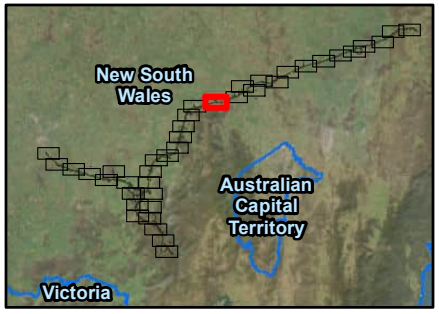

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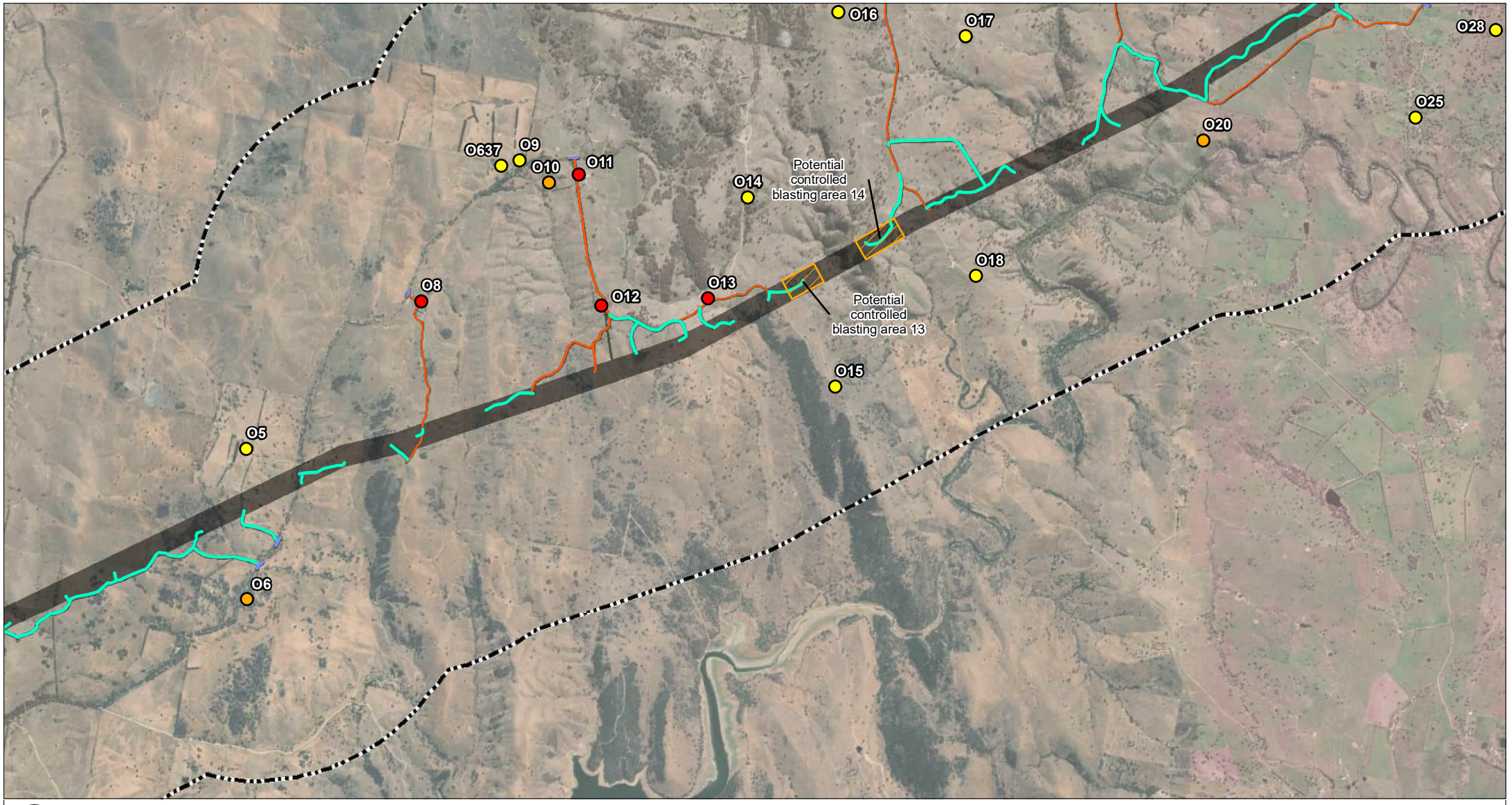

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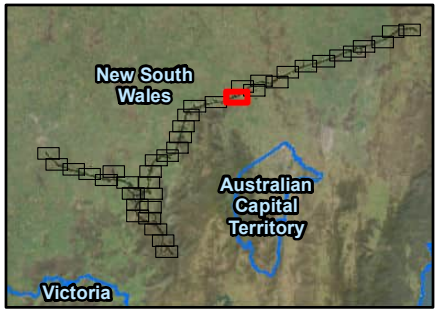

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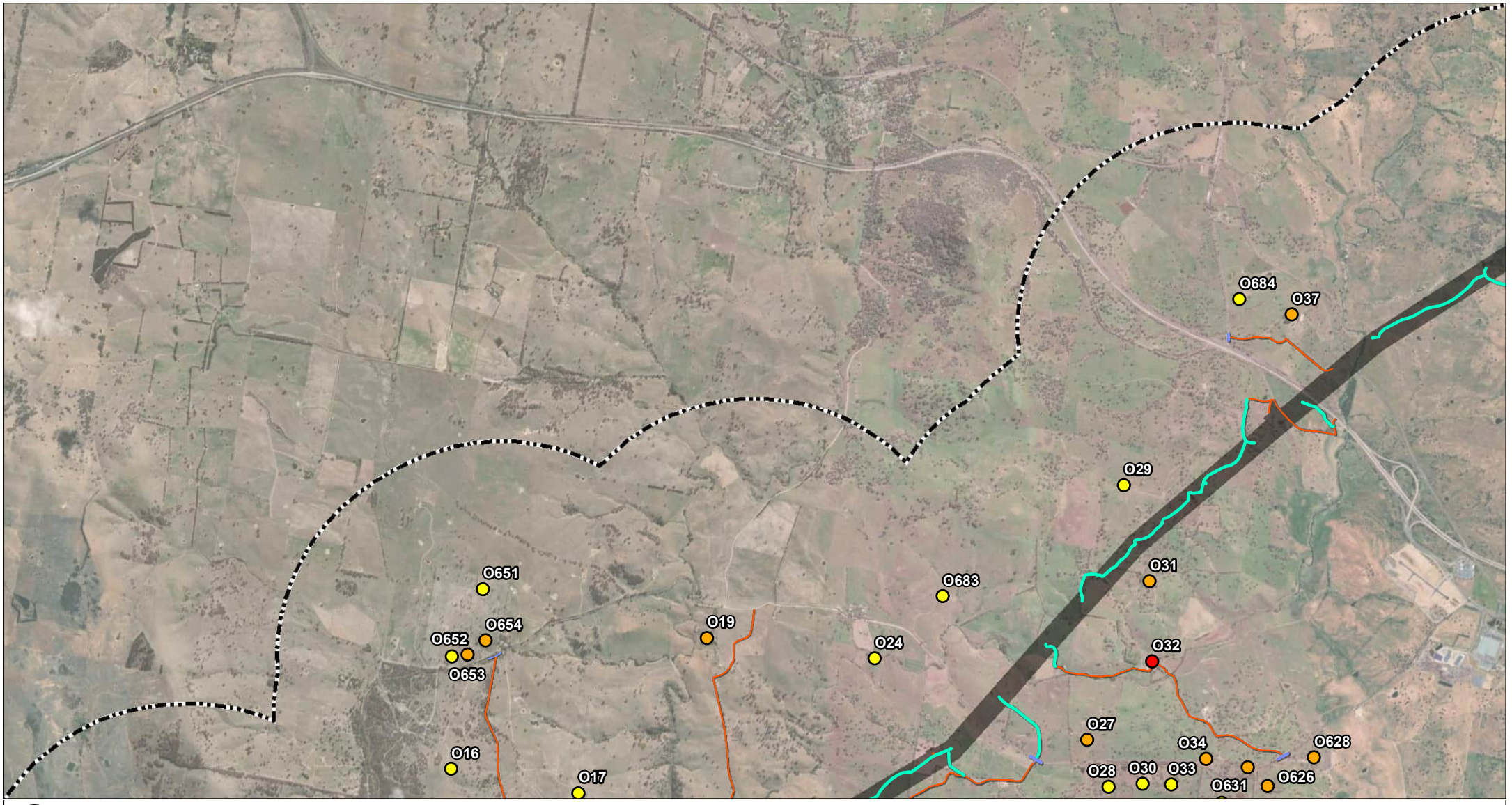

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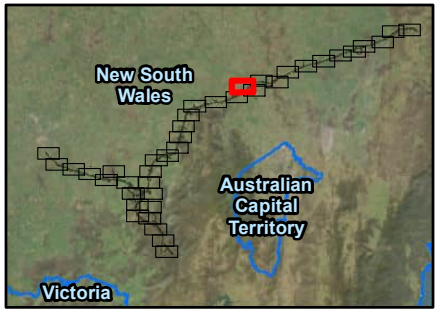

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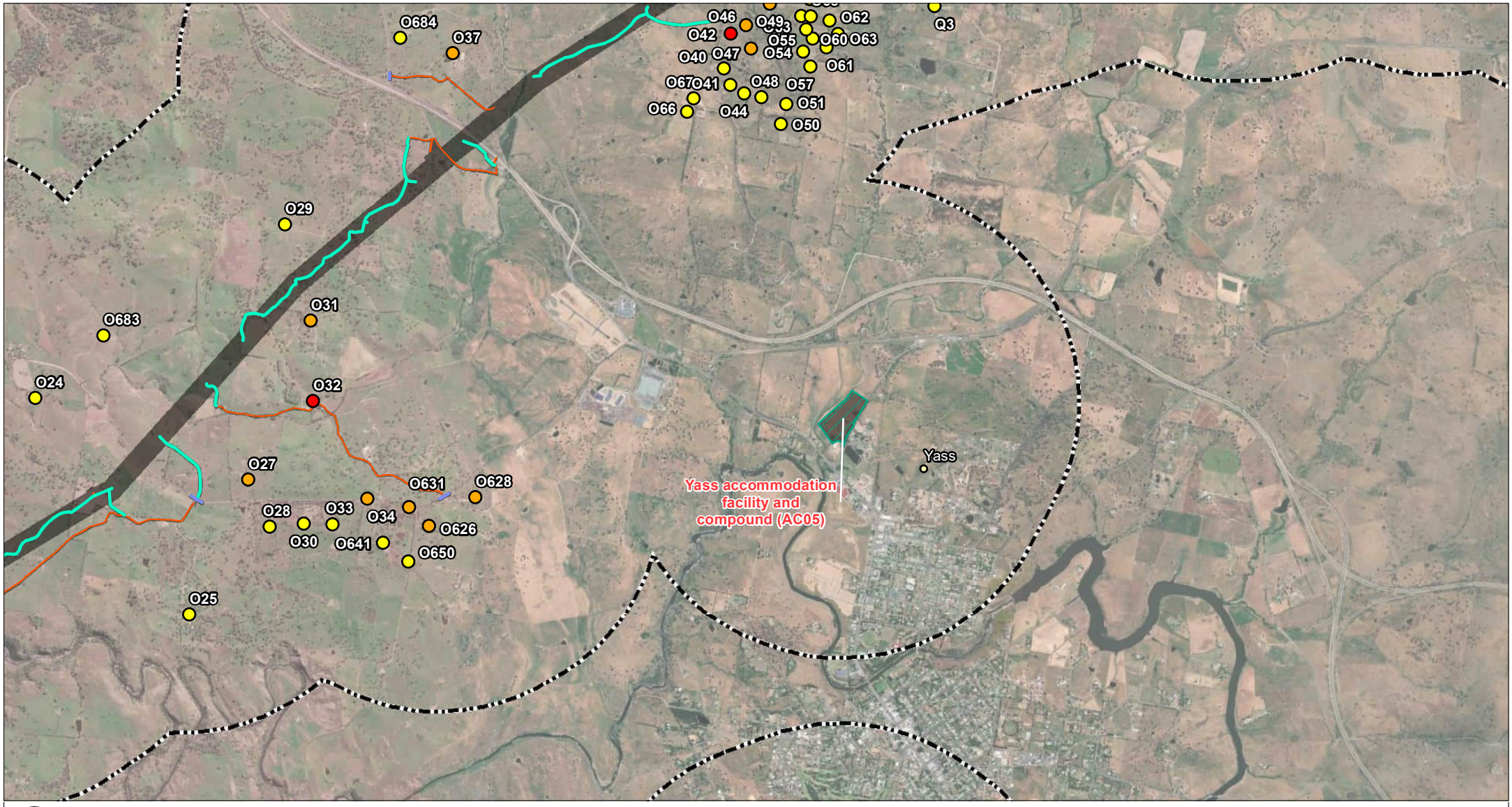

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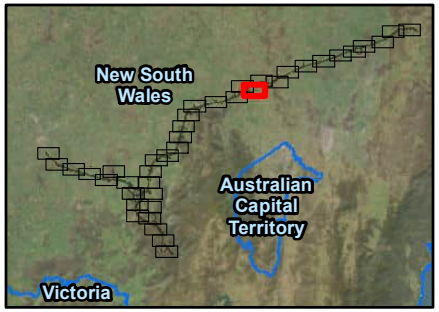

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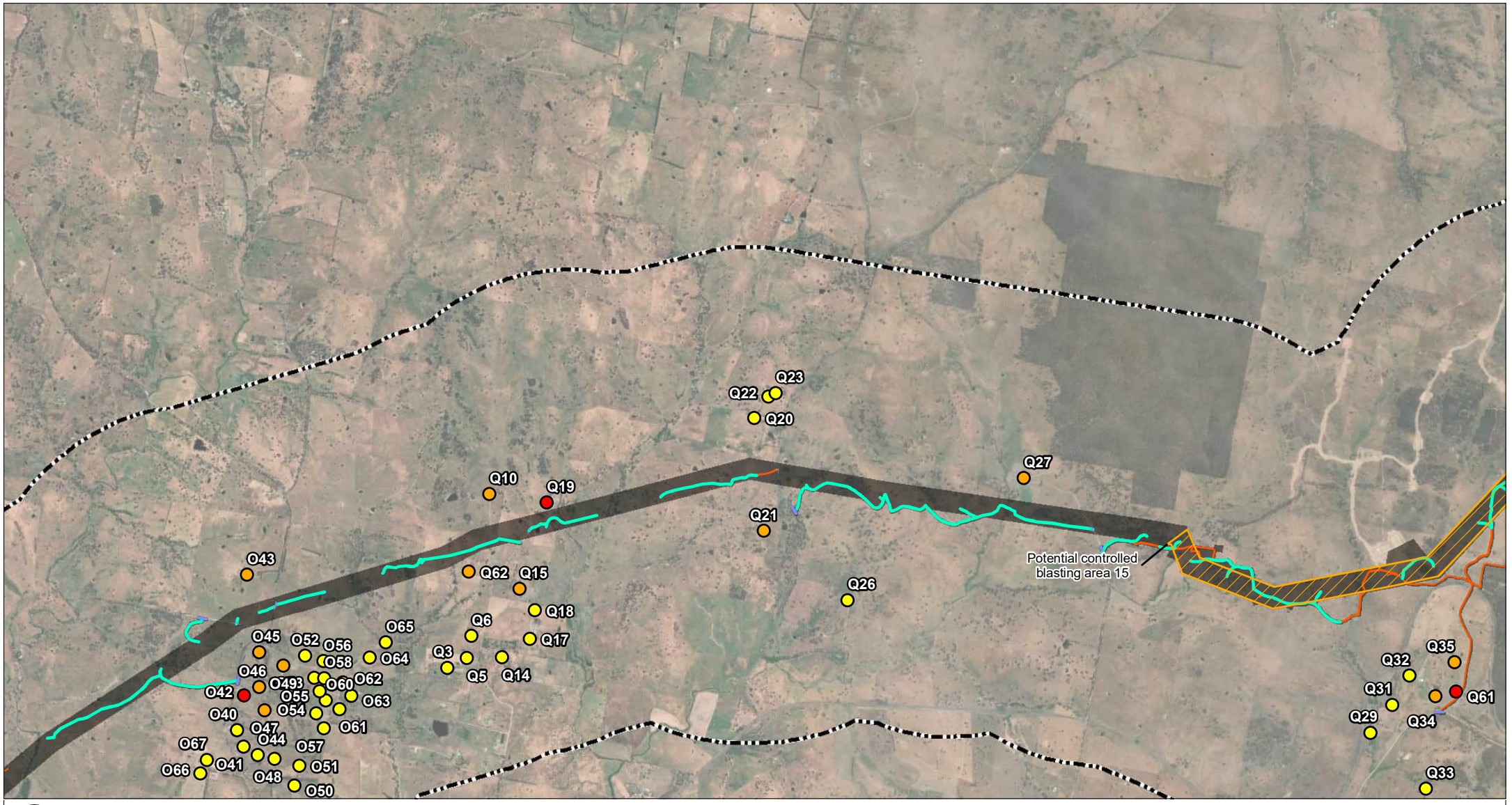

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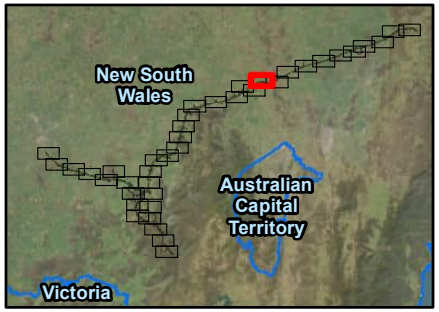

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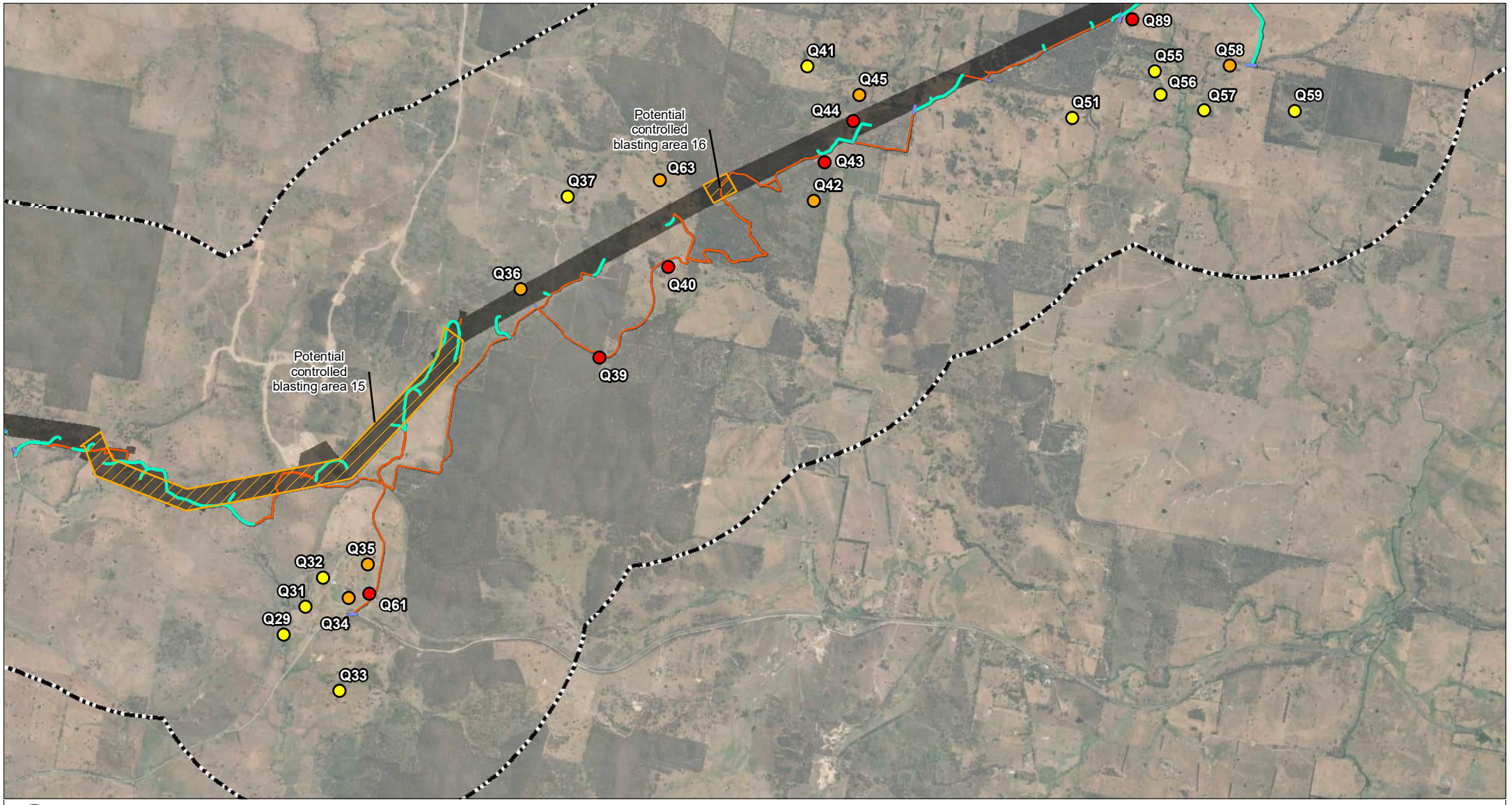

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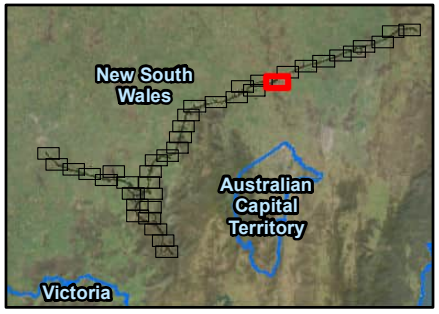
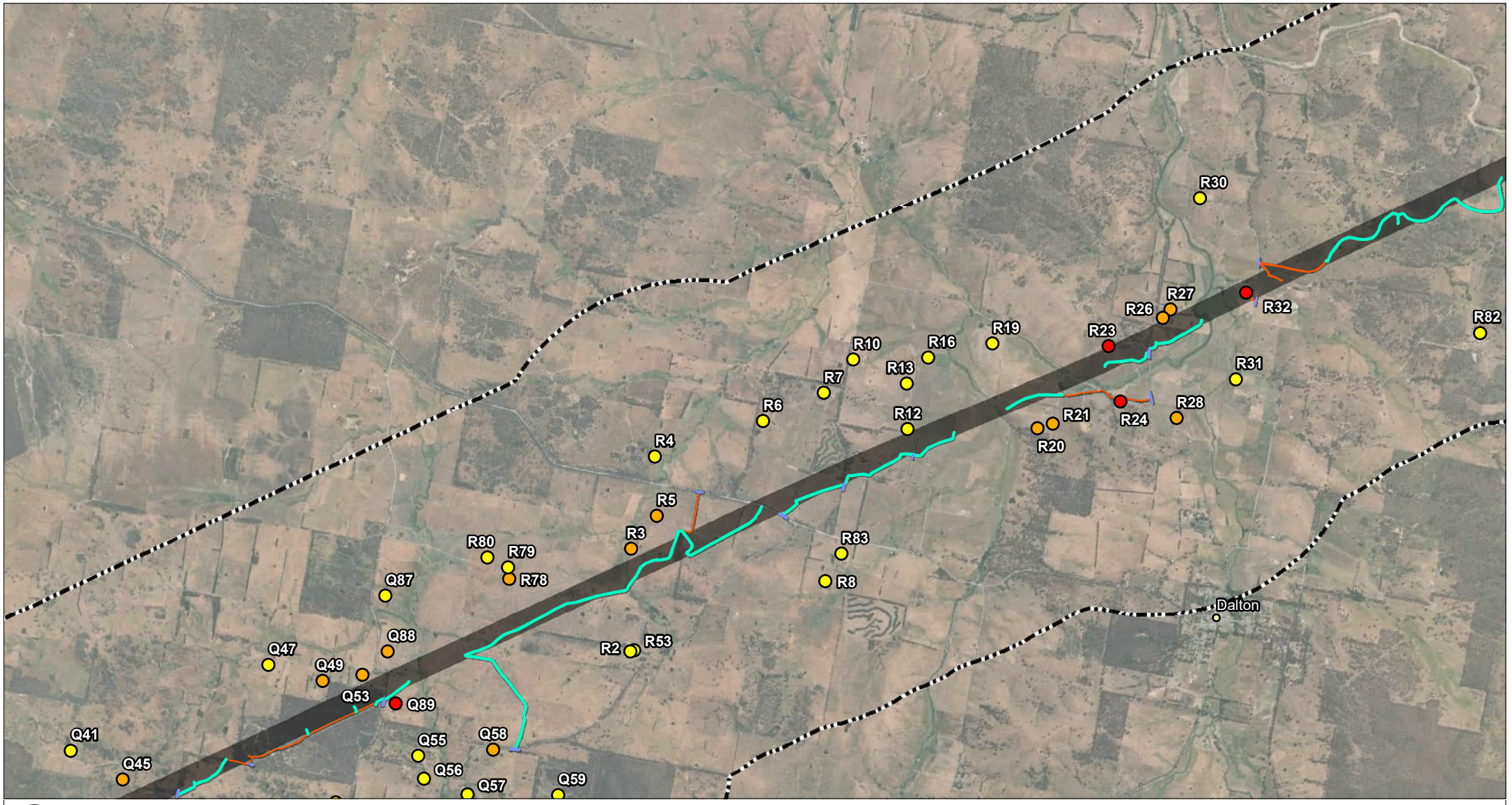


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAY-TIME ACCESS TRACK CONSTRUCTION NOISE IMPACTS

ATTACHMENT G.3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_G3_Worst-case day-time access track construction noise impacts.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
- Existing substation fence line
- Amended study area

Noise Impacts

- 1 – 10 dB (Clearly audible)
- 11 – 20 dB (Moderately intrusive)
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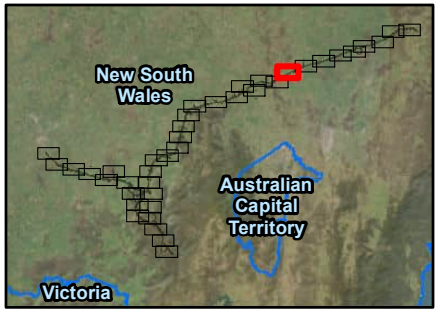

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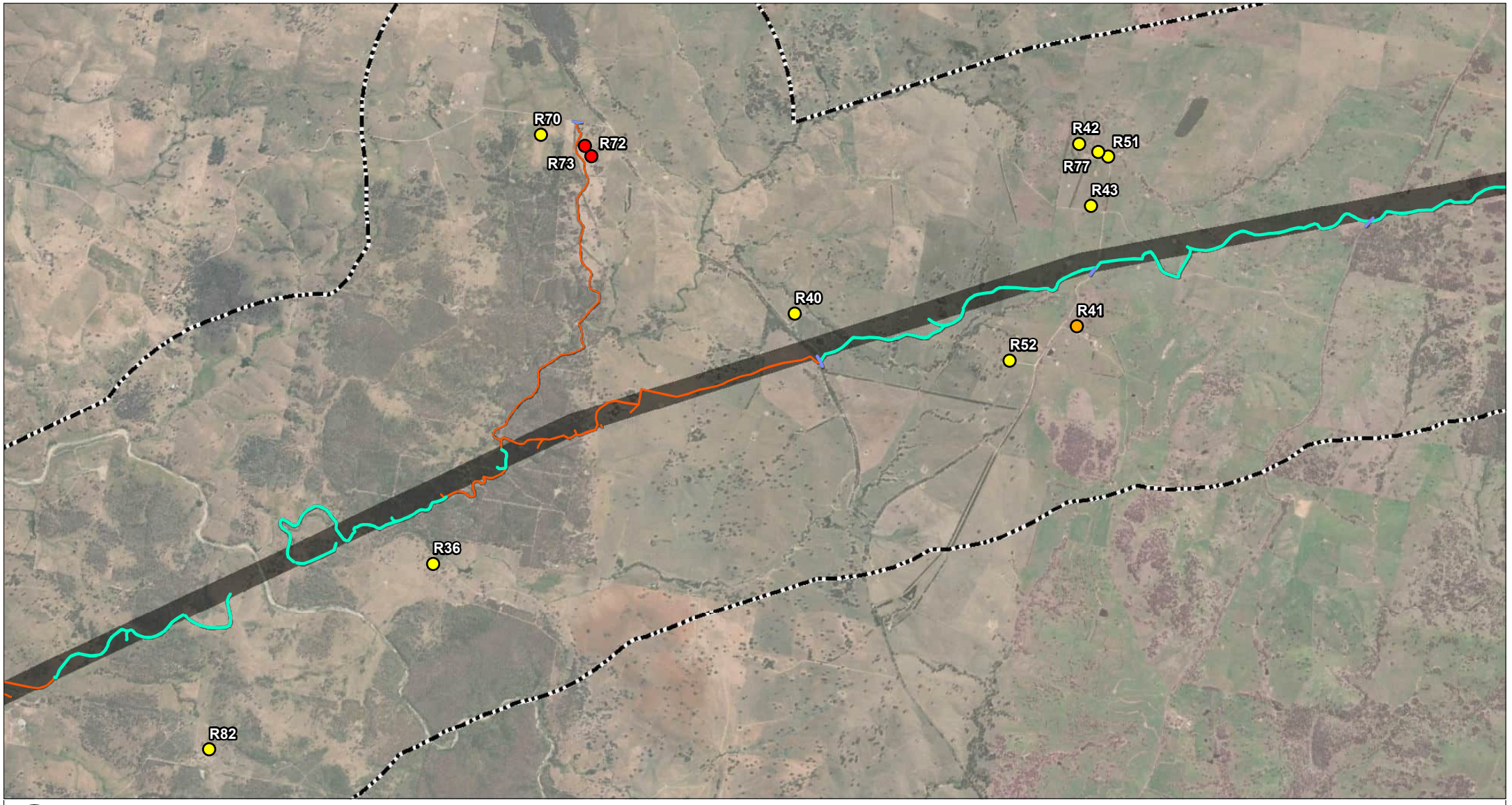

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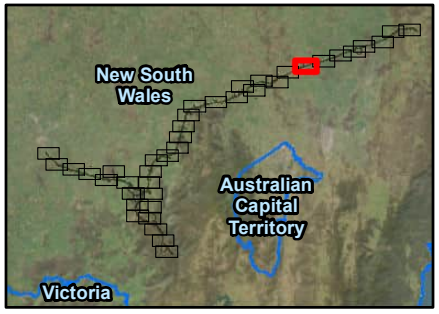

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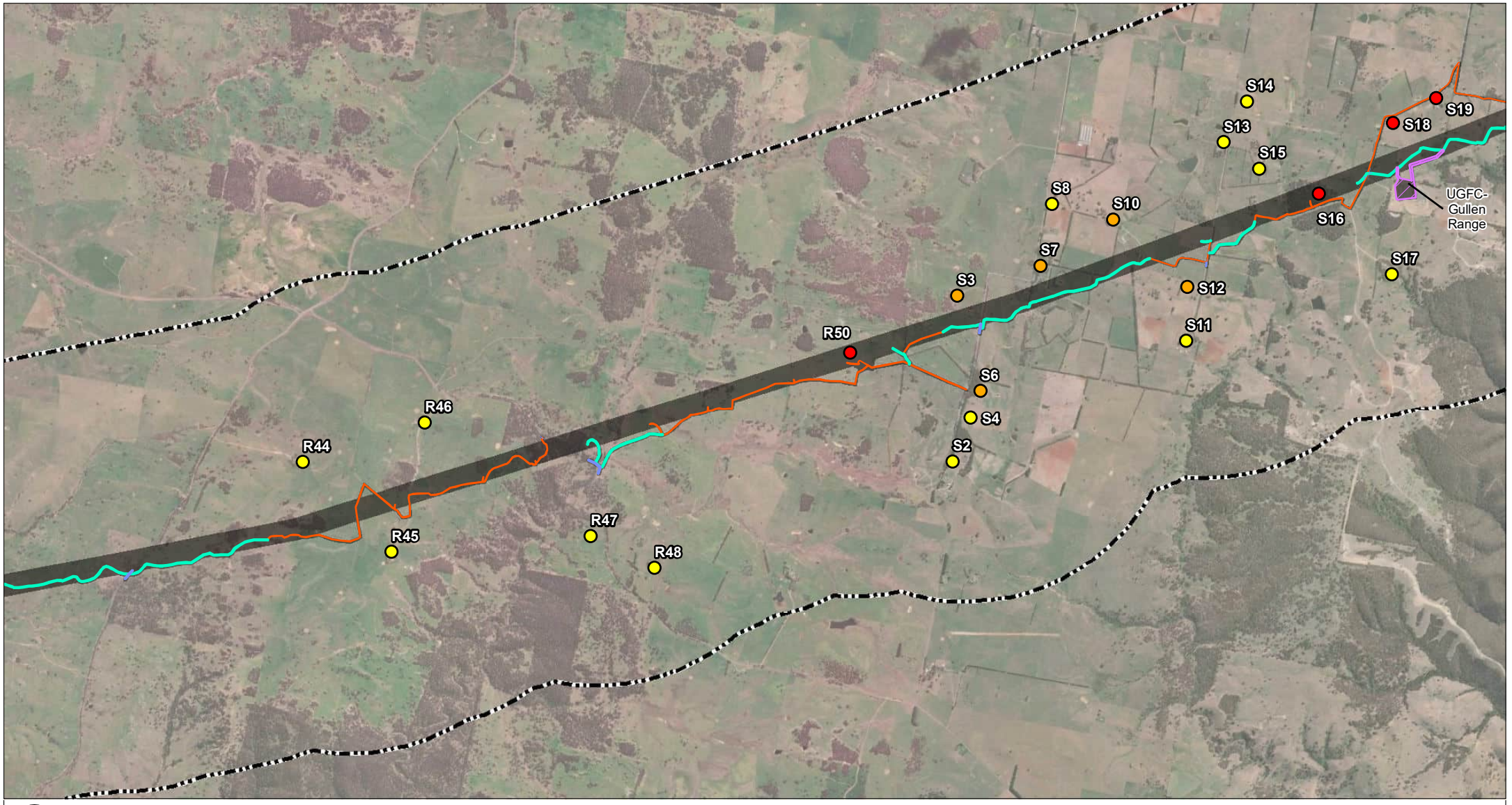

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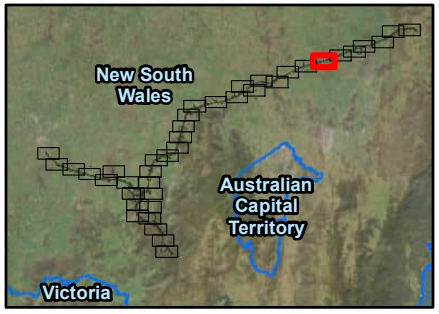

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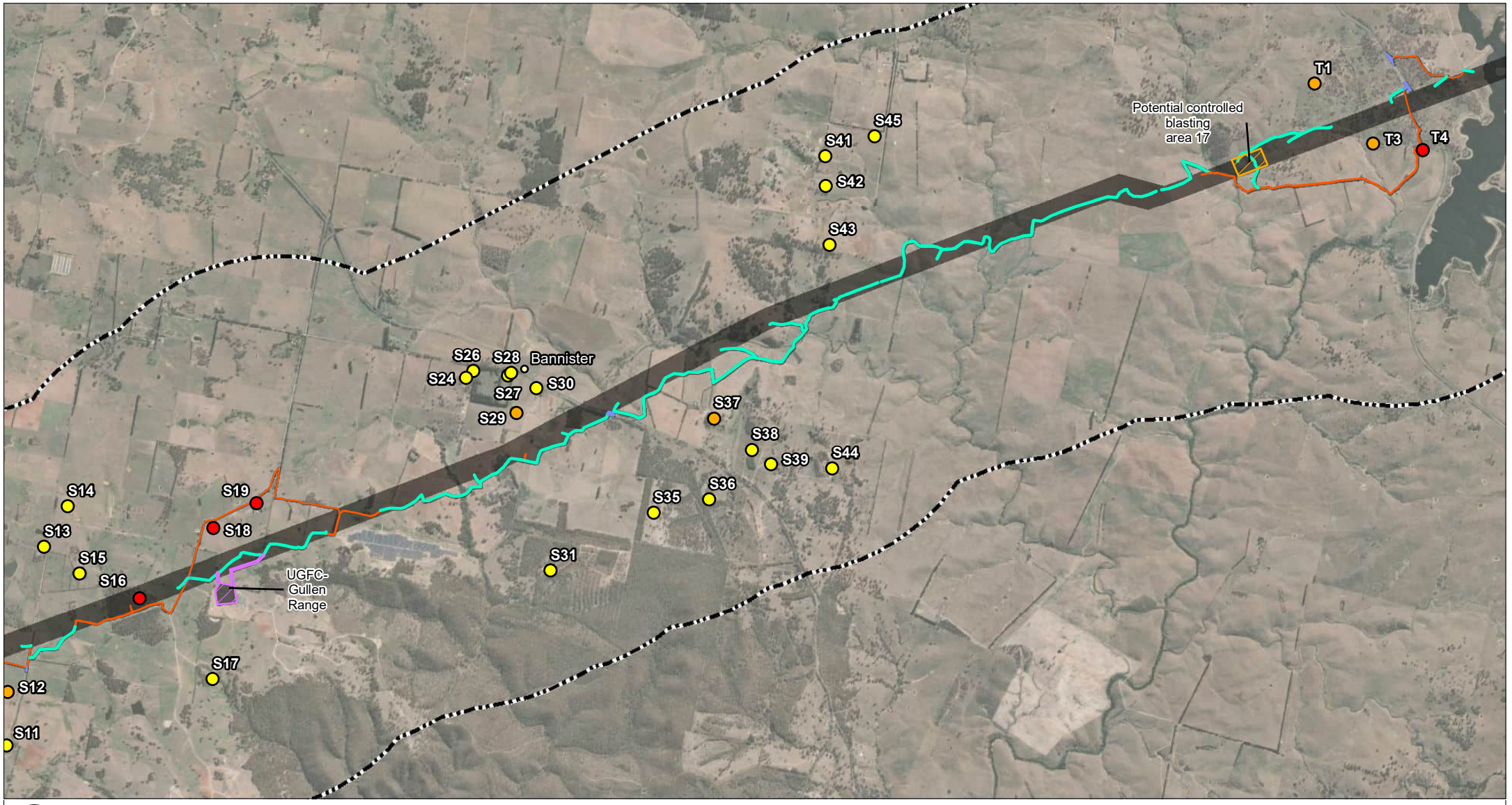

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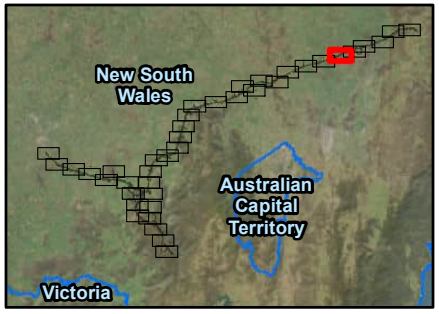

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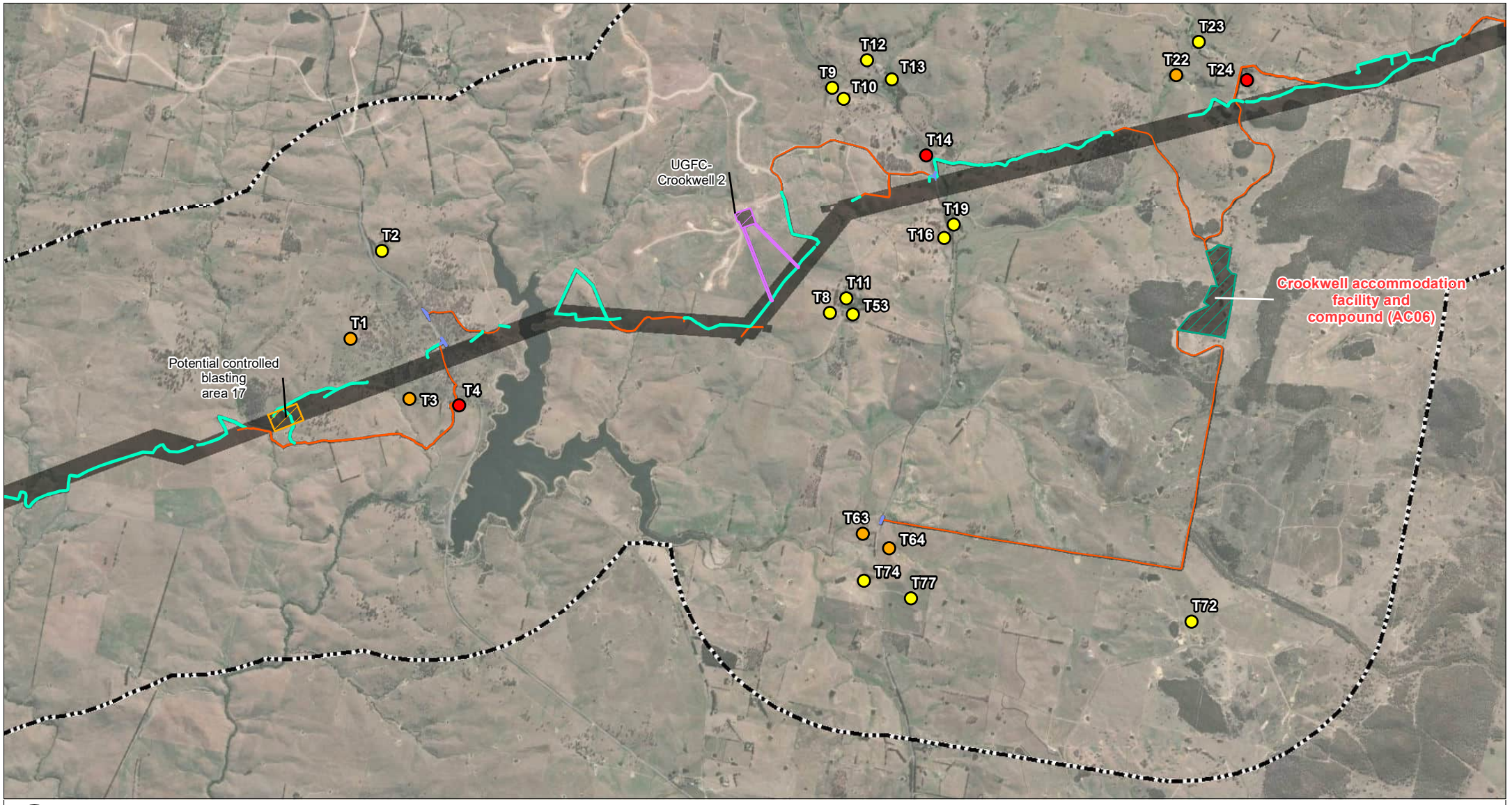

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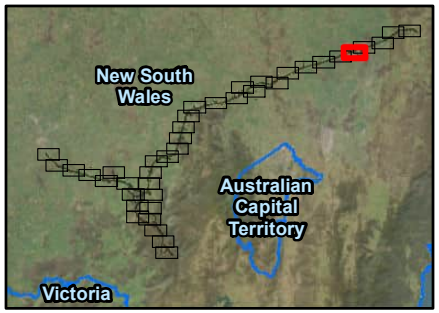

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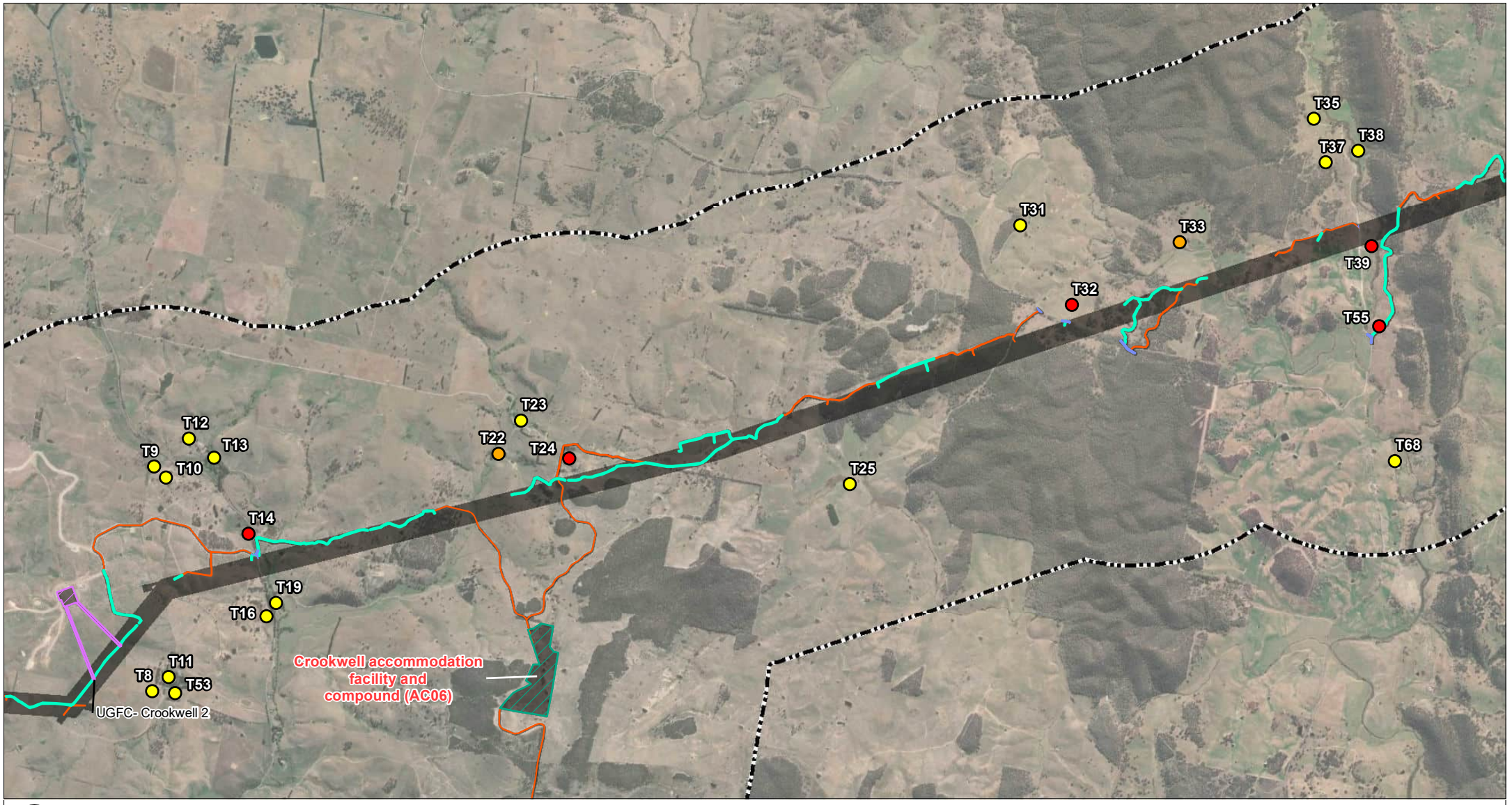

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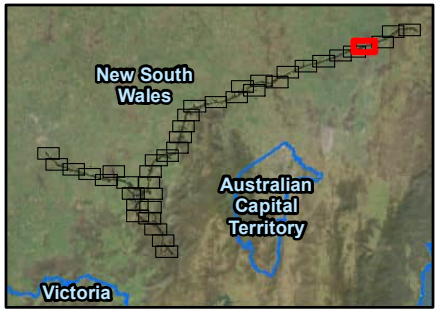

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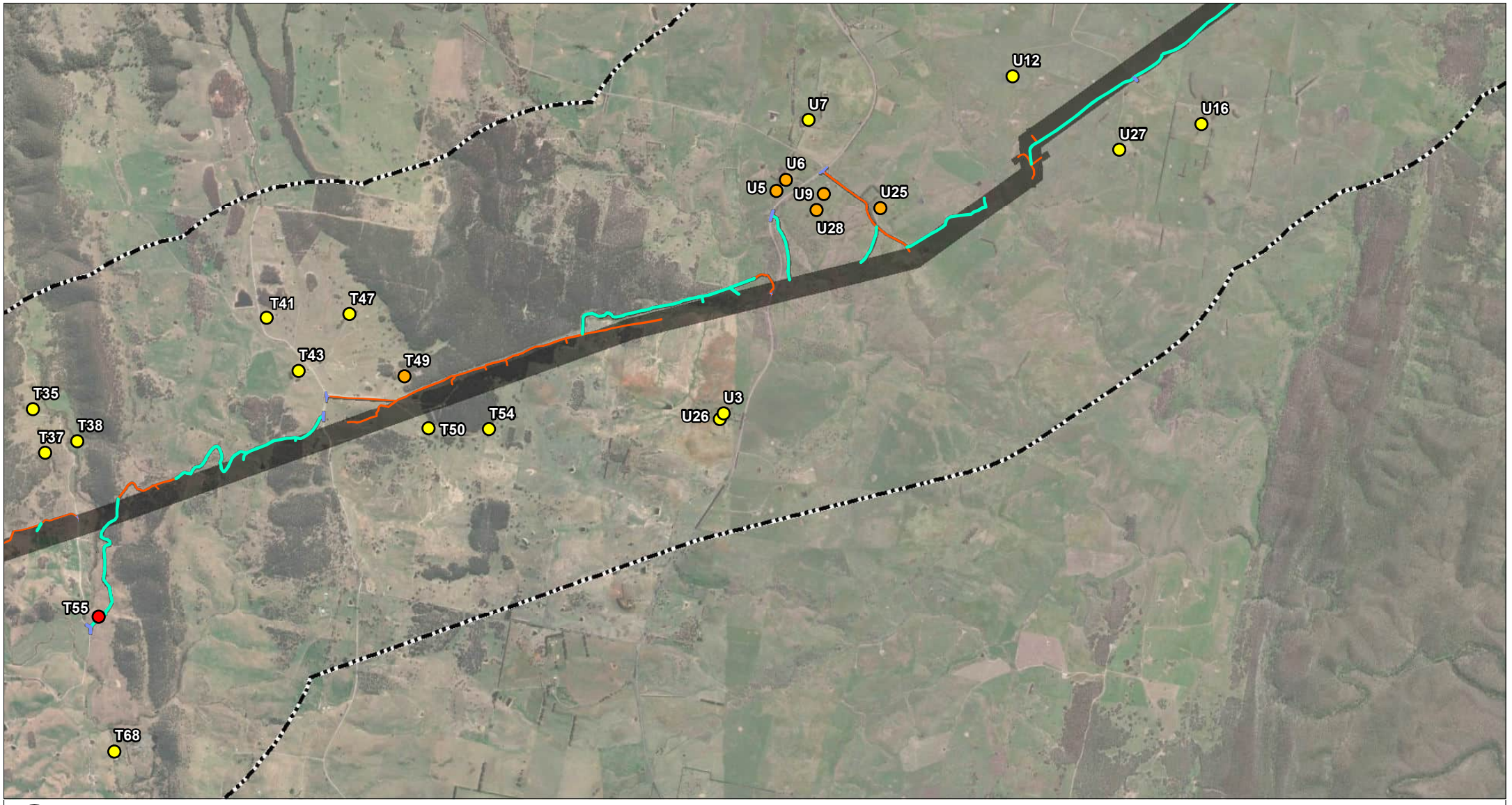

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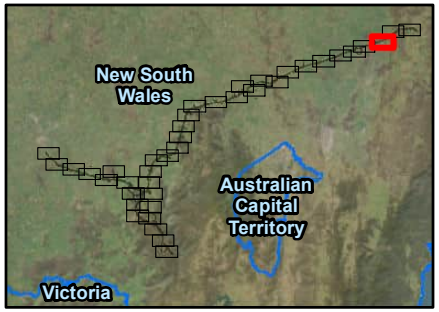

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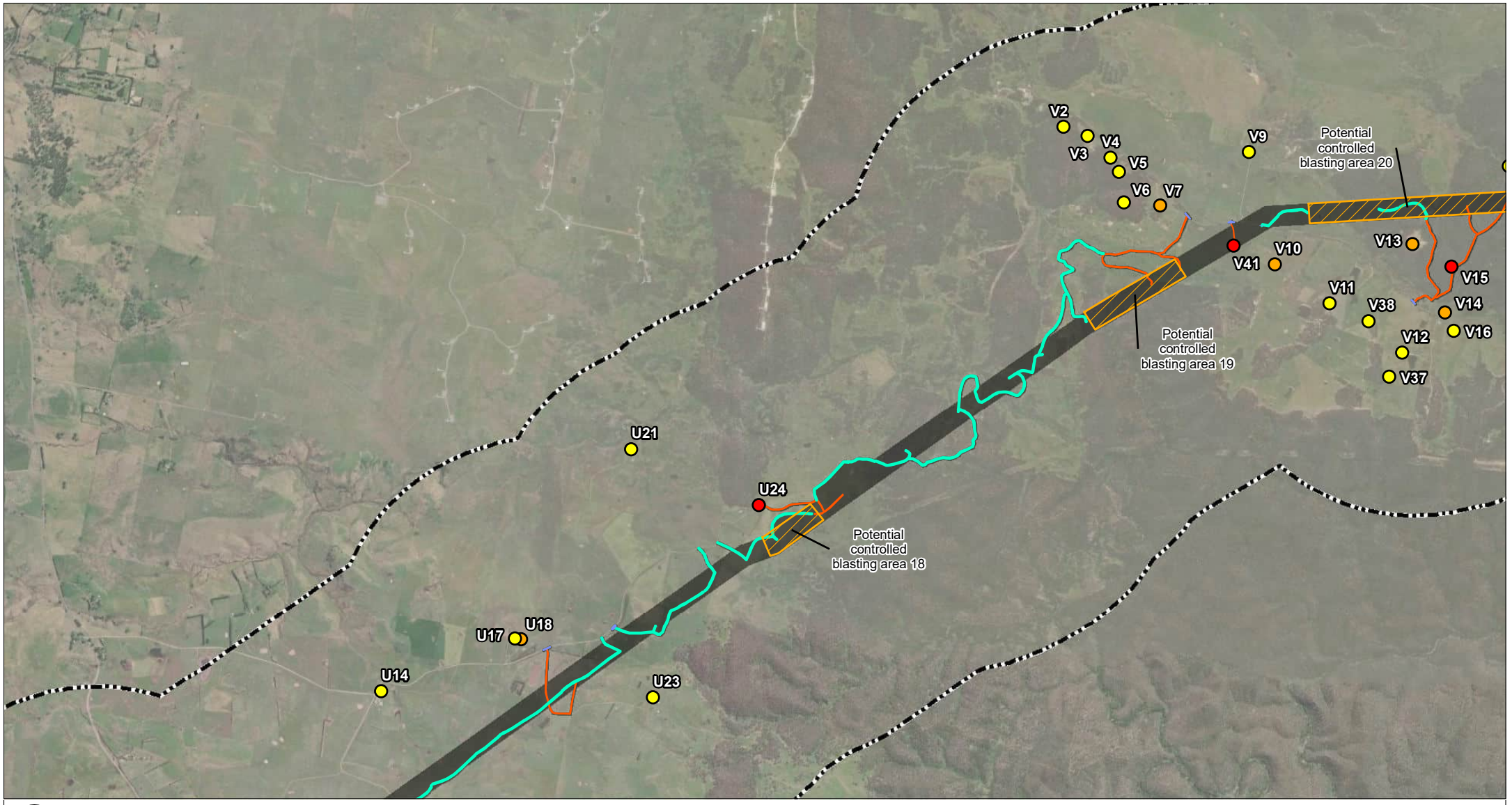

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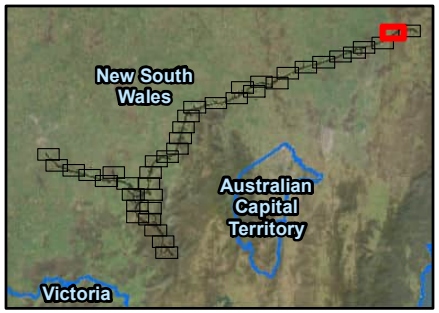

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE DAY-TIME ACCESS TRACK CONSTRUCTION NOISE IMPACTS

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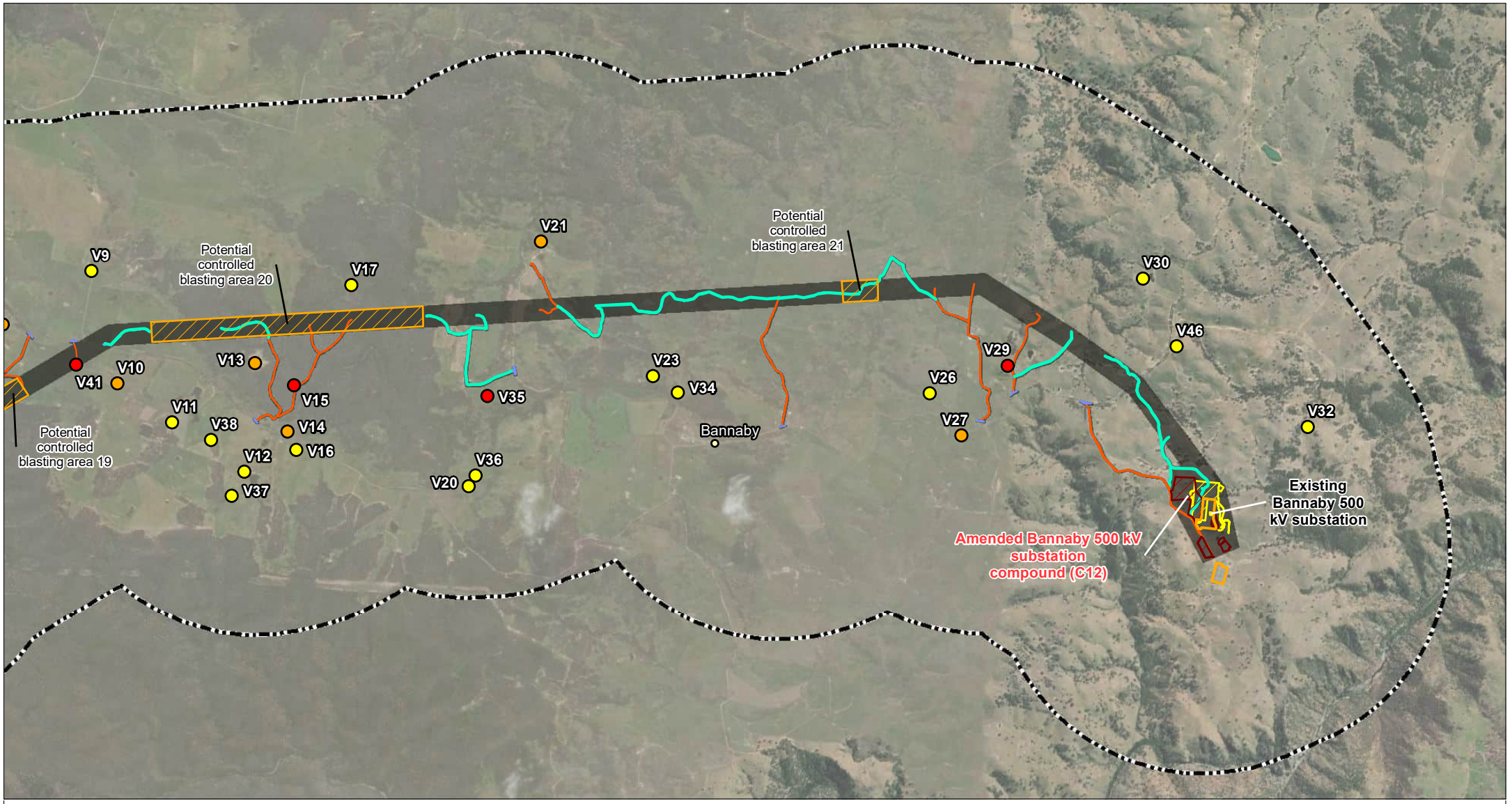

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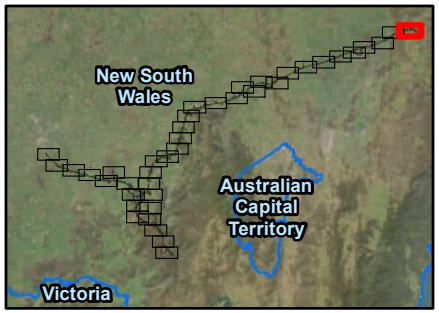

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Attachment H Construction vibration impact mapping

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

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Vibration Impacts

- Cosmetic Damage
- Human Comfort

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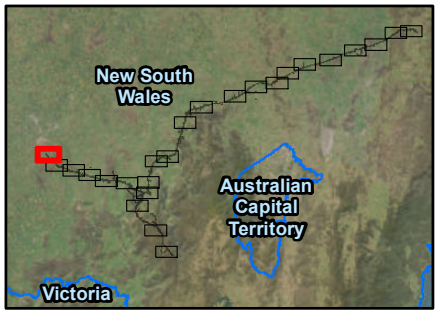

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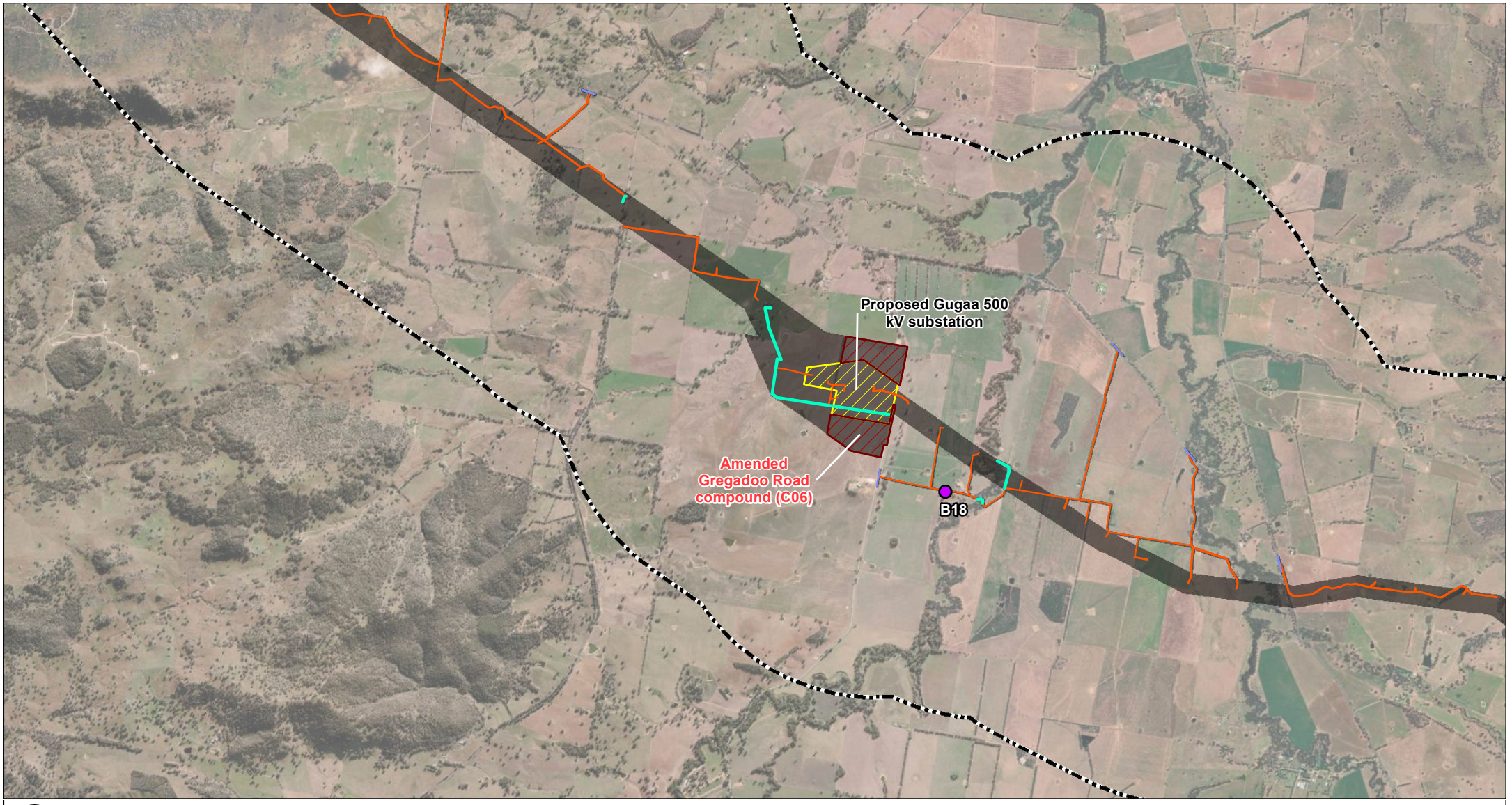
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

ATTACHMENT H



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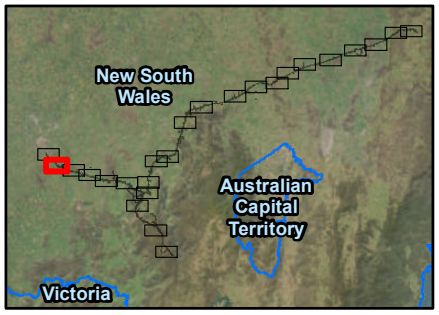

HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

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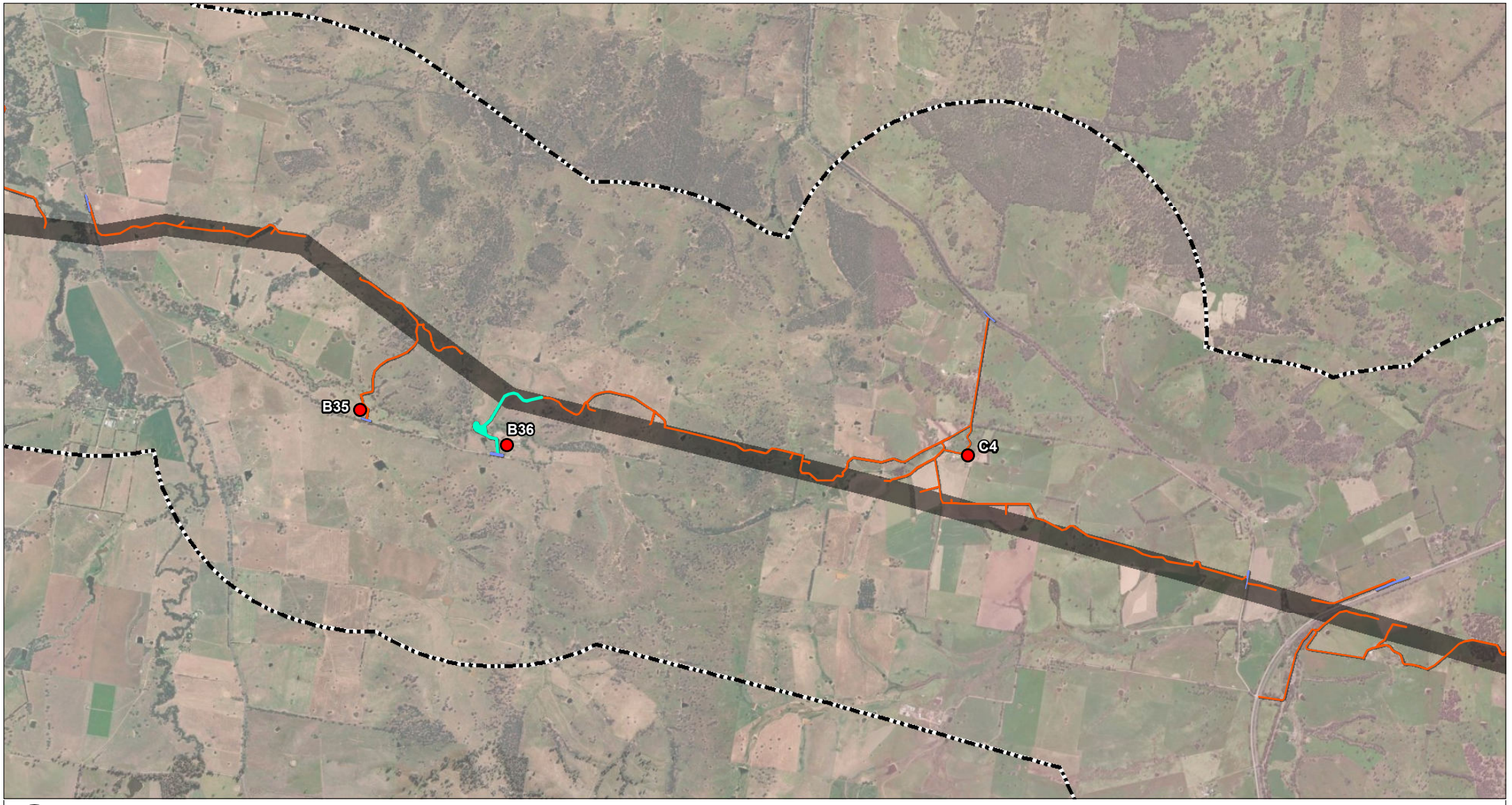

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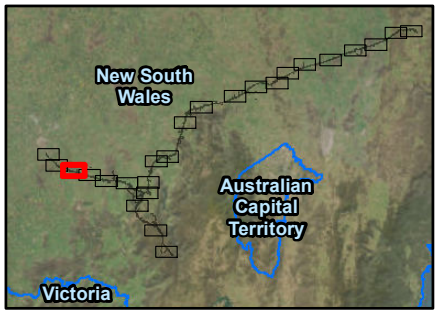

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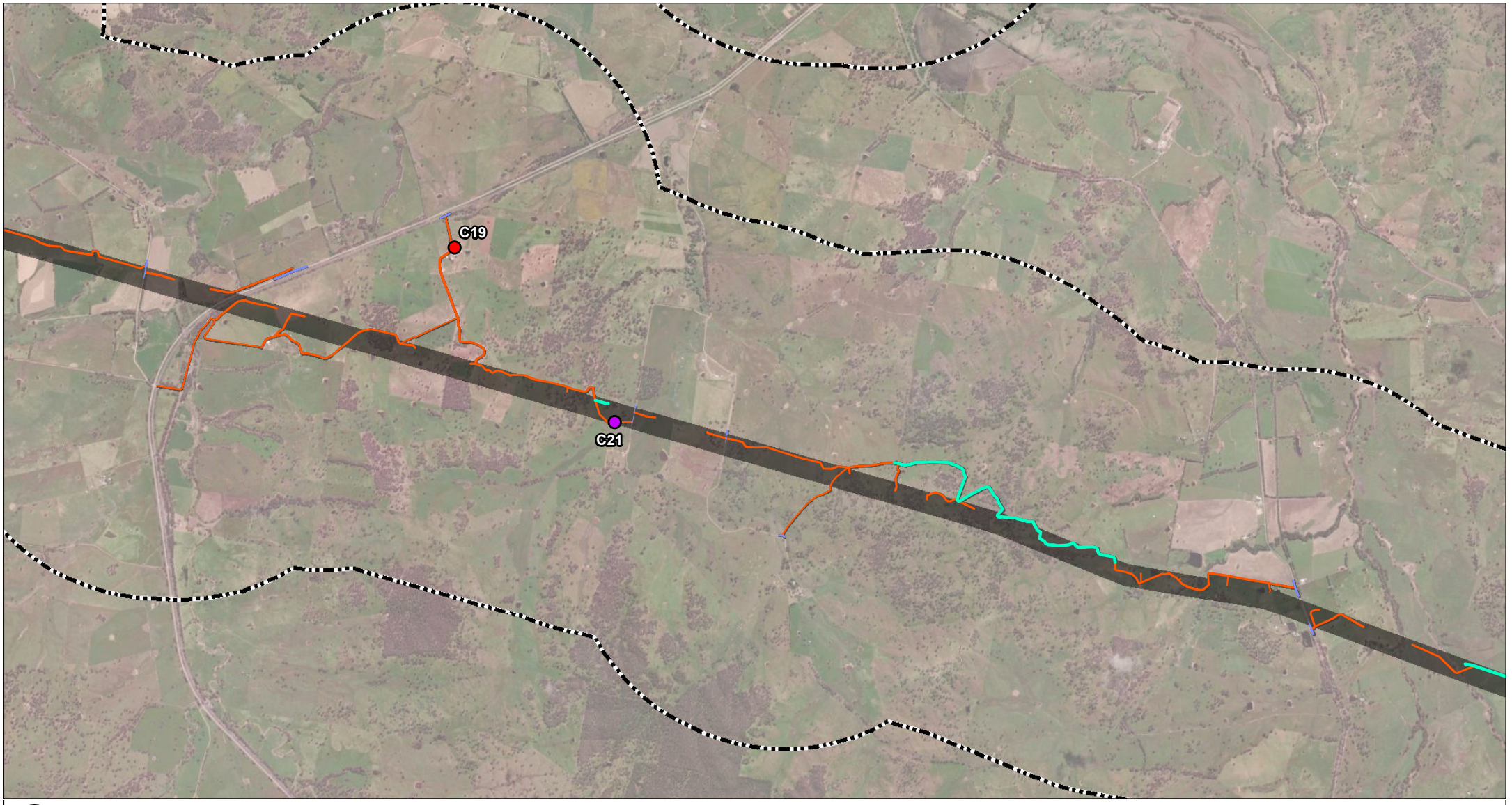

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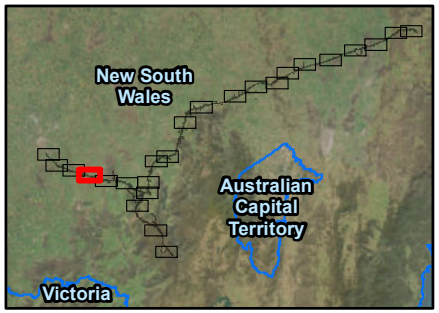

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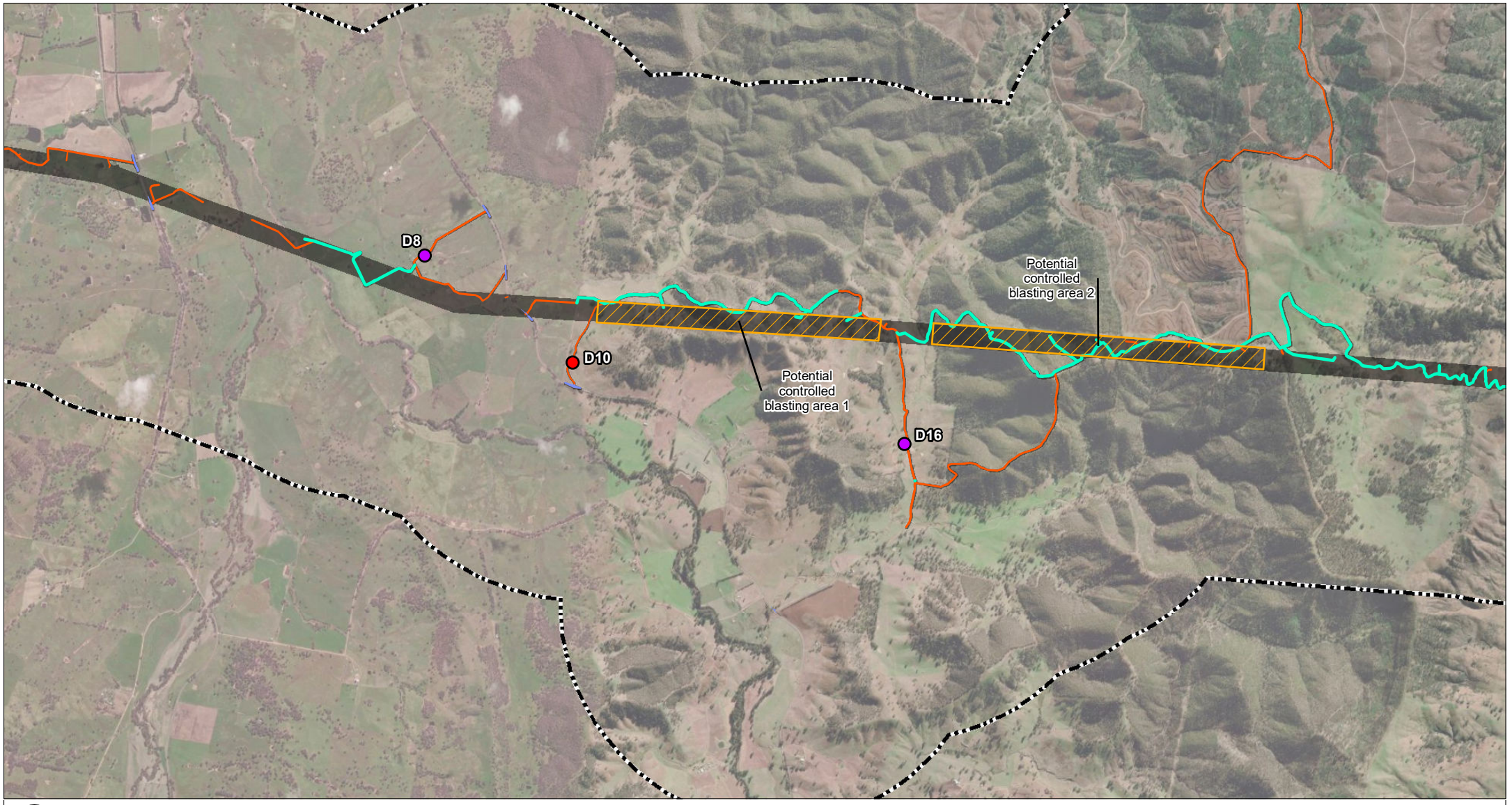

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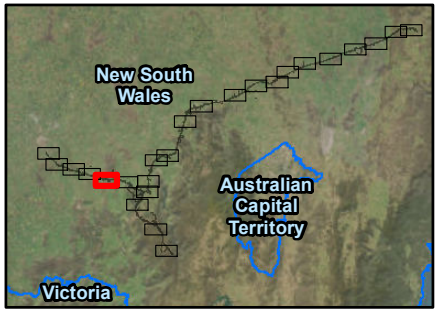

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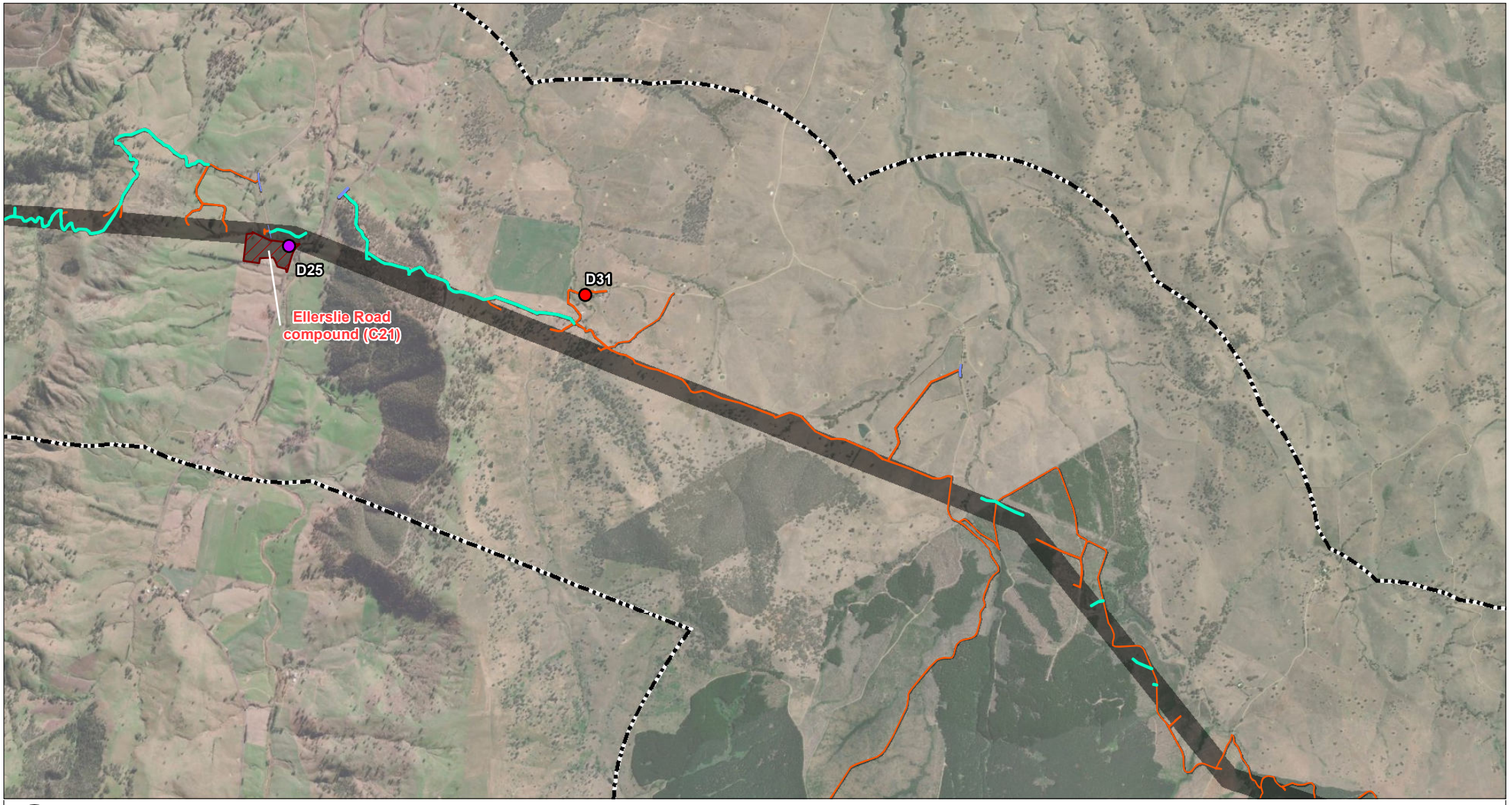

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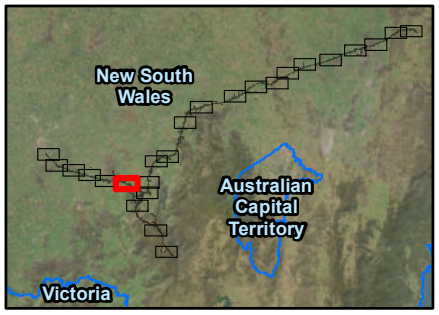
Access track - Upgrade



HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

ATTACHMENT H

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_H_Worst-case construction vibration impacts.mxd

0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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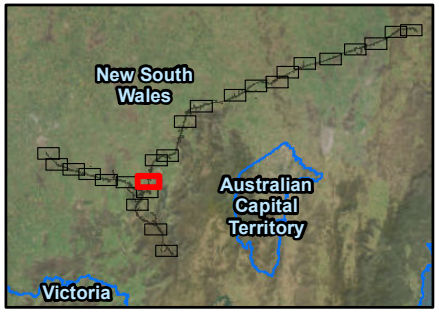

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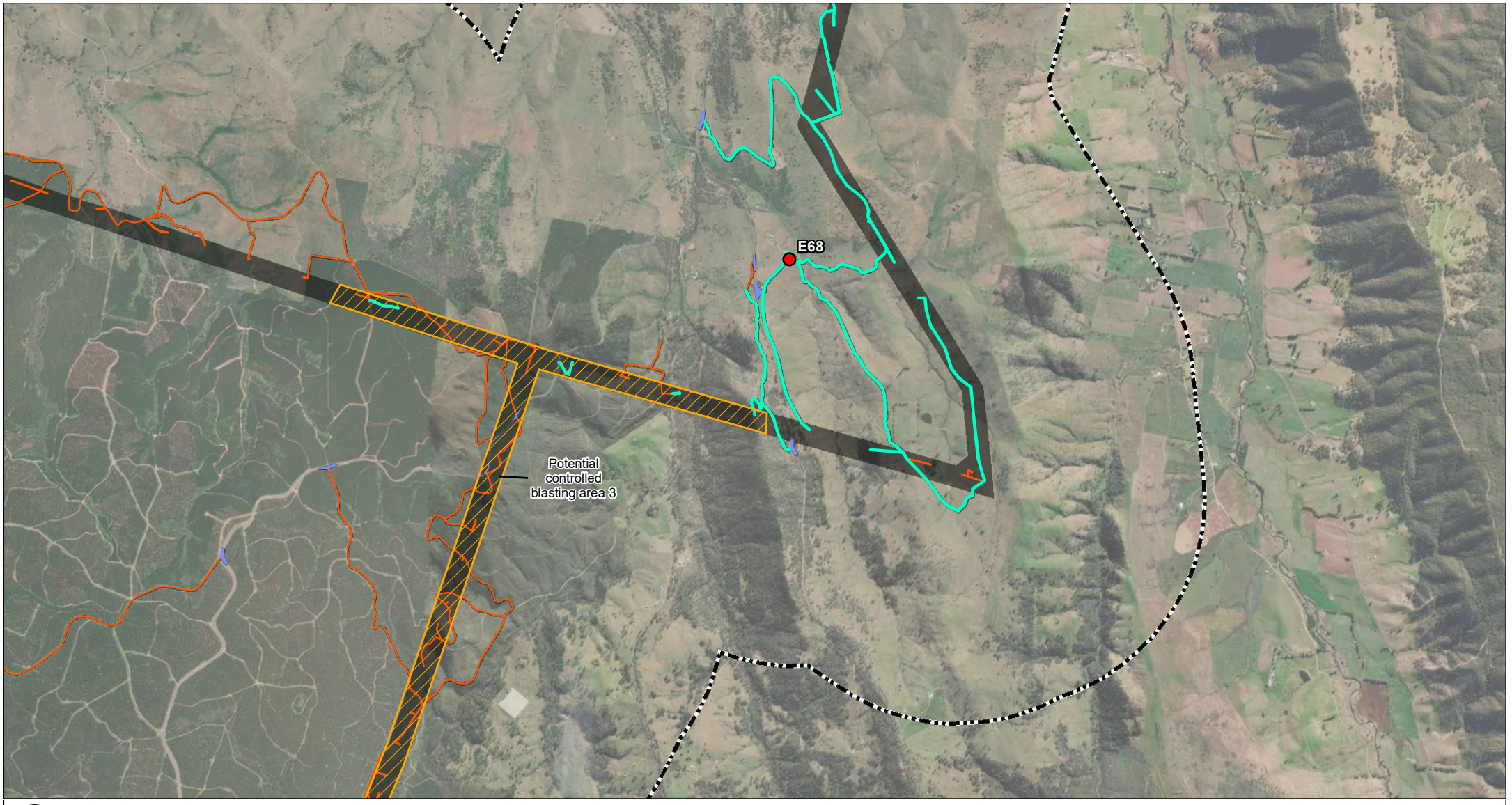

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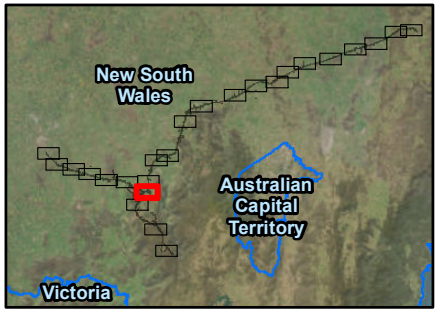

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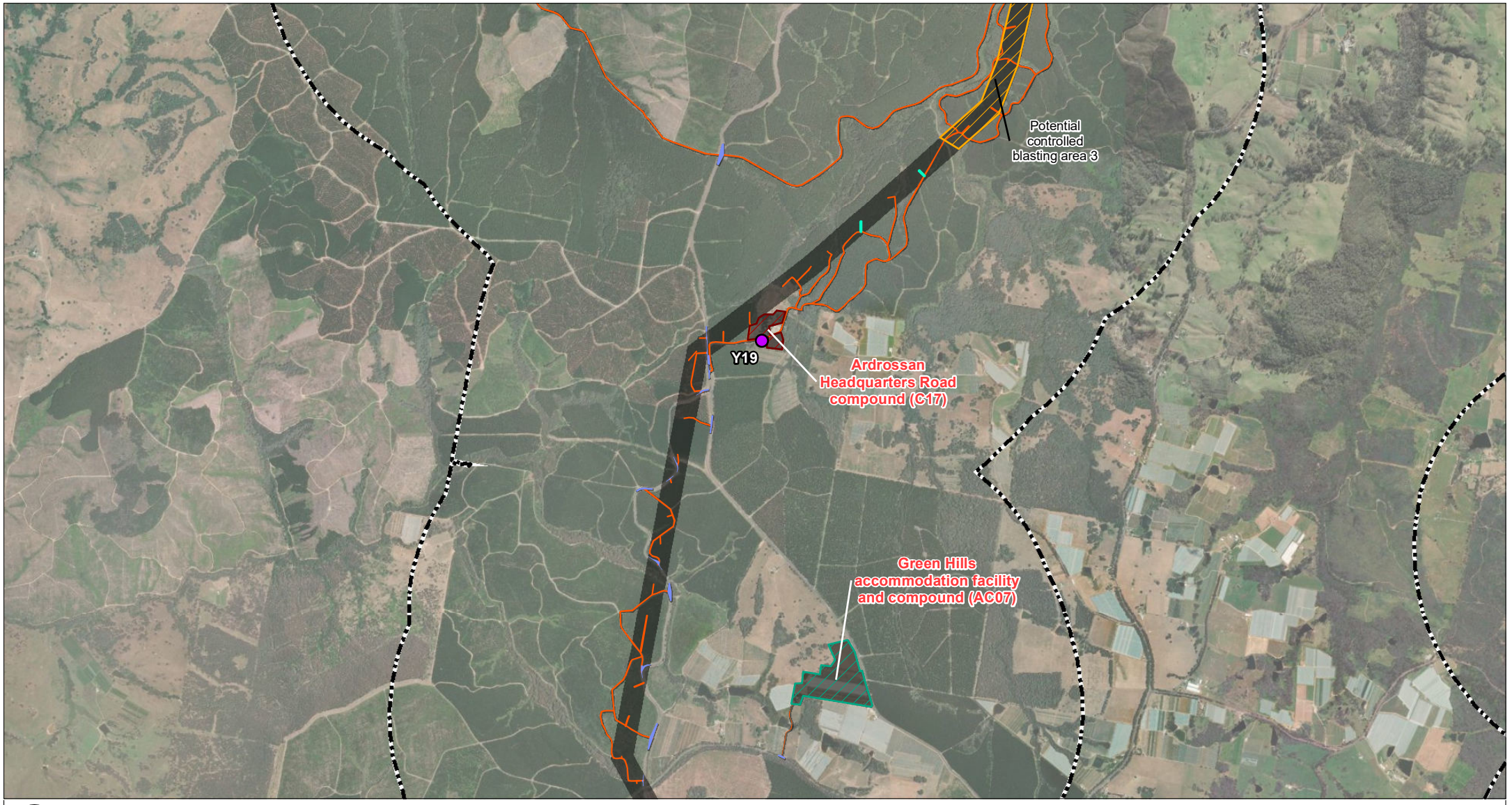

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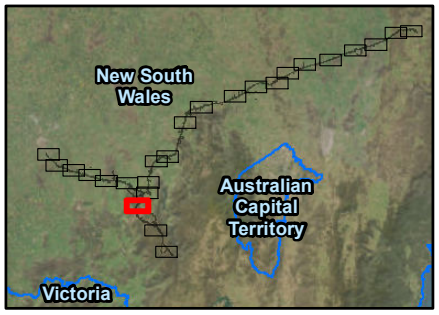

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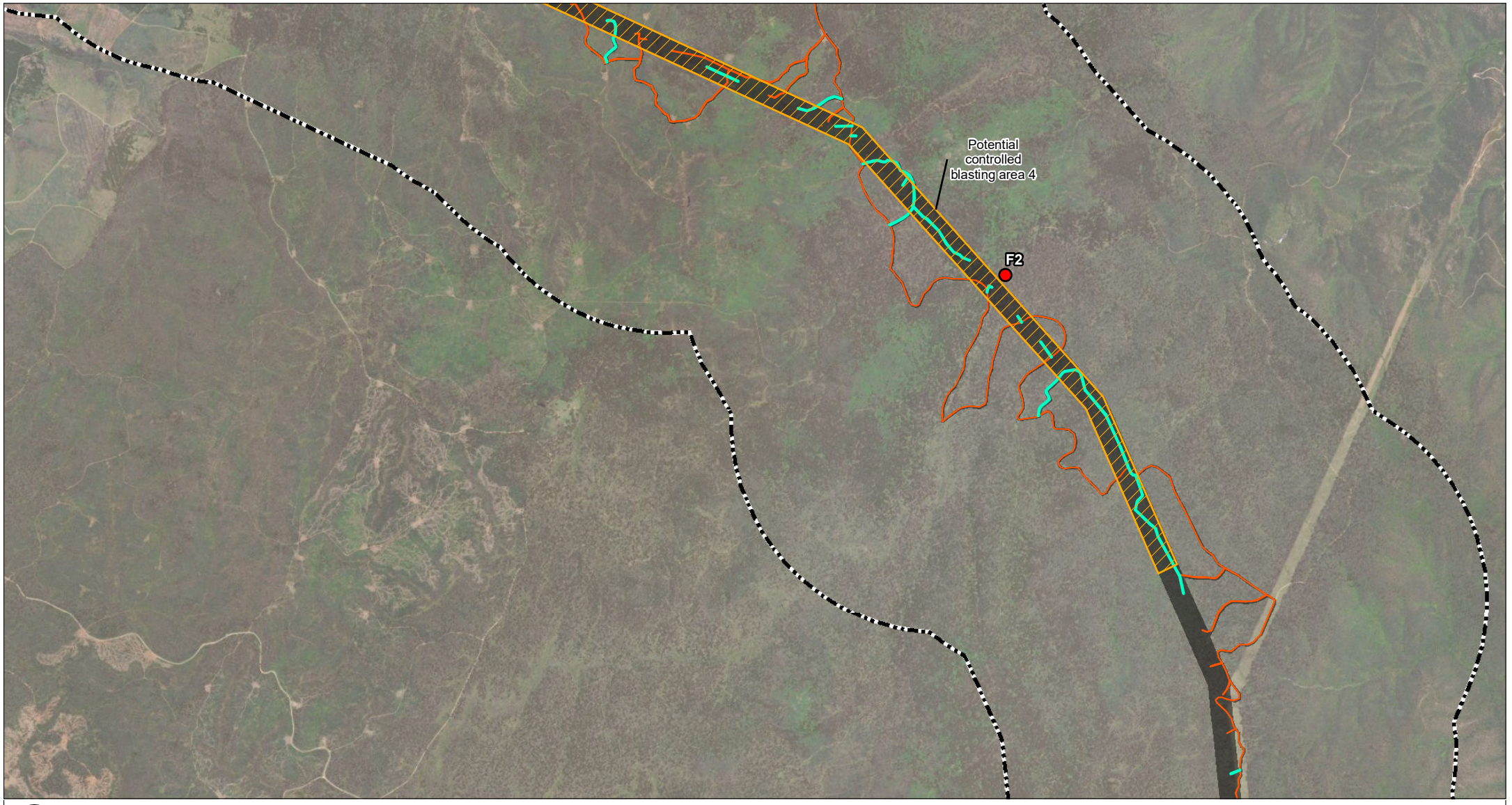

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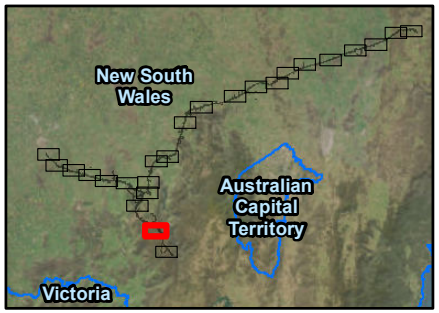

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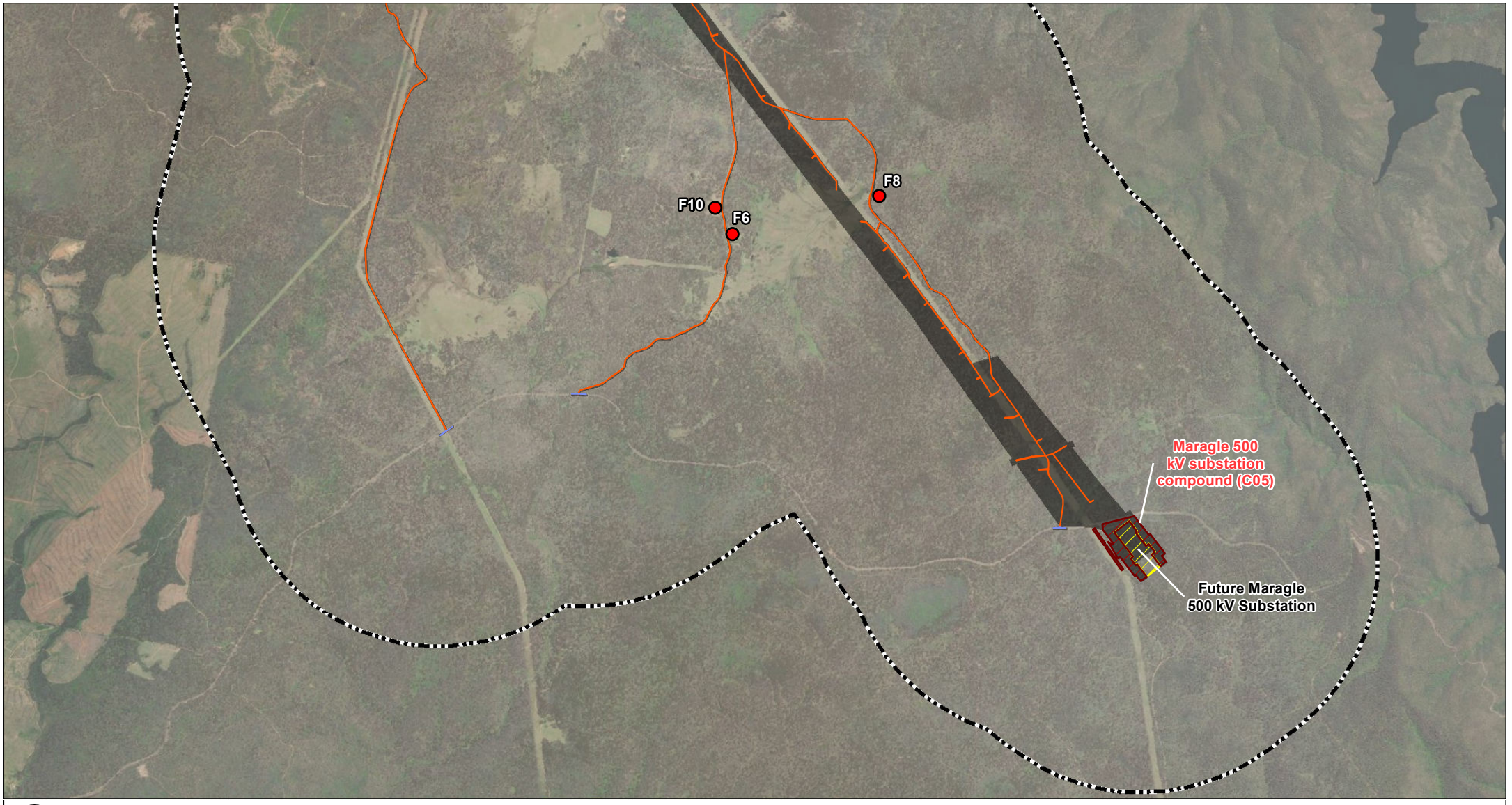

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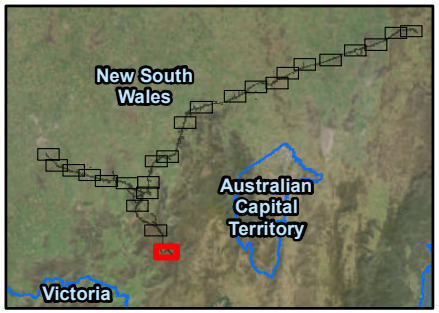

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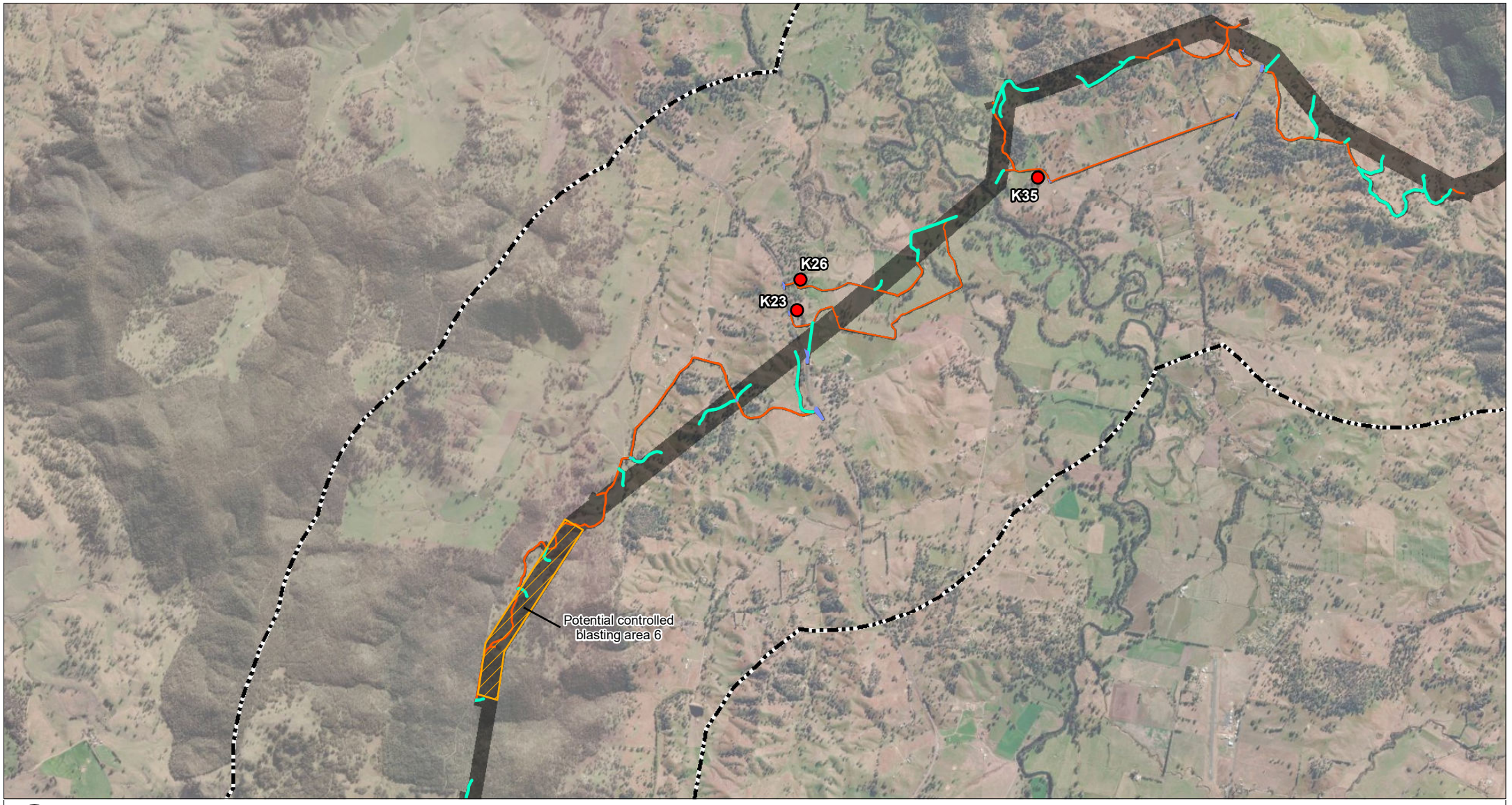

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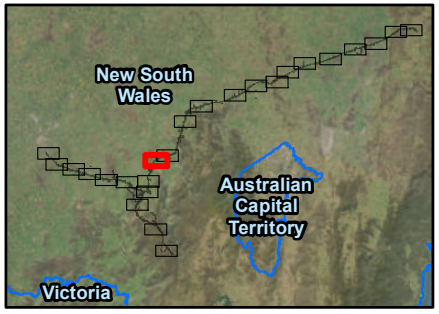

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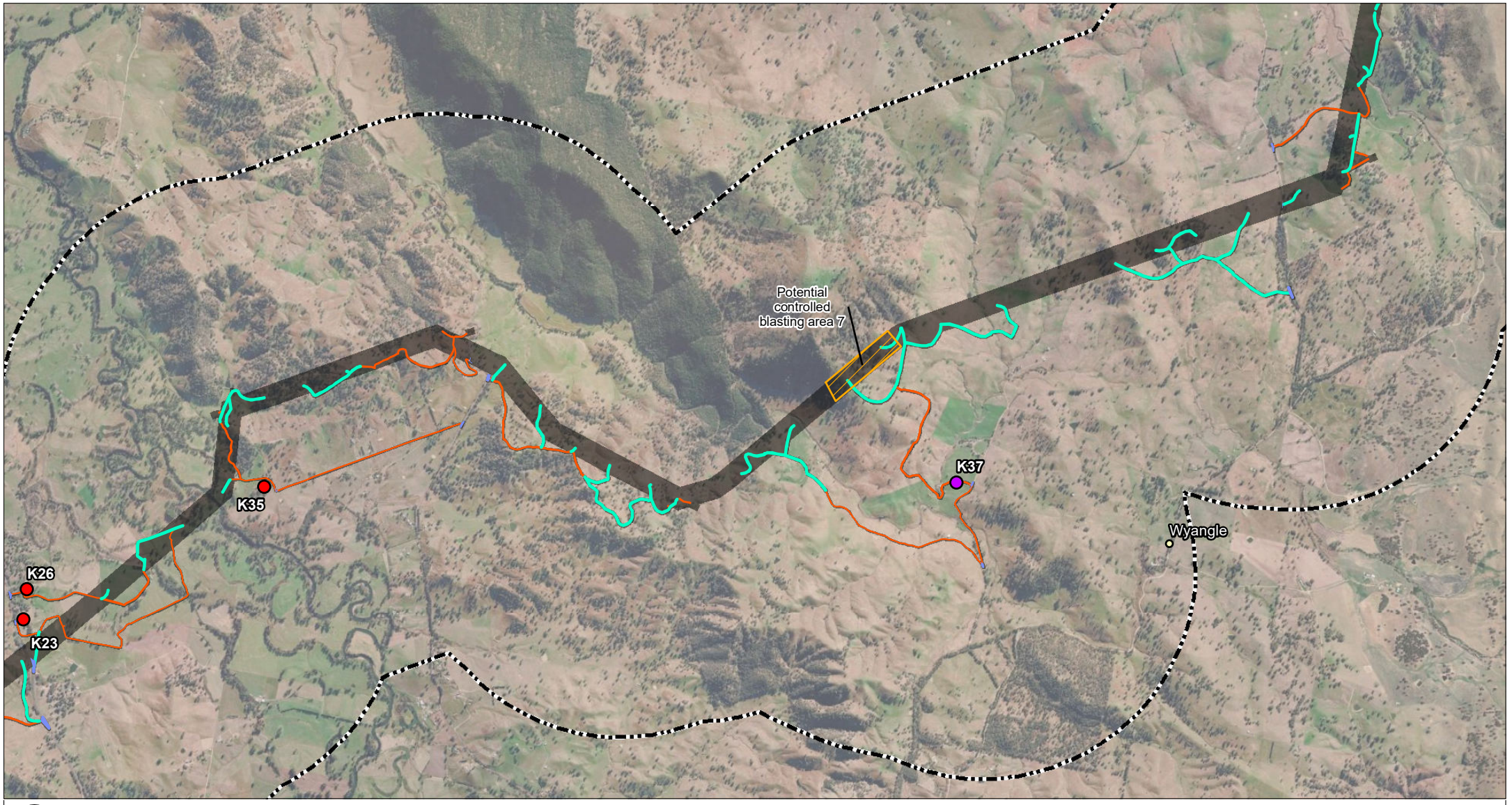

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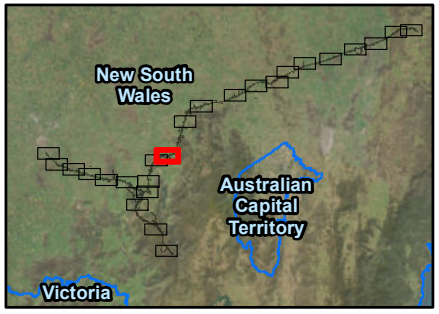

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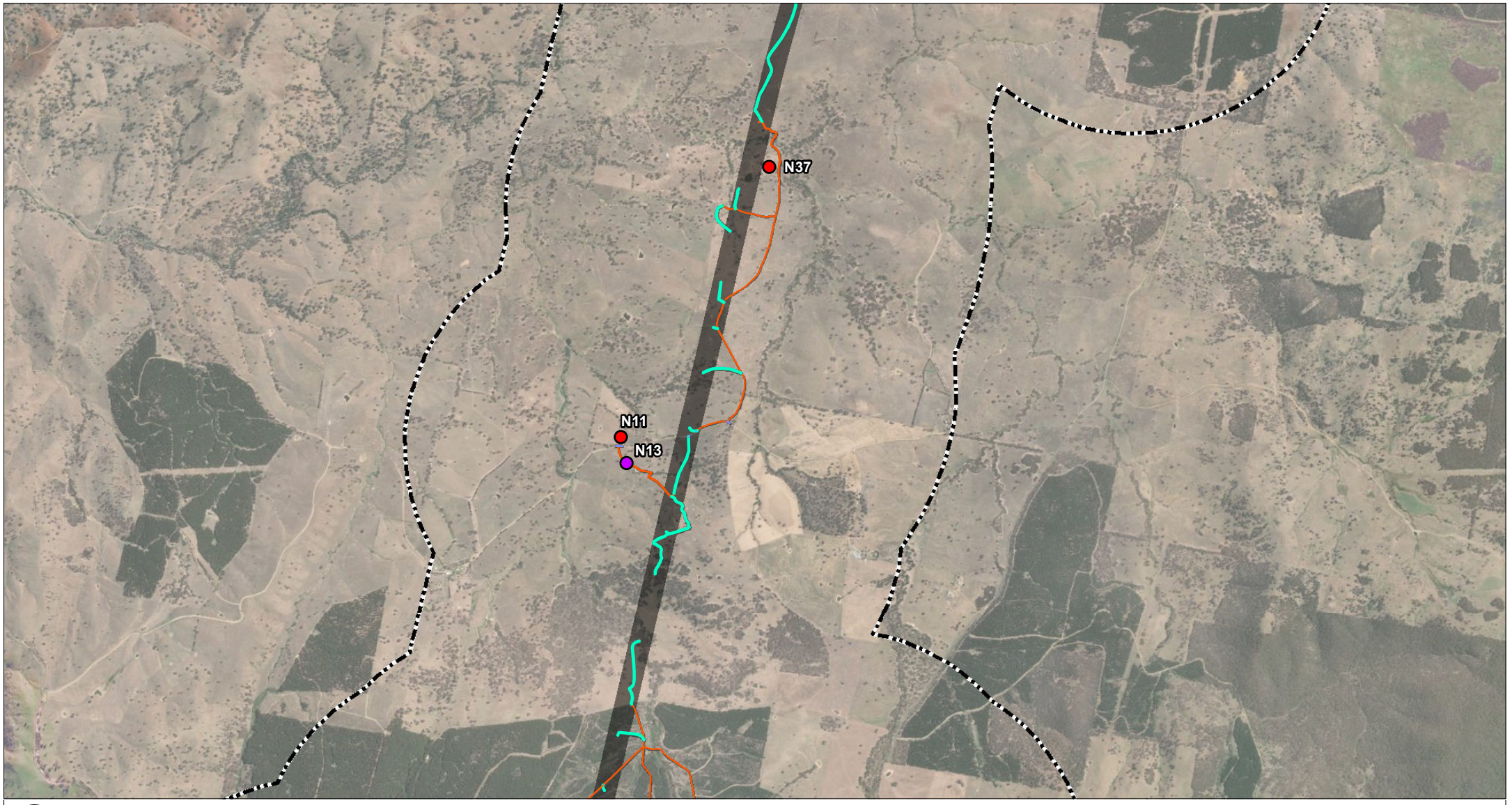

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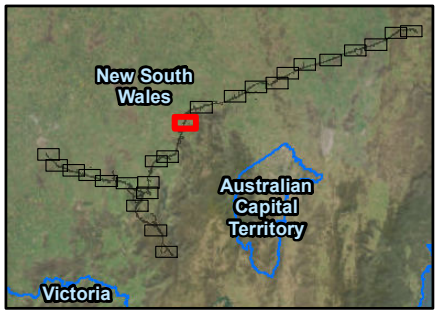

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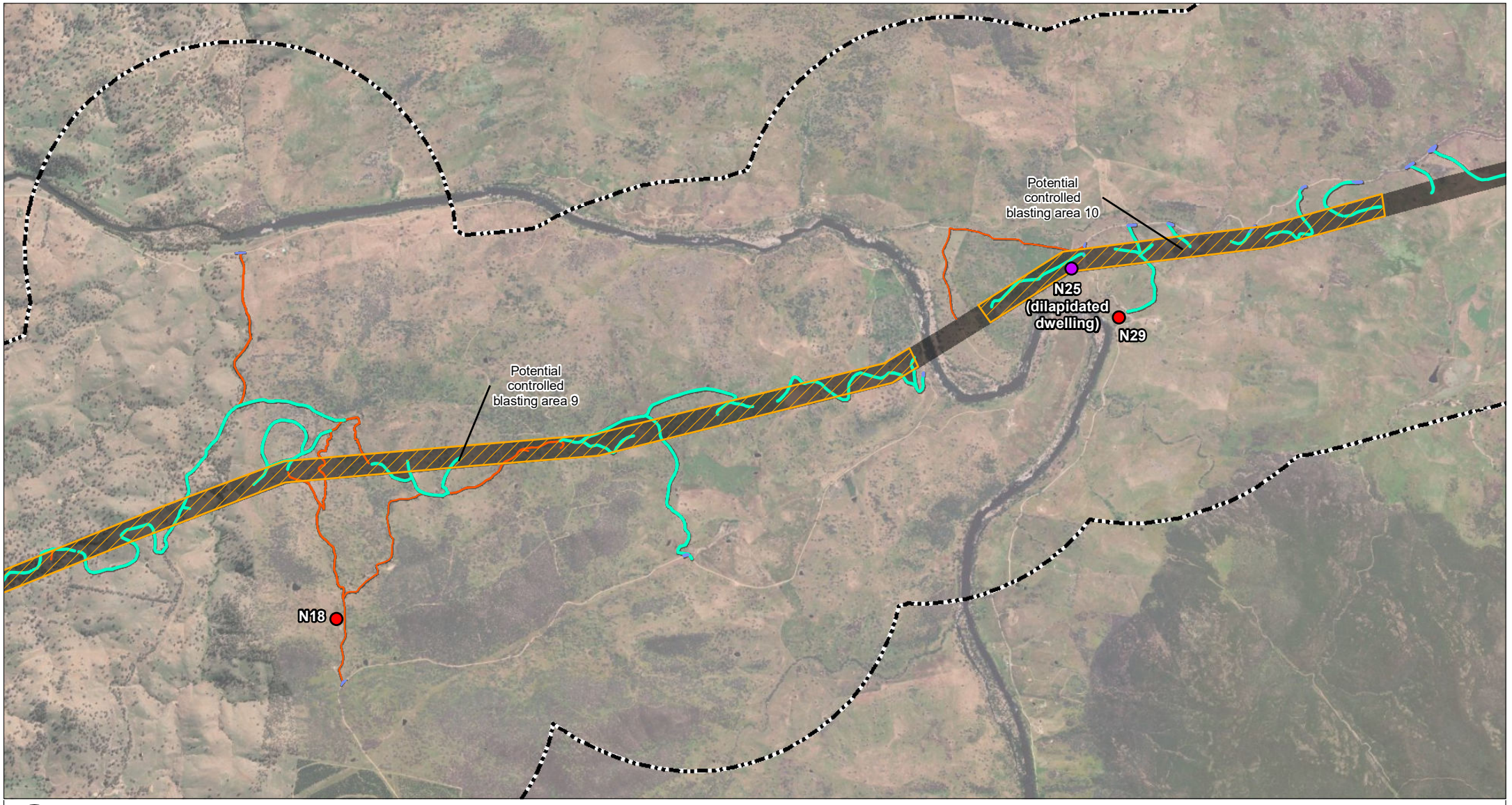

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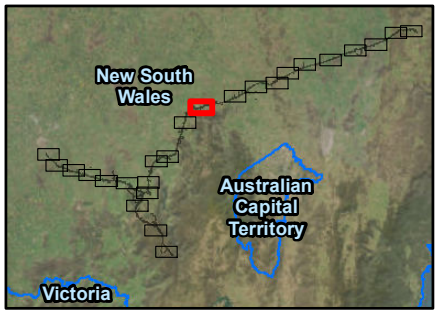

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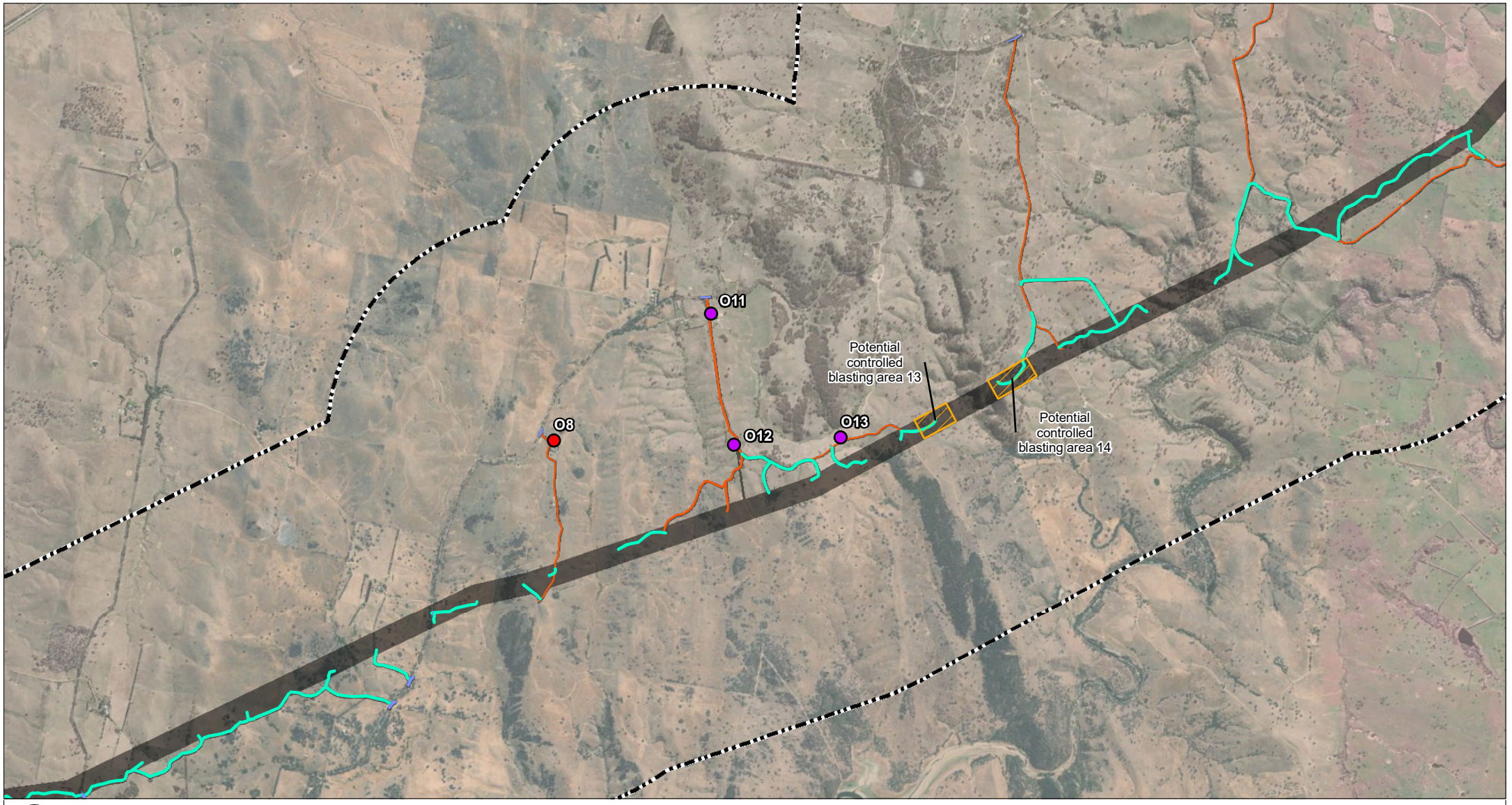

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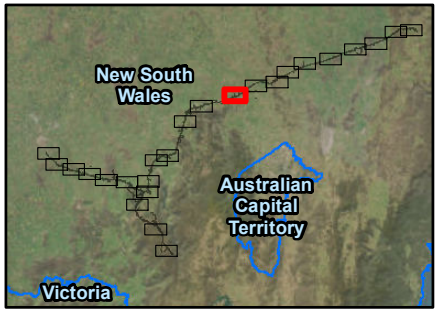

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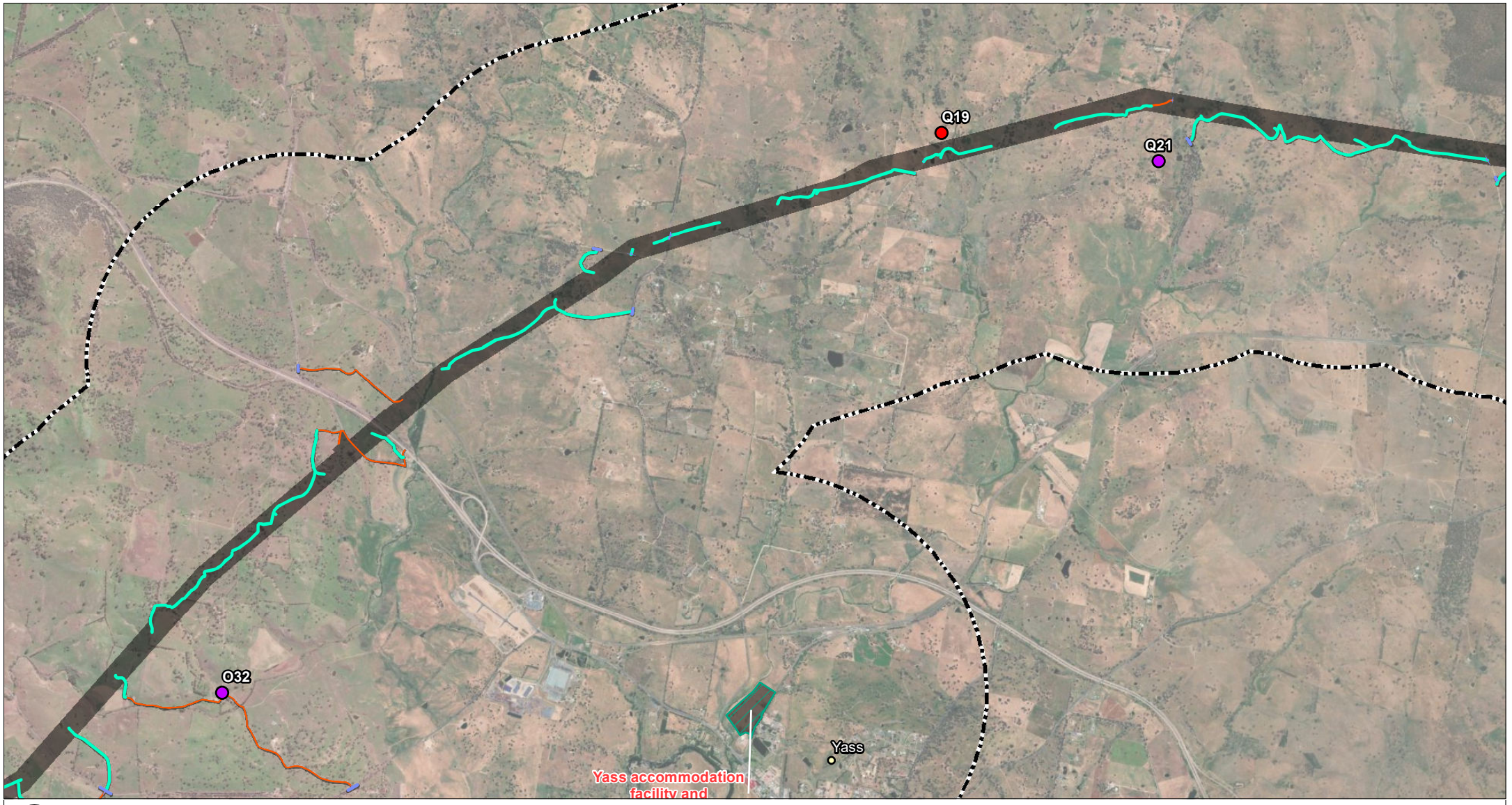

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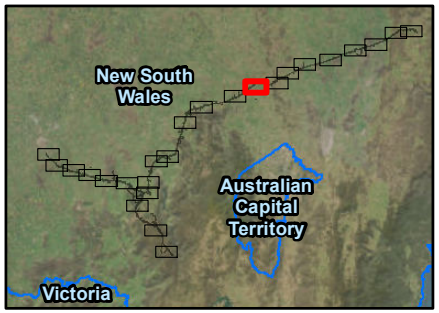

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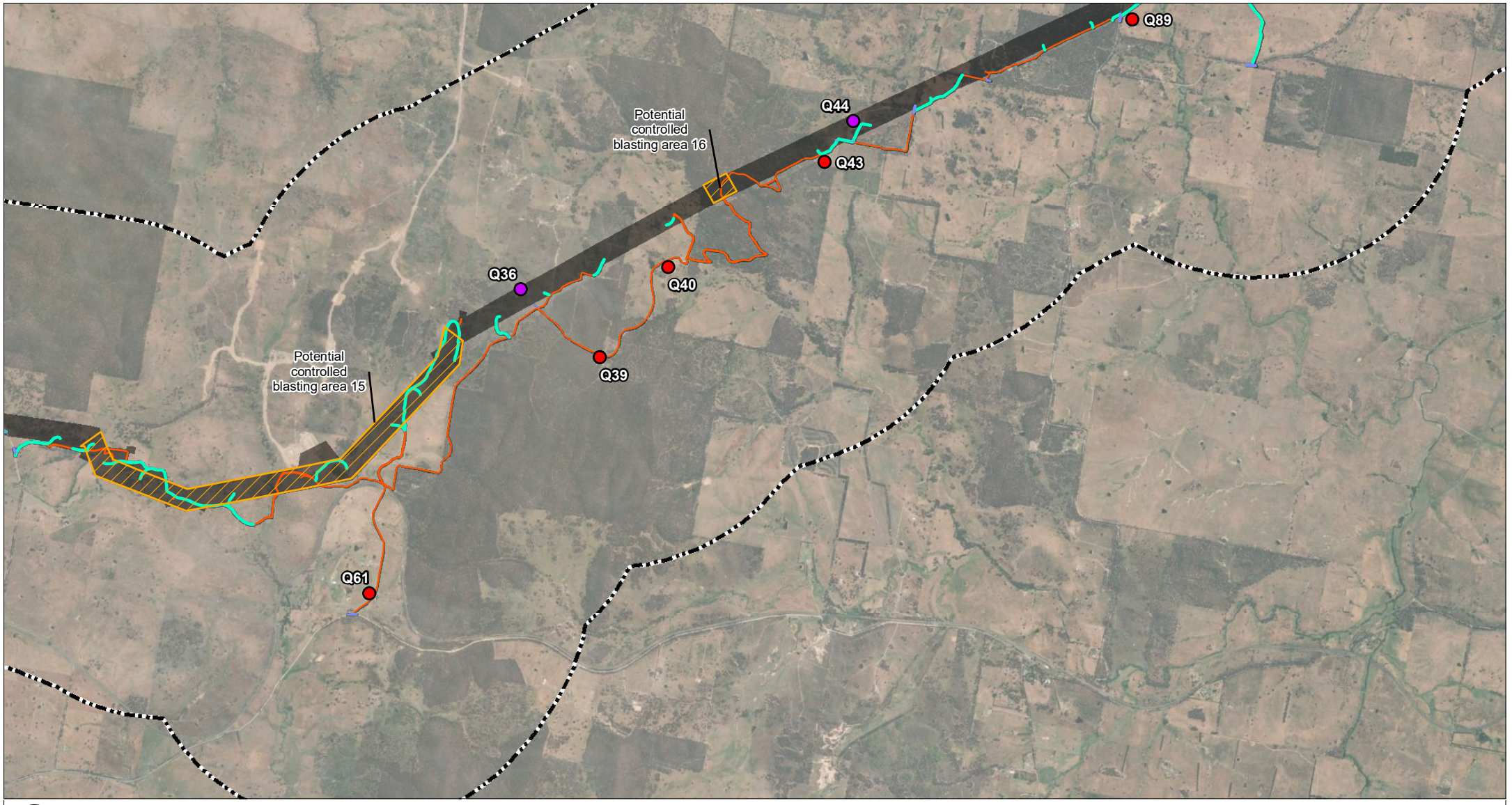

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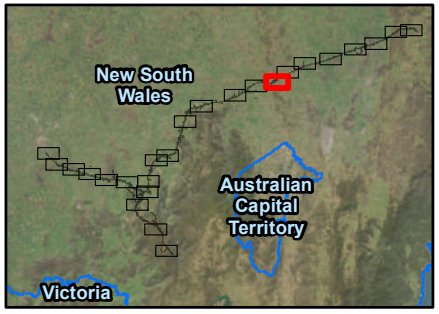

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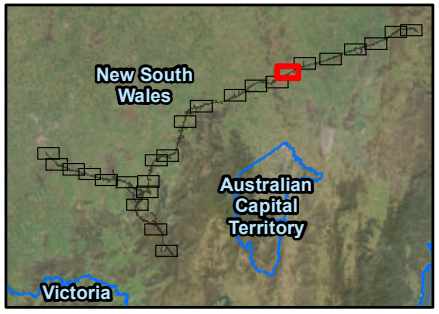

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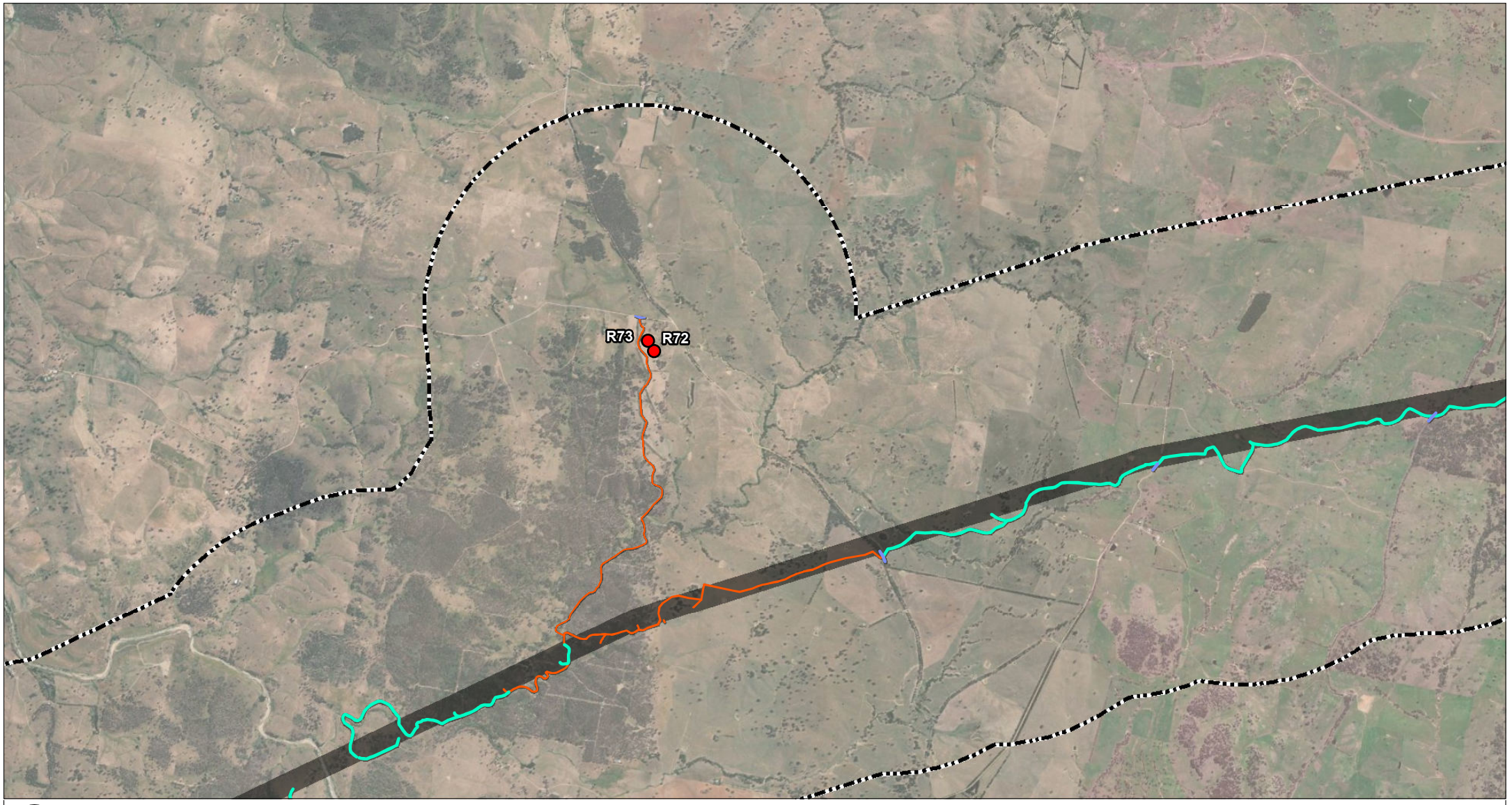

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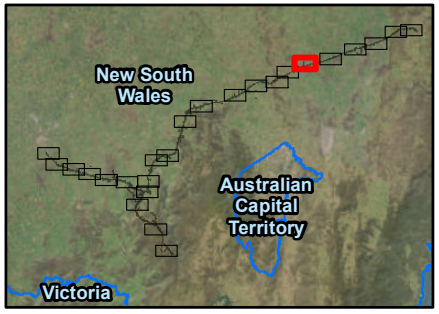

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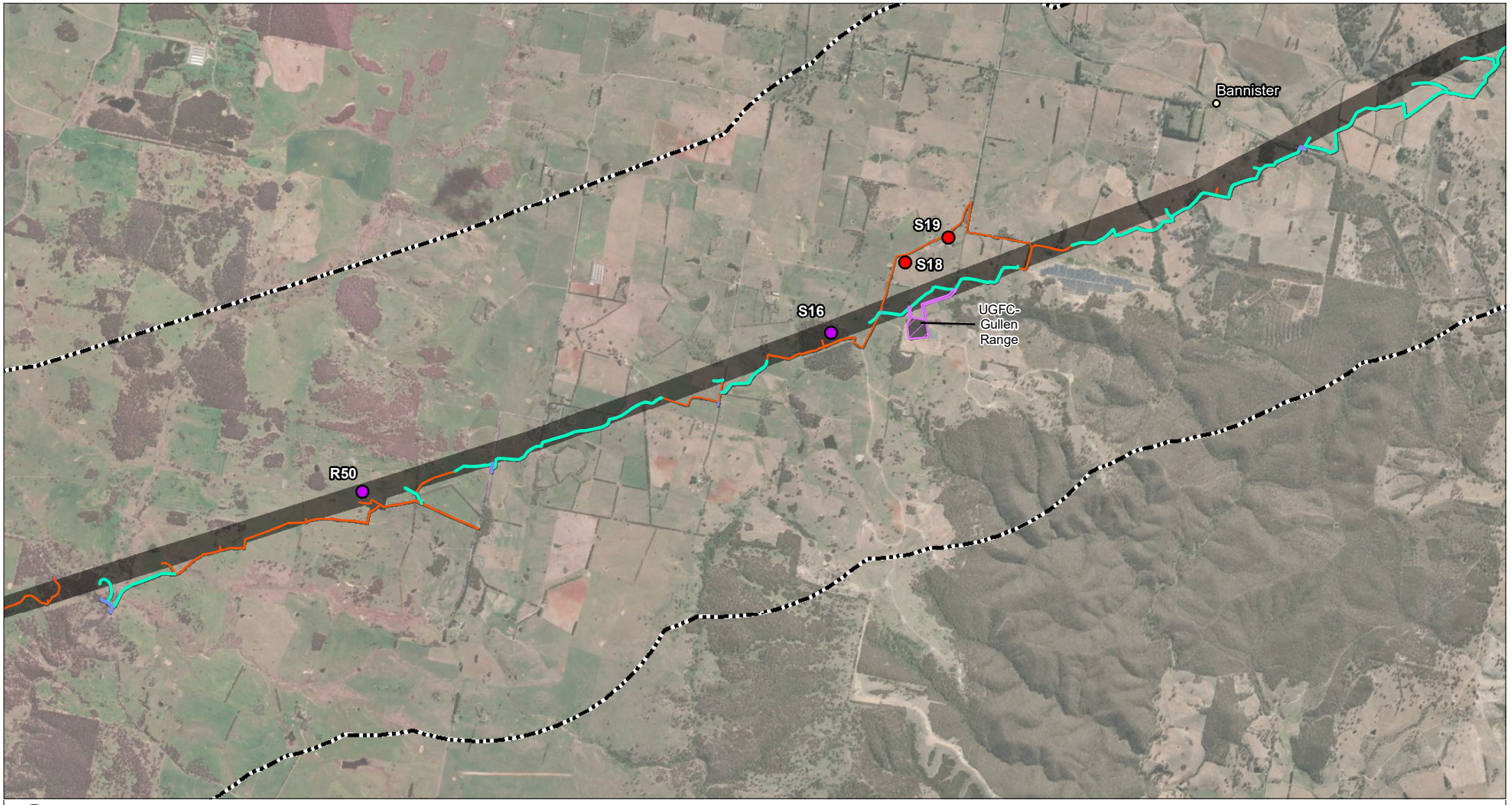

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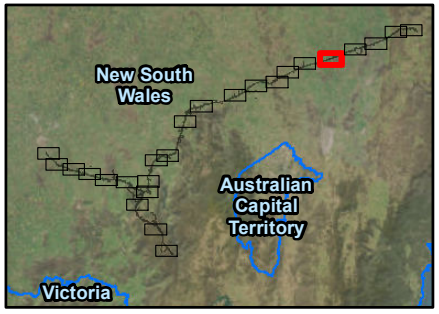

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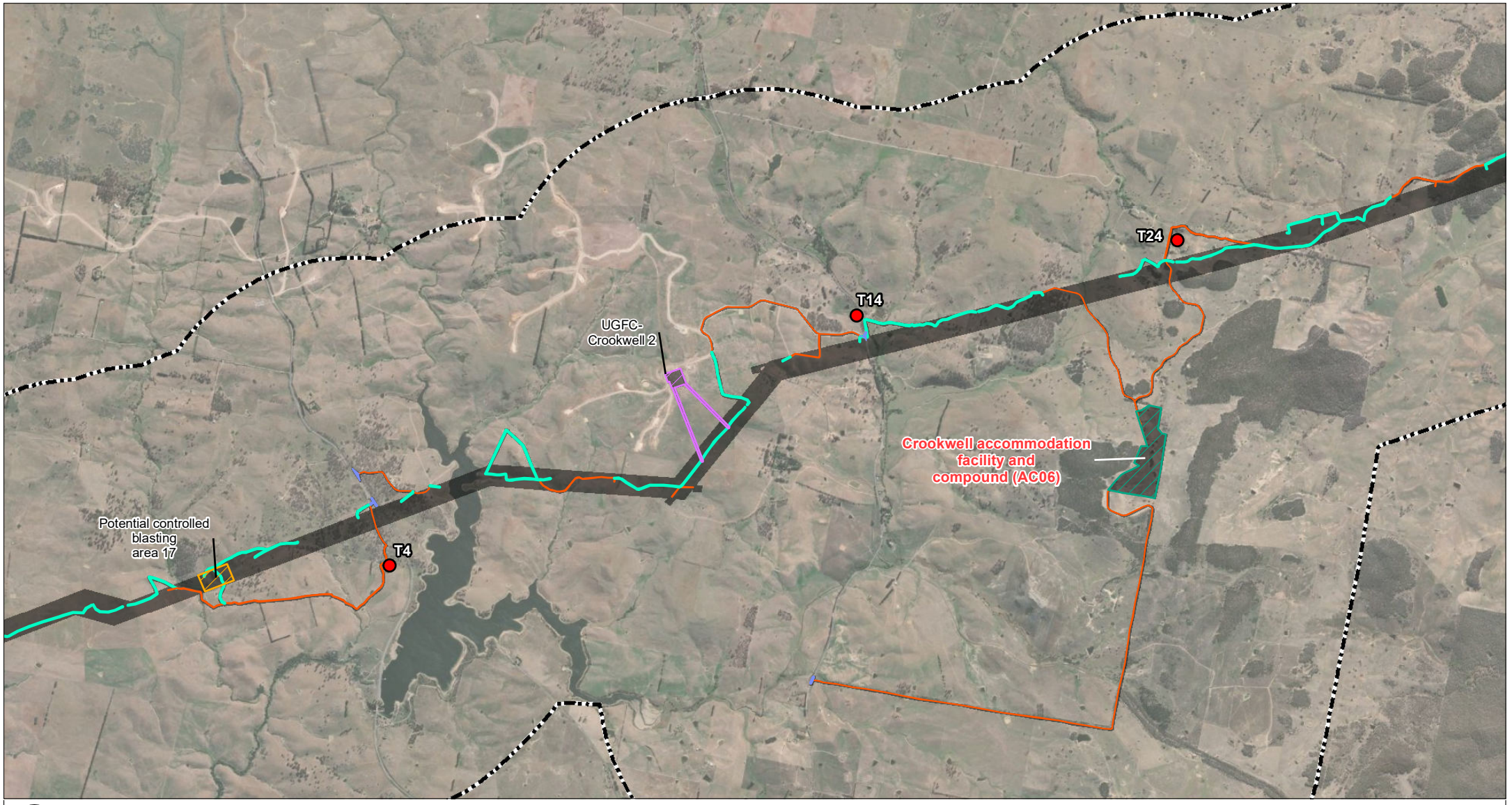

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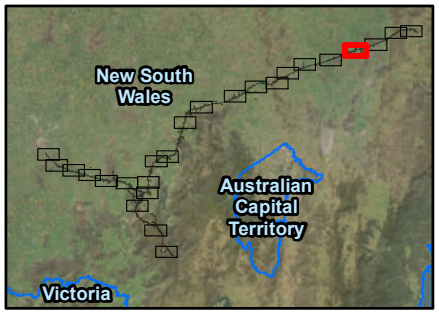


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

ATTACHMENT H

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_H_Worst-case construction vibration impacts.mxd

0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

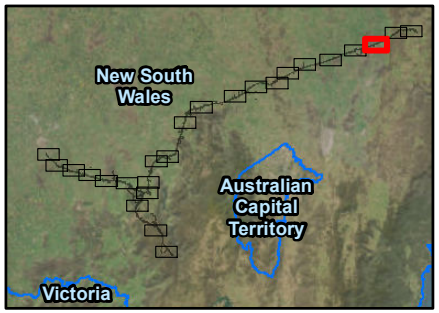
Population centre
Existing substation fence line
Amended study area

Vibration Impacts

Cosmetic Damage
Human Comfort

Project Components

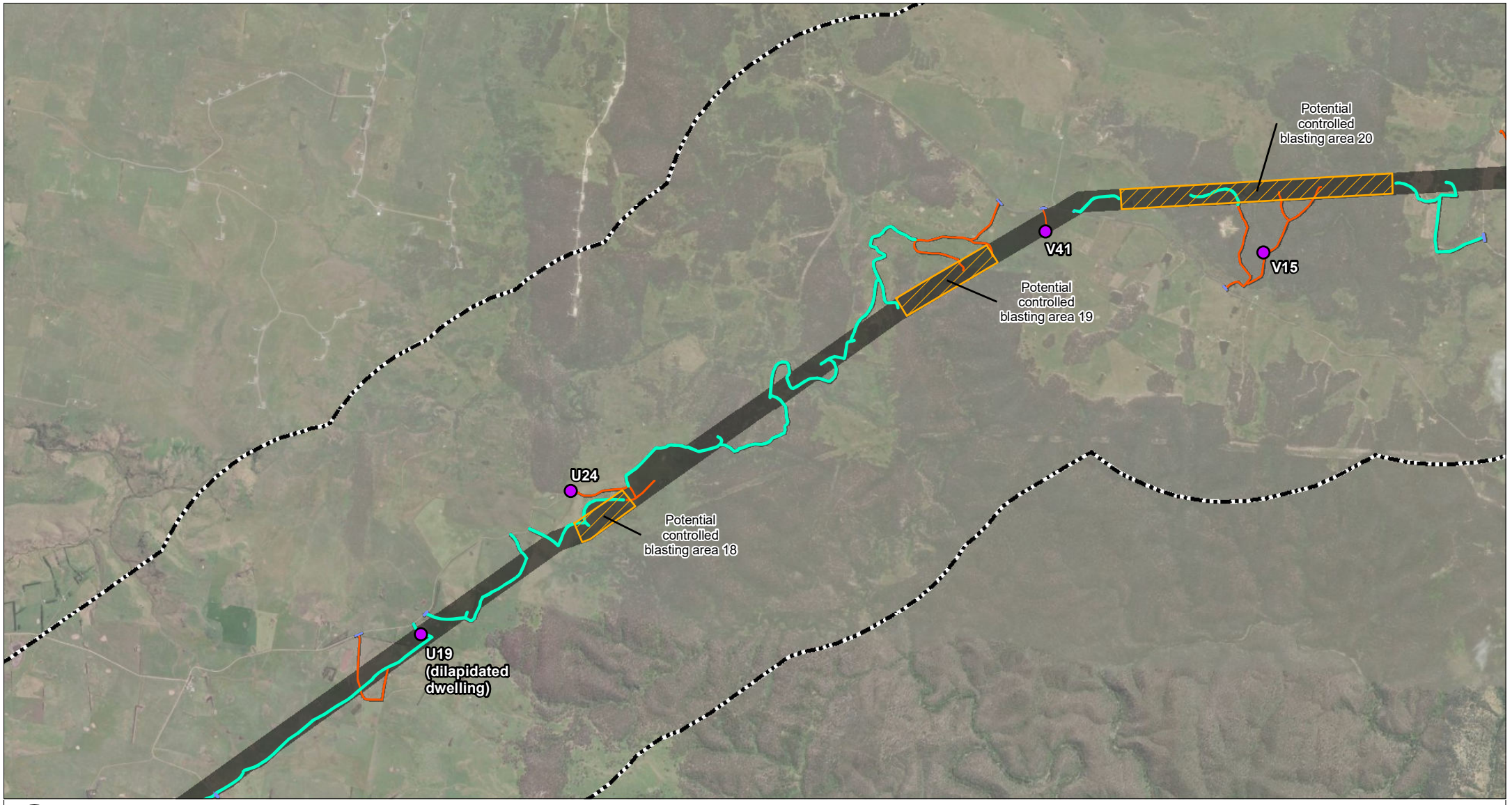
Substation
Amended project footprint
Construction compound
Combined worker accomodation facility and construction compound
Telecommunications connection
Potential controlled blasting area
Intersections
Access track - New
Access track - Upgrade



HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

ATTACHMENT H



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Project Components
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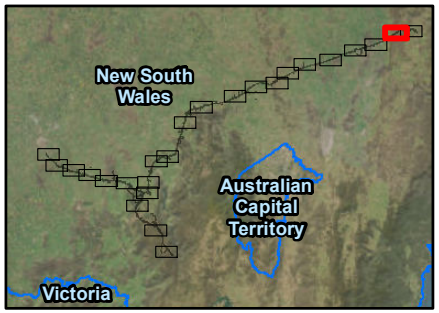

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

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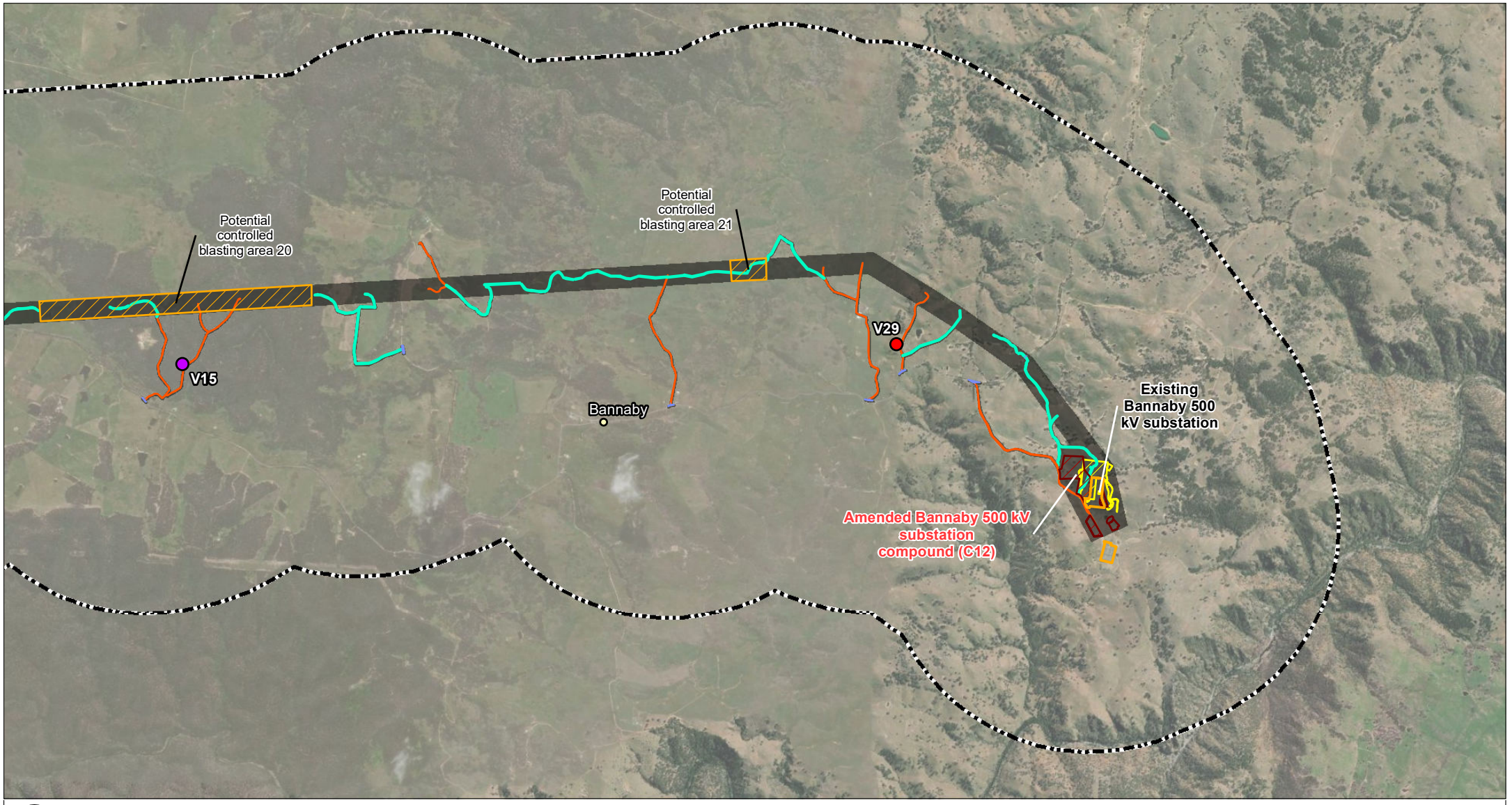

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SLR

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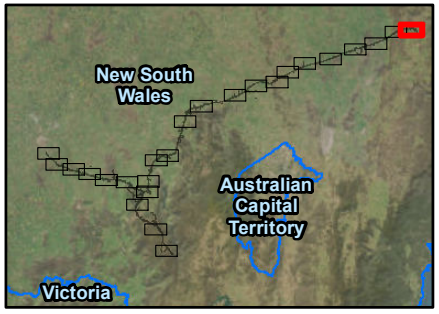


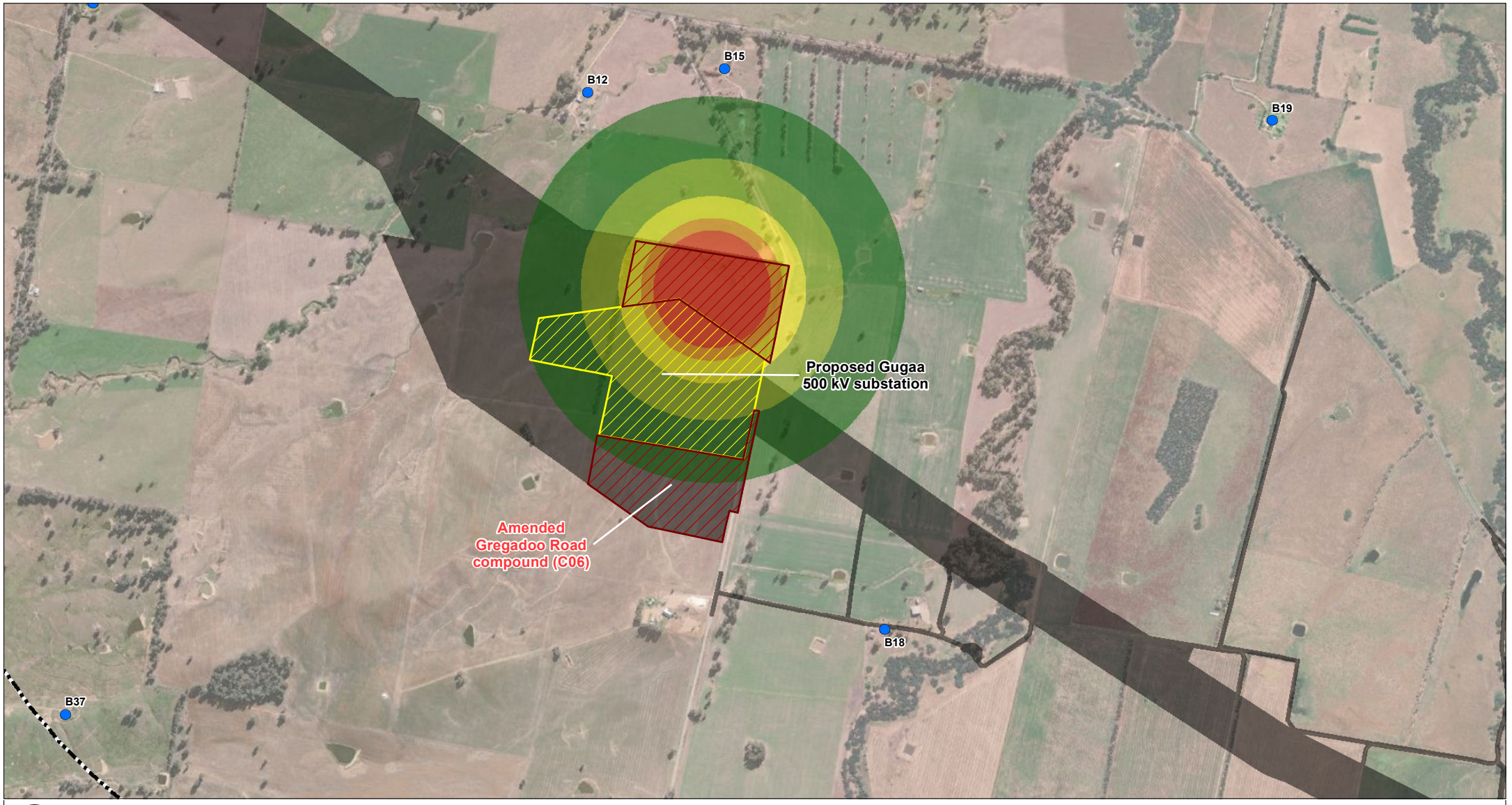
HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

WORST-CASE CONSTRUCTION VIBRATION IMPACTS

ATTACHMENT H

Attachment I Aircraft noise mapping

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum



0 100 200 400 Metres

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Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	26-Feb-2024
Drawn by:	JG

- Population centre
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LAmax Aircraft Noise

- 75 - 80 dBA
- 80 - 85 dBA
- 85 - 90 dBA
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HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM COMPOUND ARRIVAL AND DEPARTURE TO 1000FT

ATTACHMENT I.1

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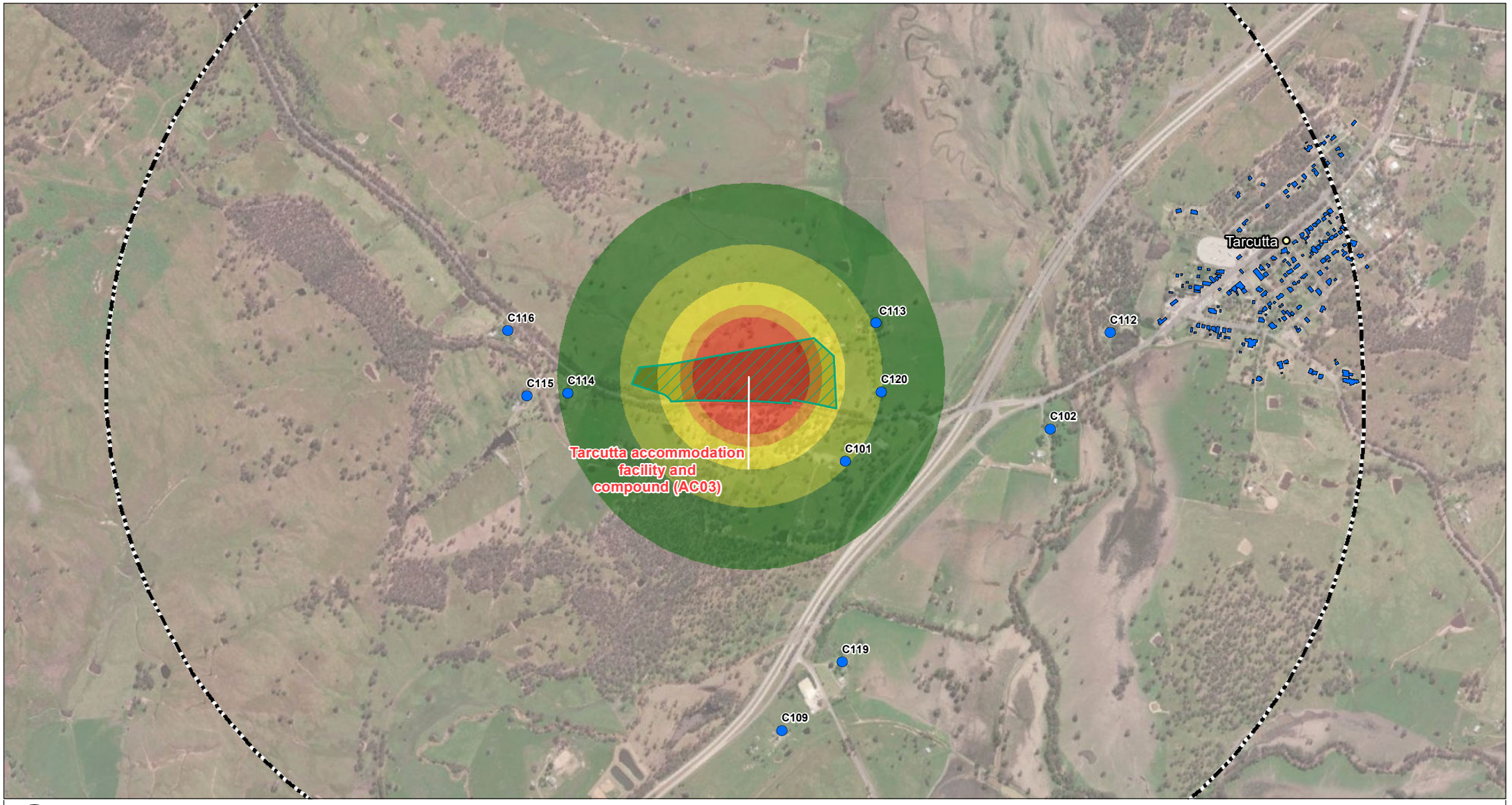

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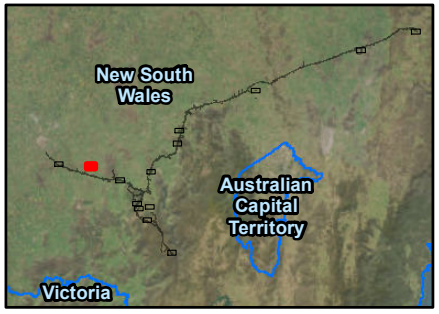

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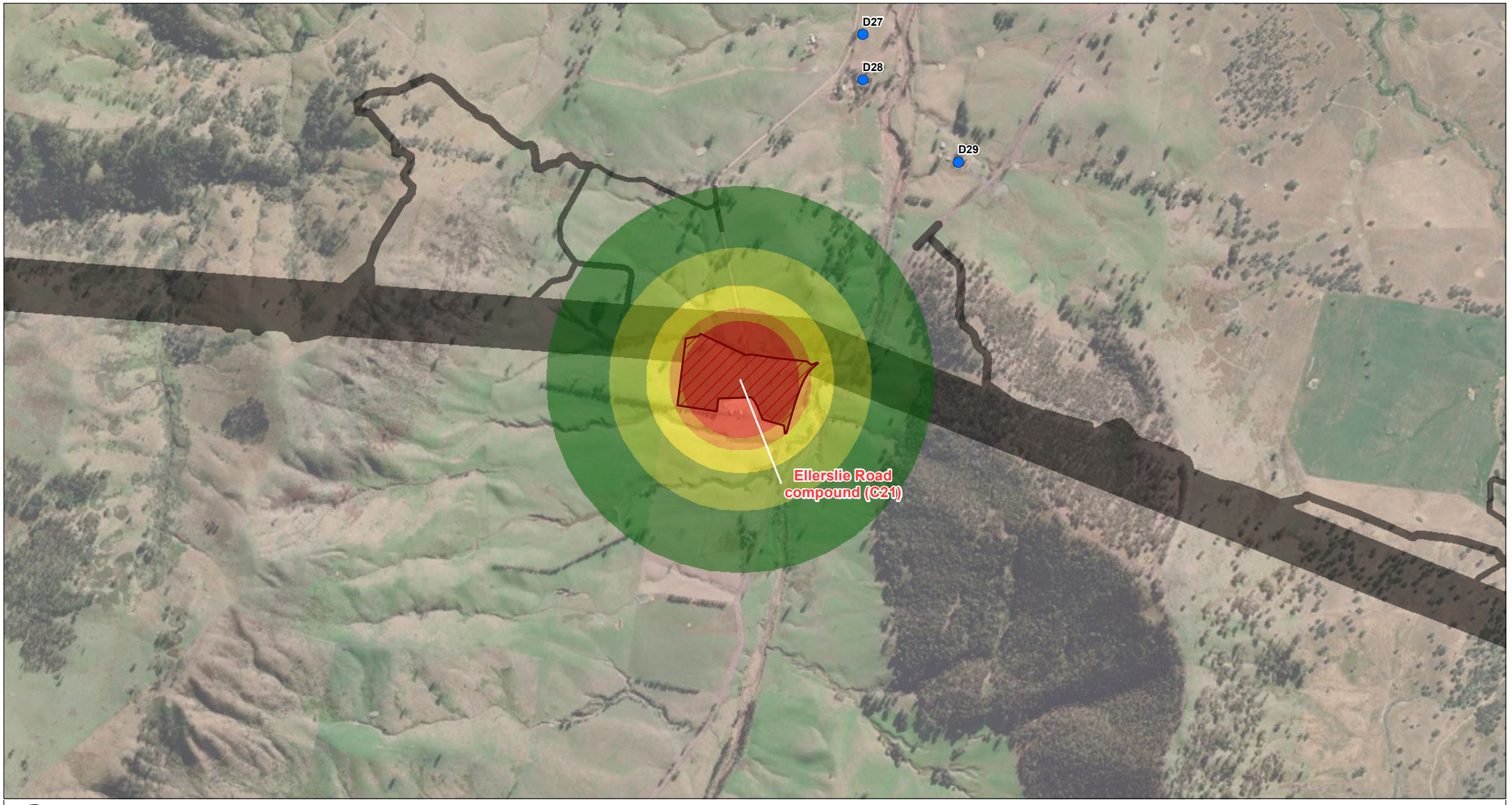

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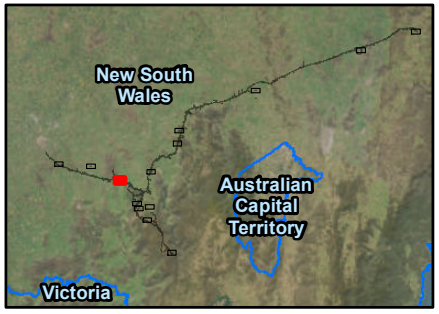

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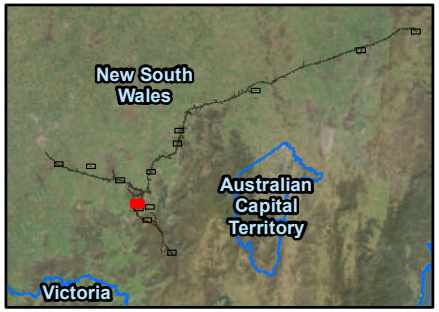

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

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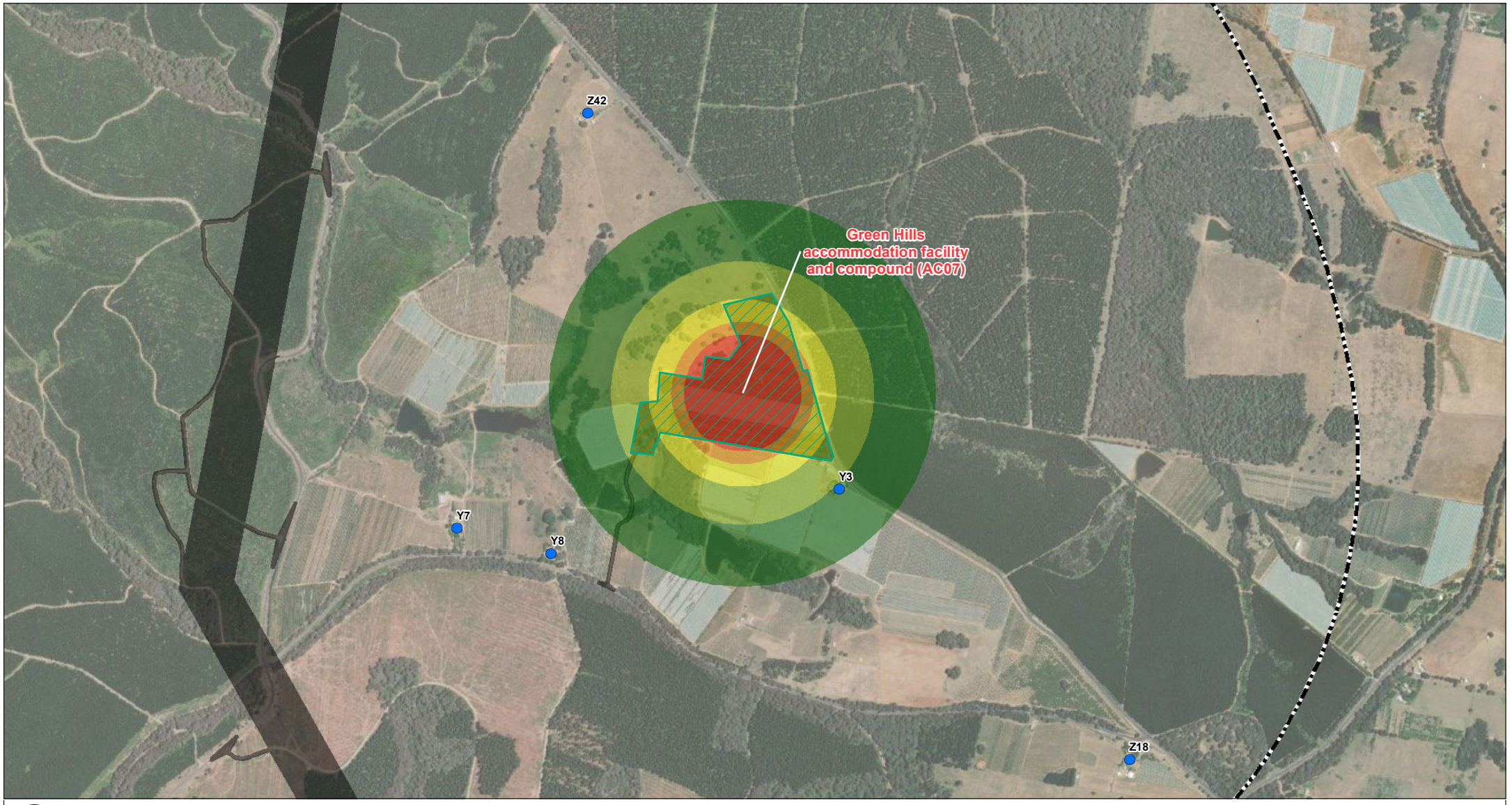

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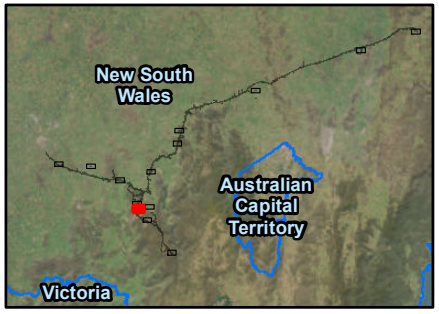

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NOISE AND VIBRATION IMPACT ASSESSMENT

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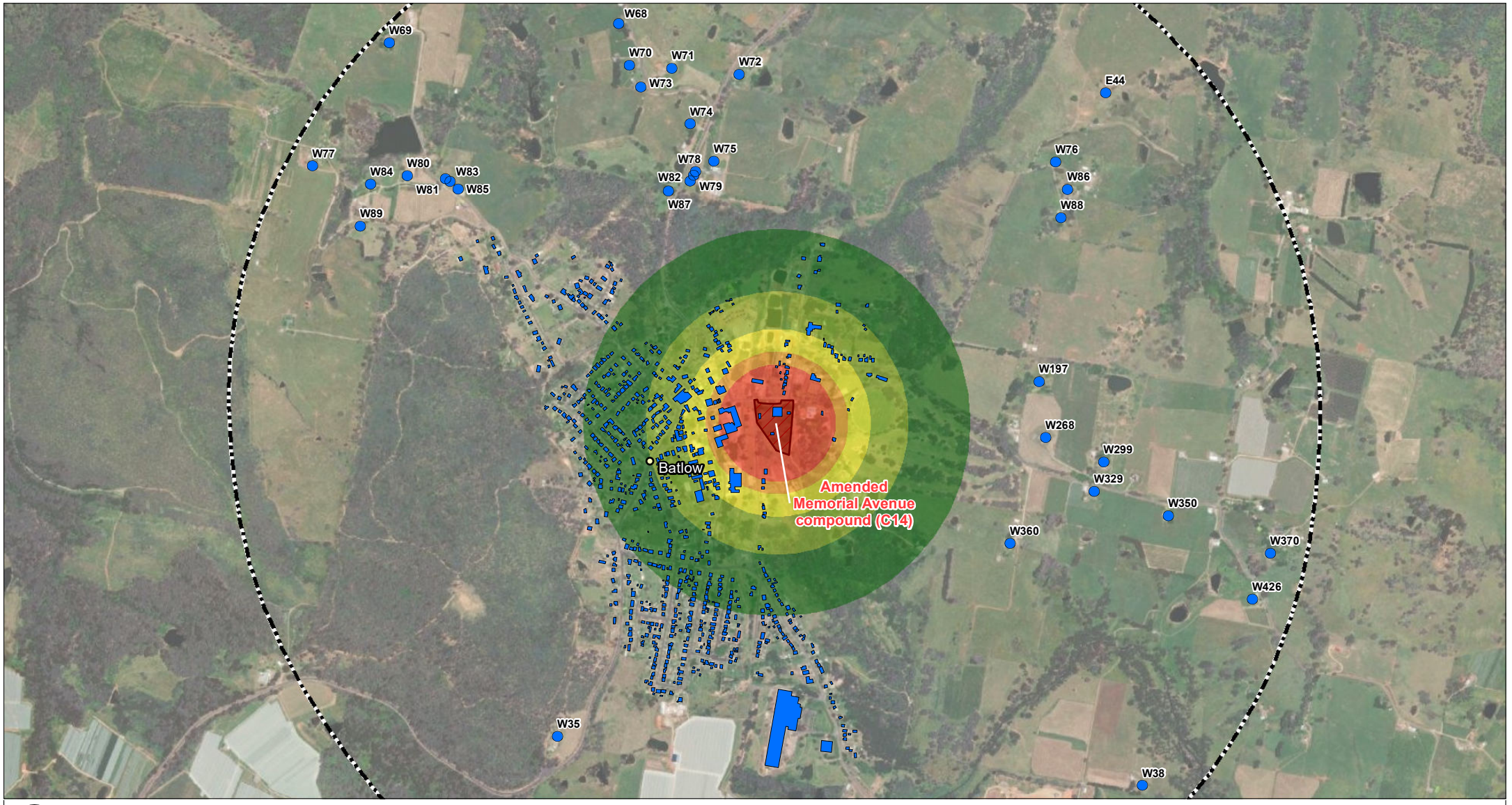

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HUMELINK
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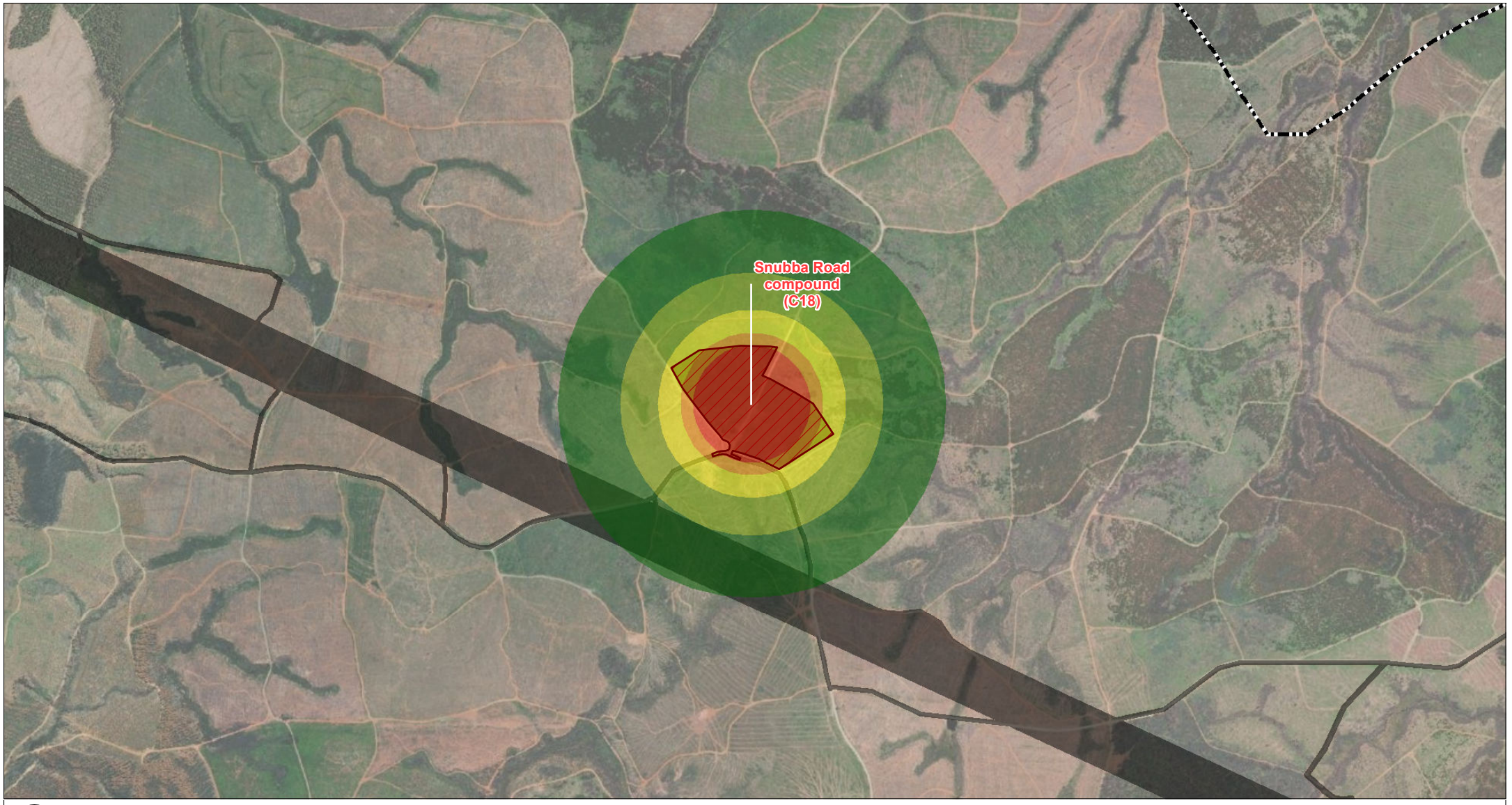

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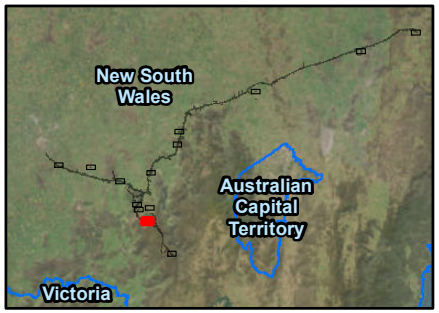

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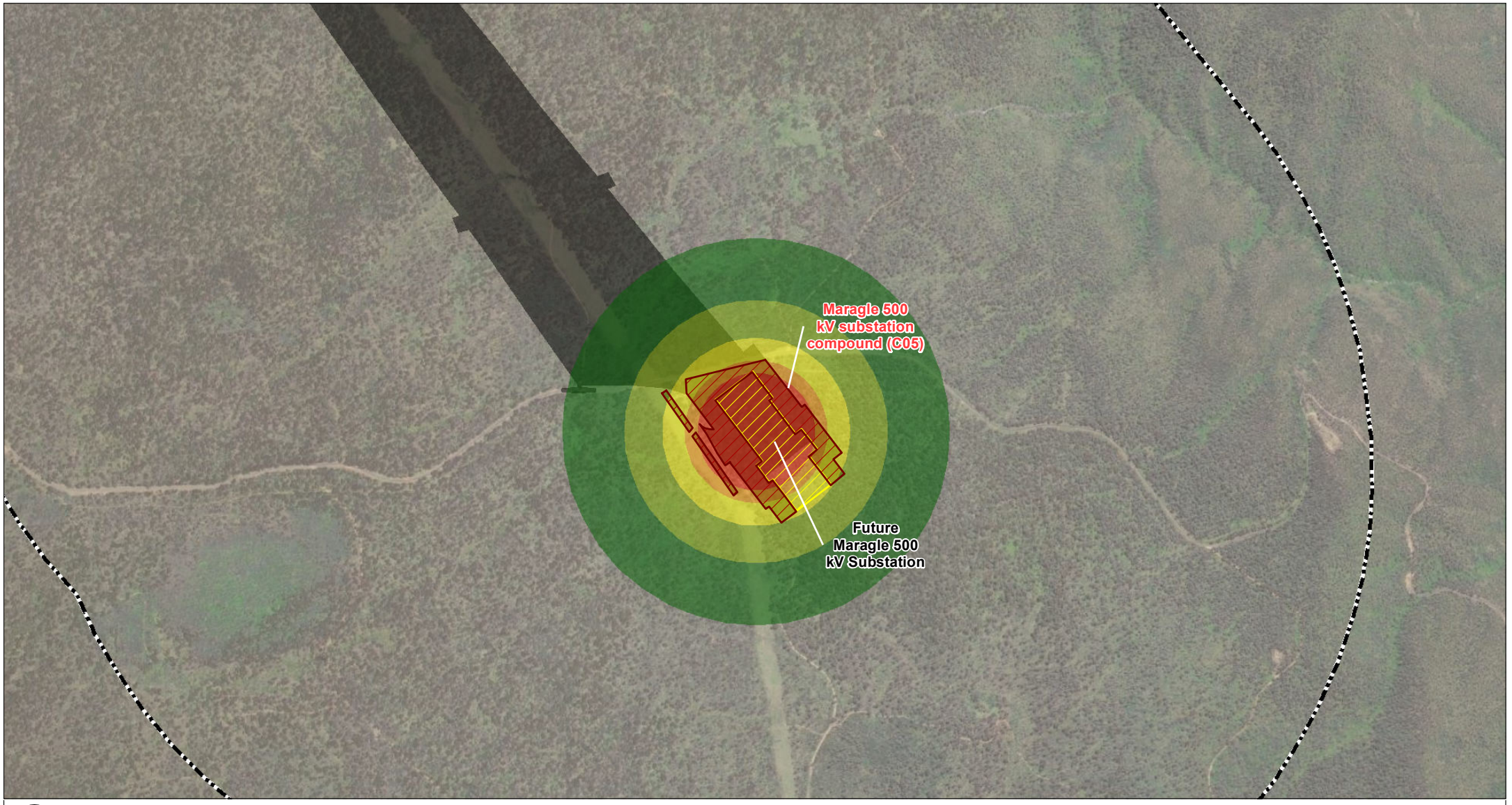

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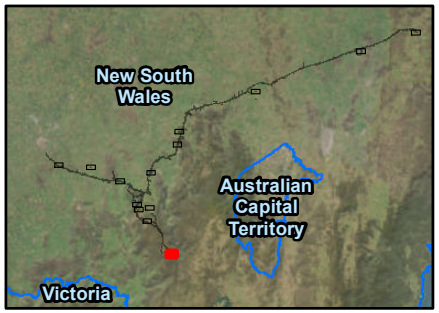

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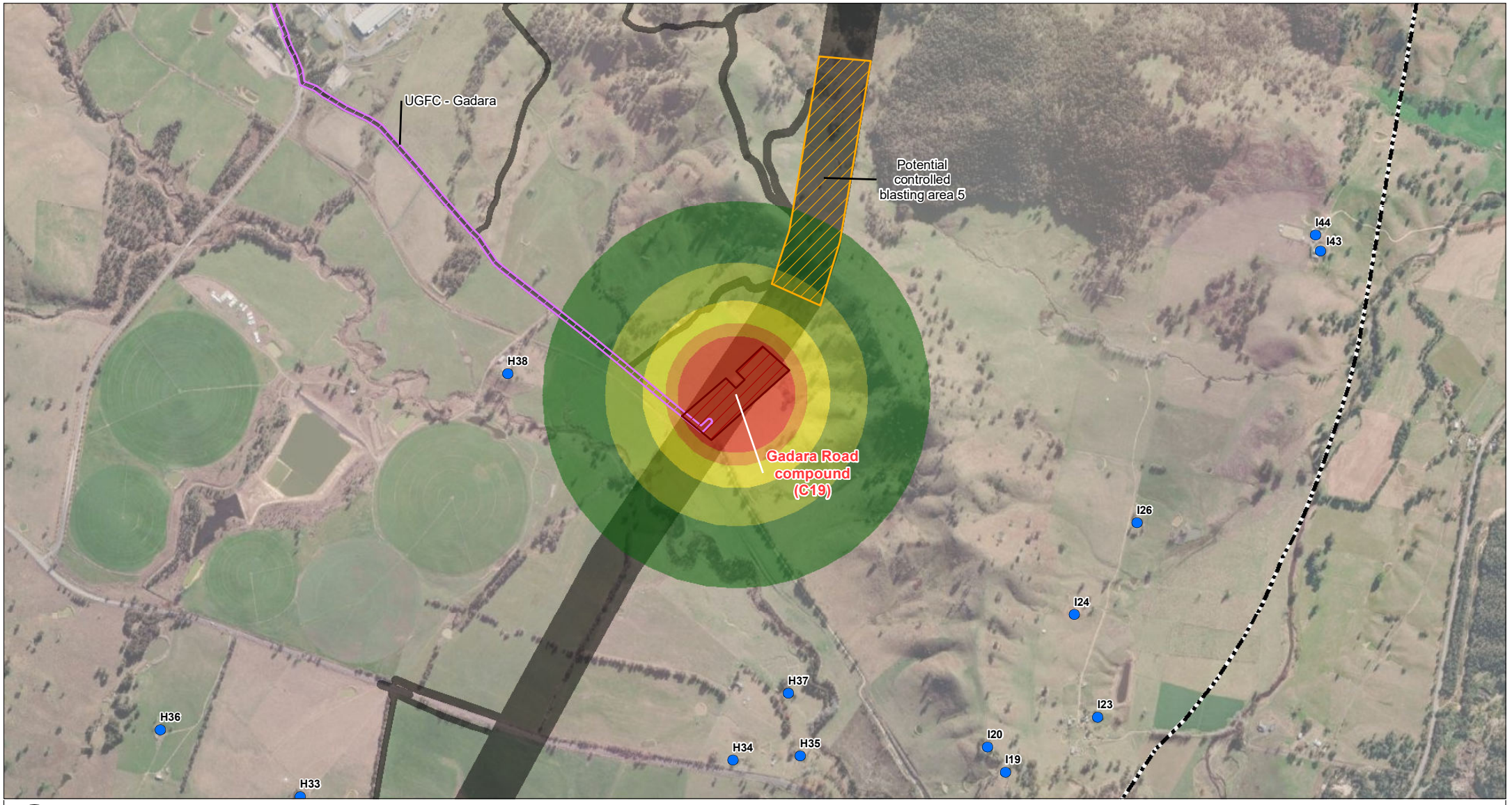

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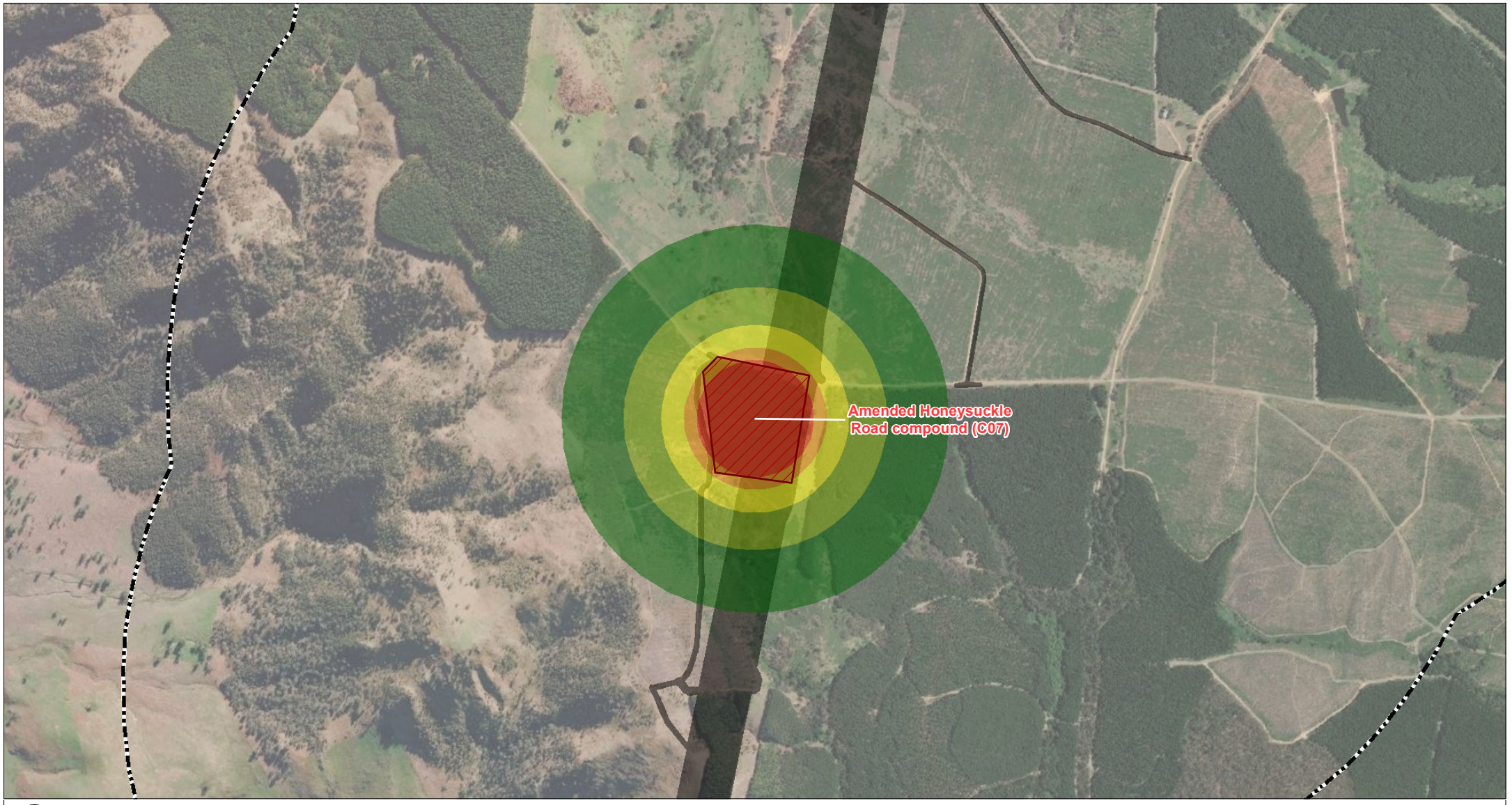

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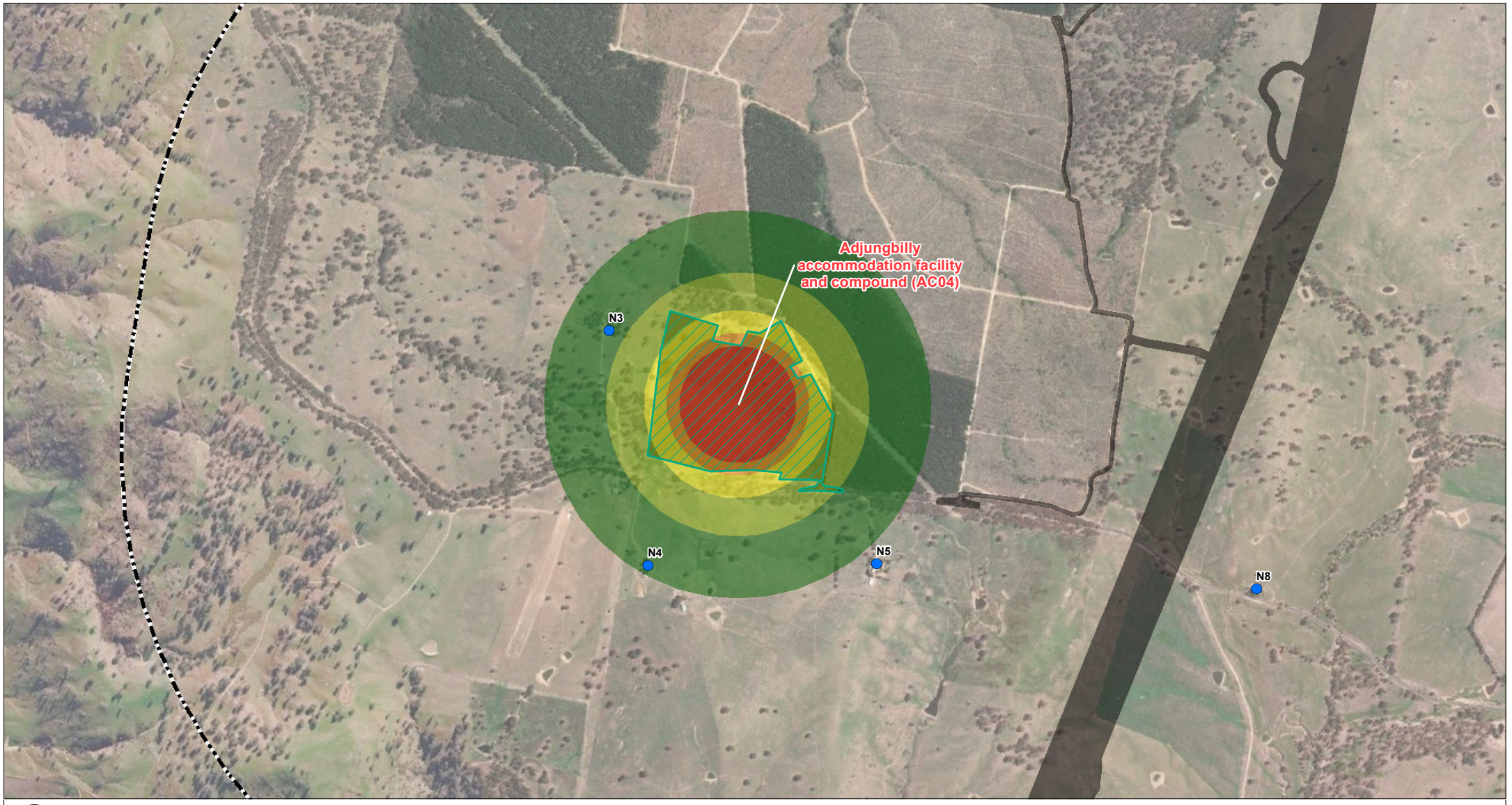

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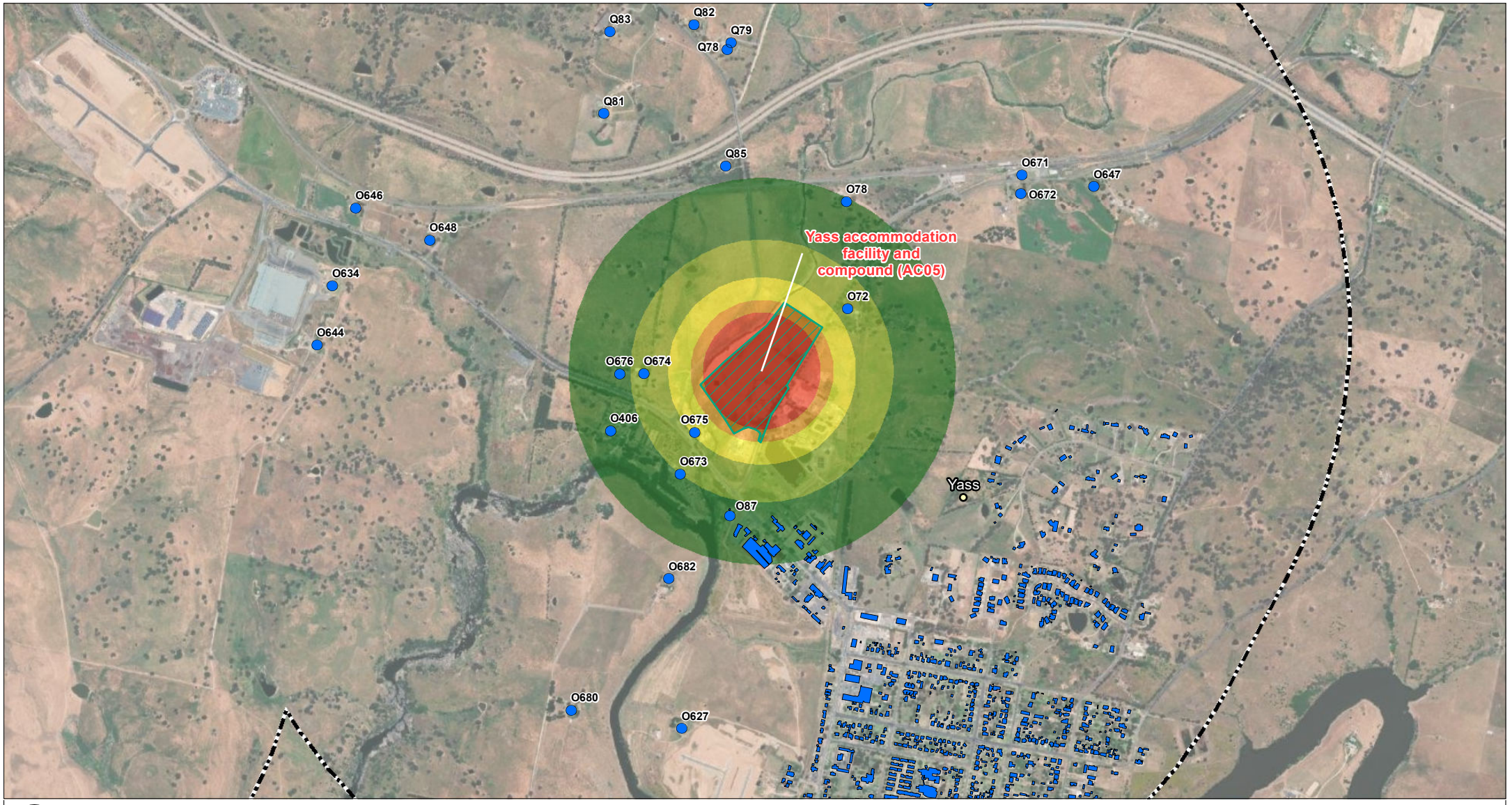

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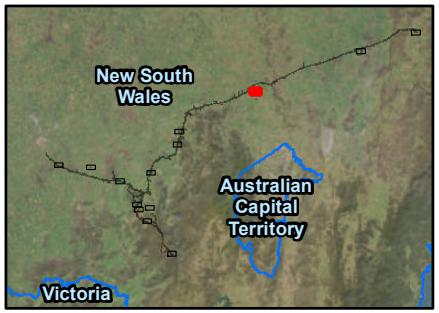

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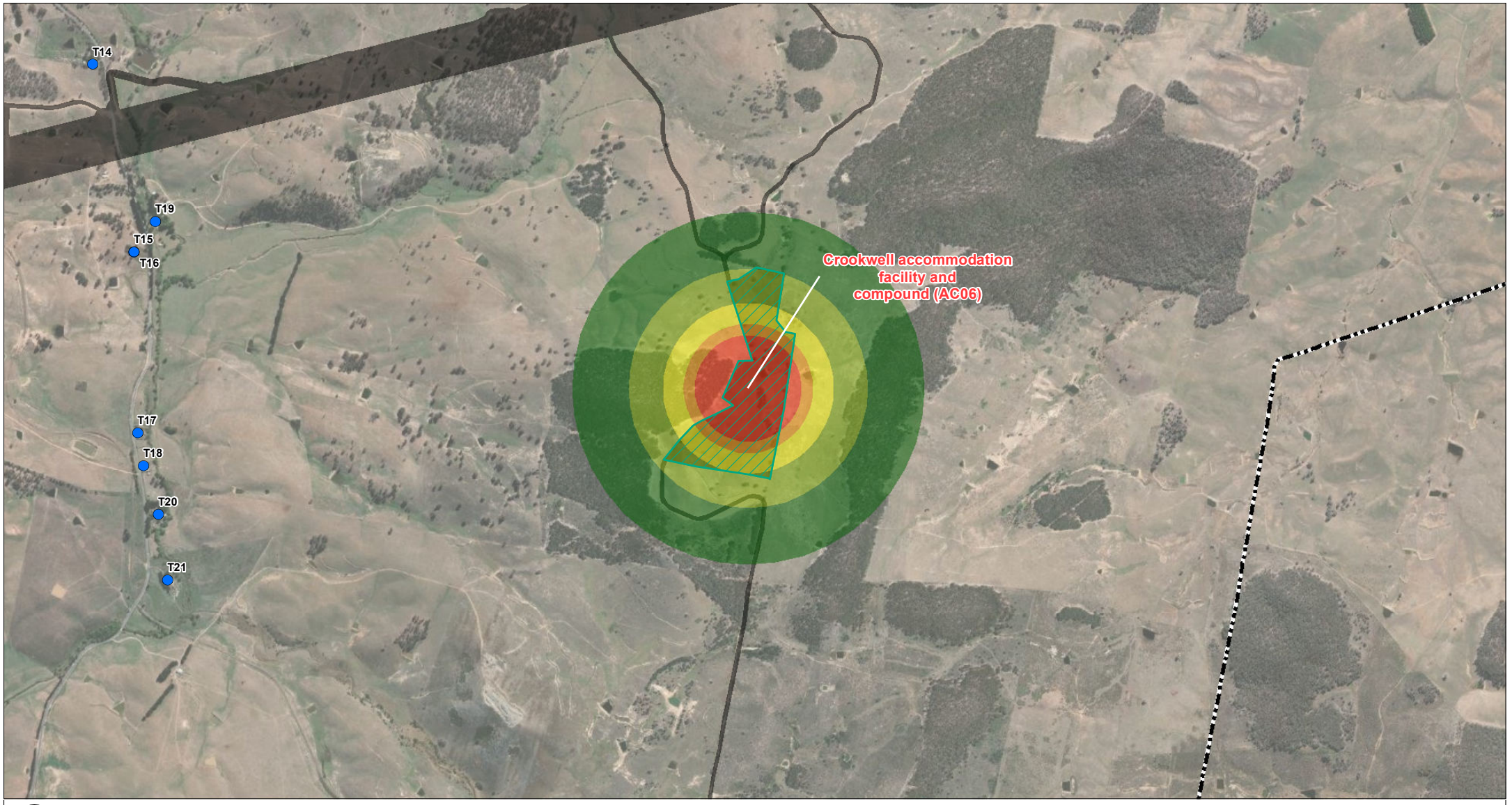

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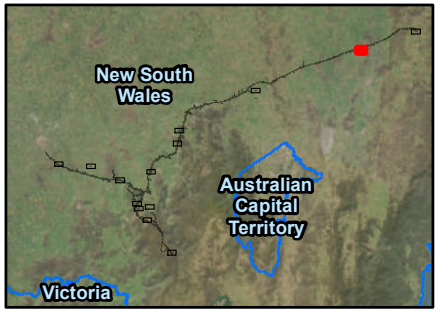
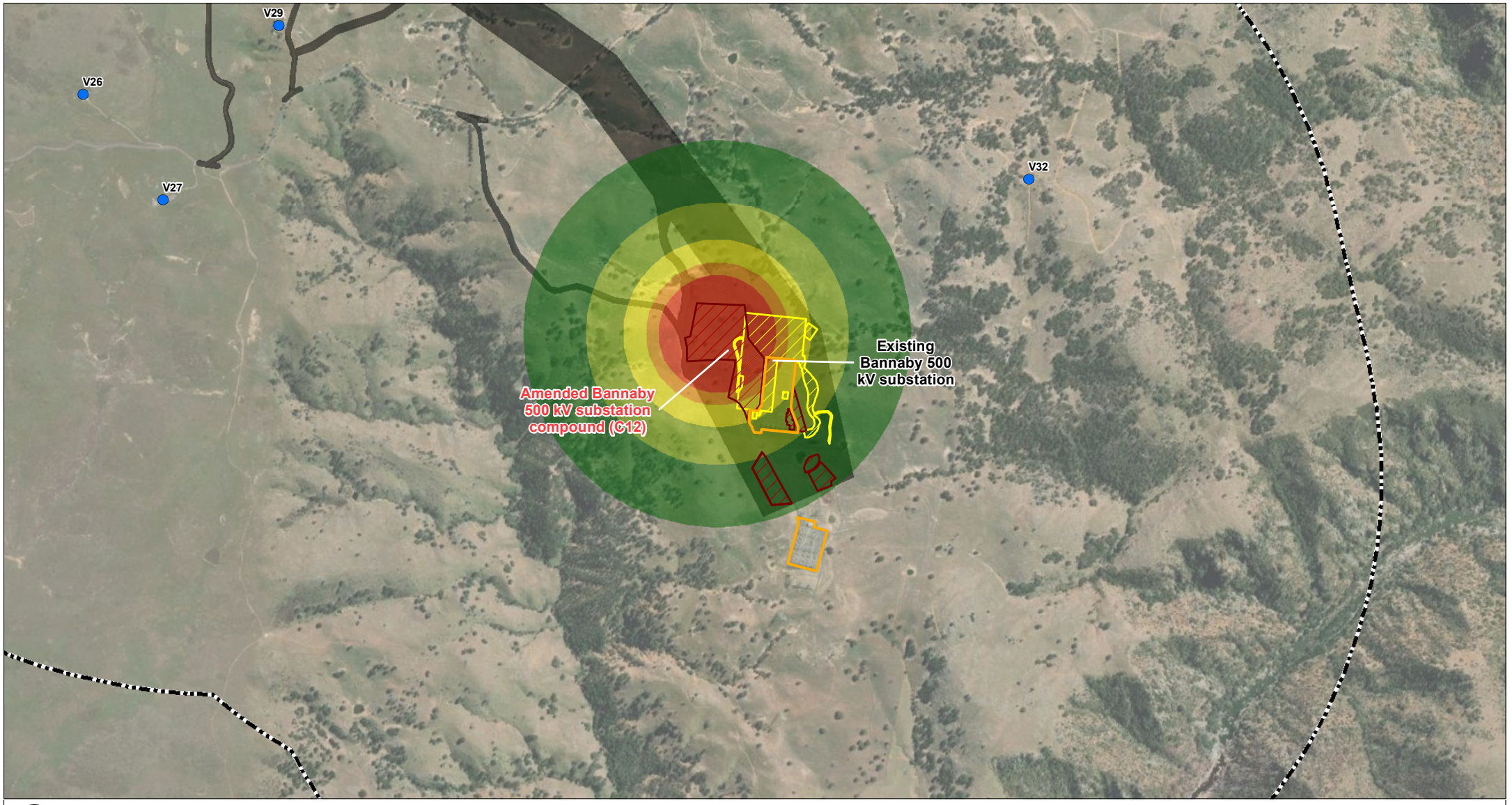


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM COMPOUND ARRIVAL AND DEPARTURE TO 1000FT

ATTACHMENT I.1

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I1_Helicopter noise from compound arrival and departure to 1000ft.mxd



0 100 200 400 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	610.30622
Date:	26-Feb-2024
Drawn by:	JG

- Population centre
- Receiver
- Existing substation fence line
- Amended study area

LAmax Aircraft Noise

- 75 - 80 dBA
- 80 - 85 dBA
- 85 - 90 dBA
- 90 - 95 dBA
- >95 dBA

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Potential controlled blasting area

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM COMPOUND ARRIVAL AND DEPARTURE TO 1000FT

ATTACHMENT I.1

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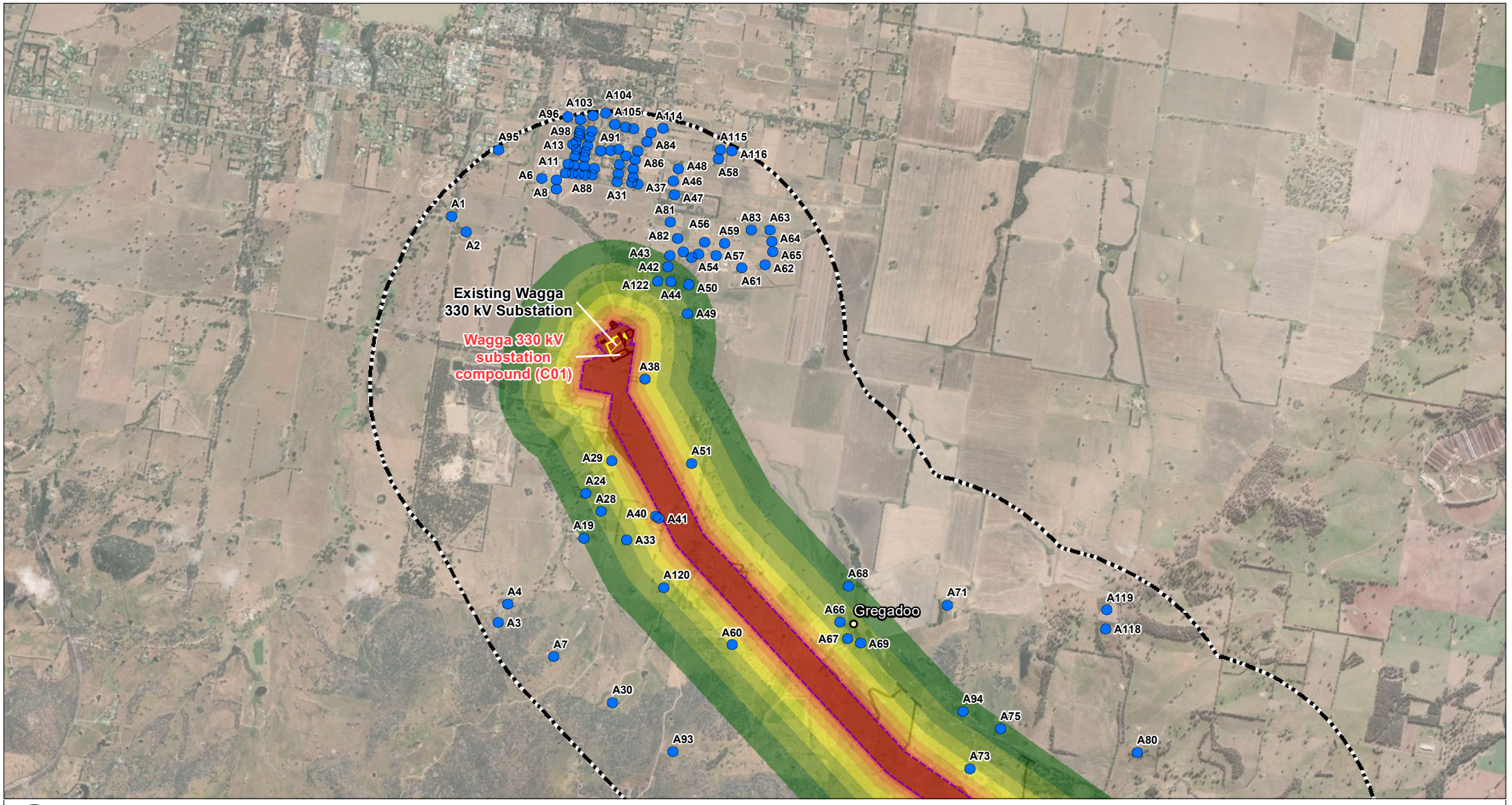


0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

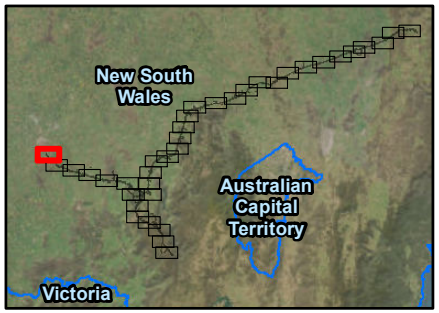
Population centre
Receiver
Existing substation fence line
Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
- 65 - 70 dBA
- 70 - 75 dBA
- 75 - 80 dBA
- 80 - 85 dBA
- 85 - 90 dBA
- >90 dBA

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Project corridor

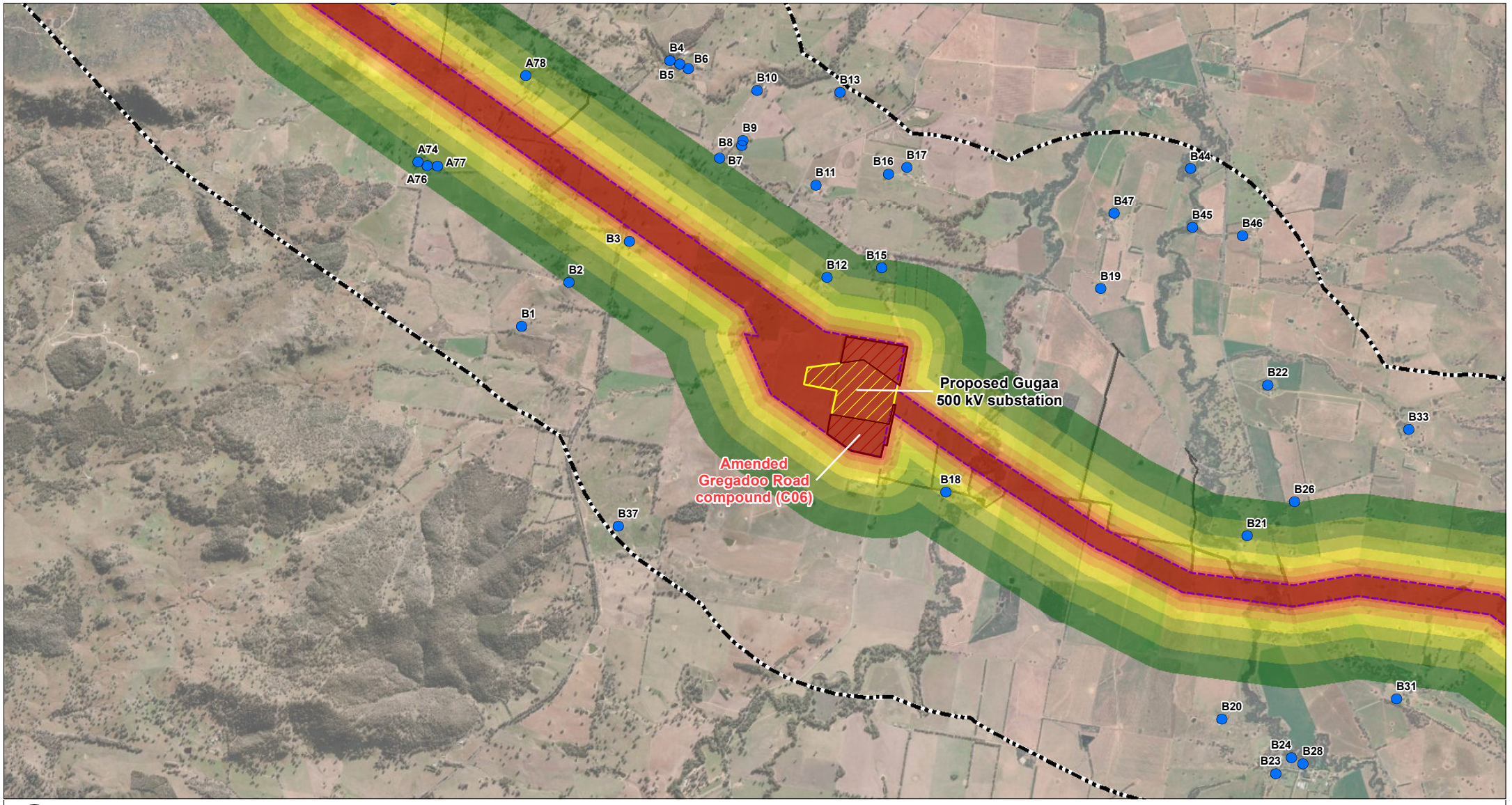


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

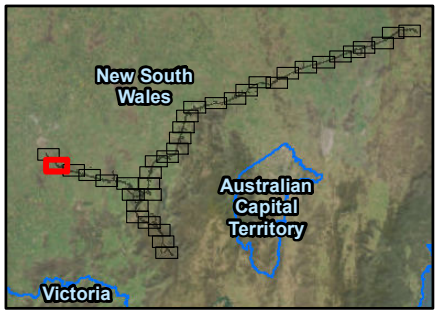
- Population centre
- Receiver
- Existing substation fence line
- Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
- 65 - 70 dBA
- 70 - 75 dBA
- 75 - 80 dBA
- 80 - 85 dBA
- 85 - 90 dBA
- >90 dBA

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Project corridor

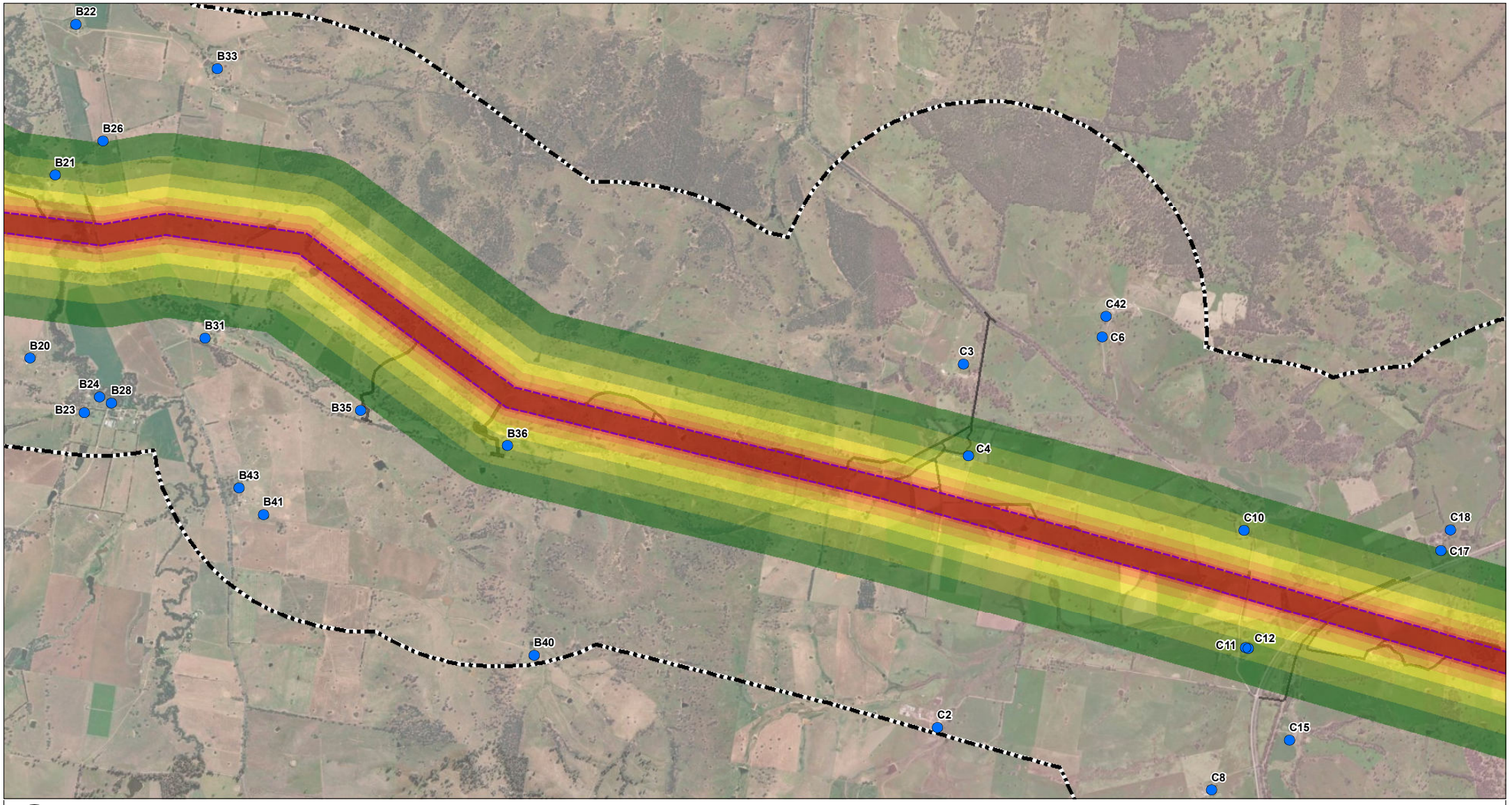


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

Population centre
Receiver
Existing substation fence line
Amended study area

LAmax Aircraft Noise

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65 - 70 dBA
70 - 75 dBA
75 - 80 dBA
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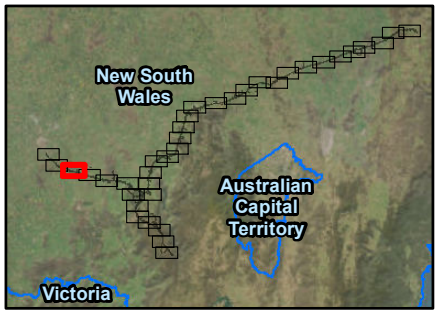
85 - 90 dBA
>90 dBA

Project Components

Substation
Amended project footprint
Construction compound
Combined worker accomodation facility and construction compound
Telecommunications connection
Project corridor



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NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

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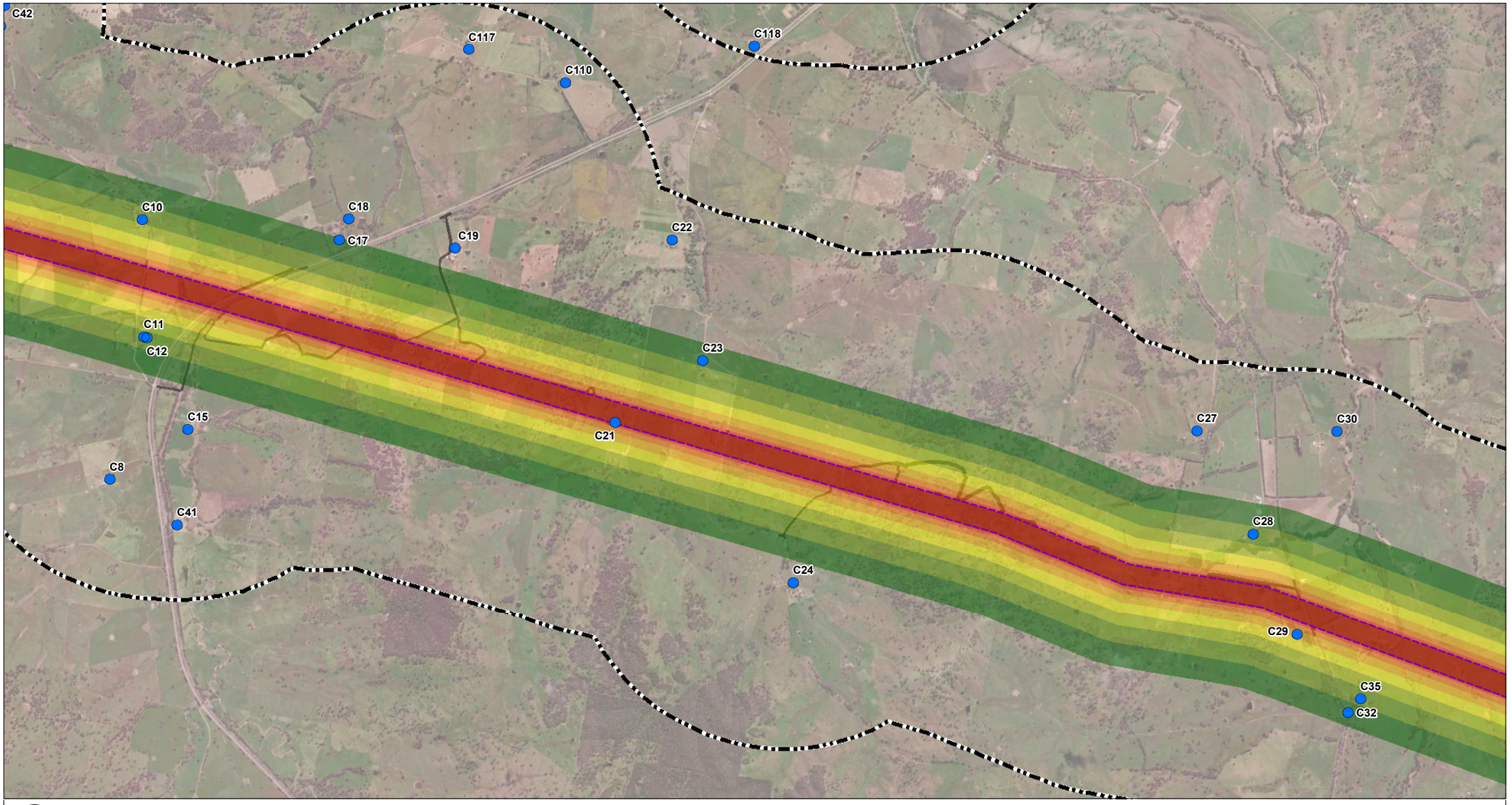

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Project Components

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- Construction compound
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- Telecommunications connection
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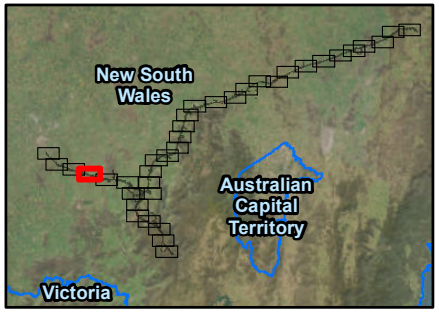

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NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

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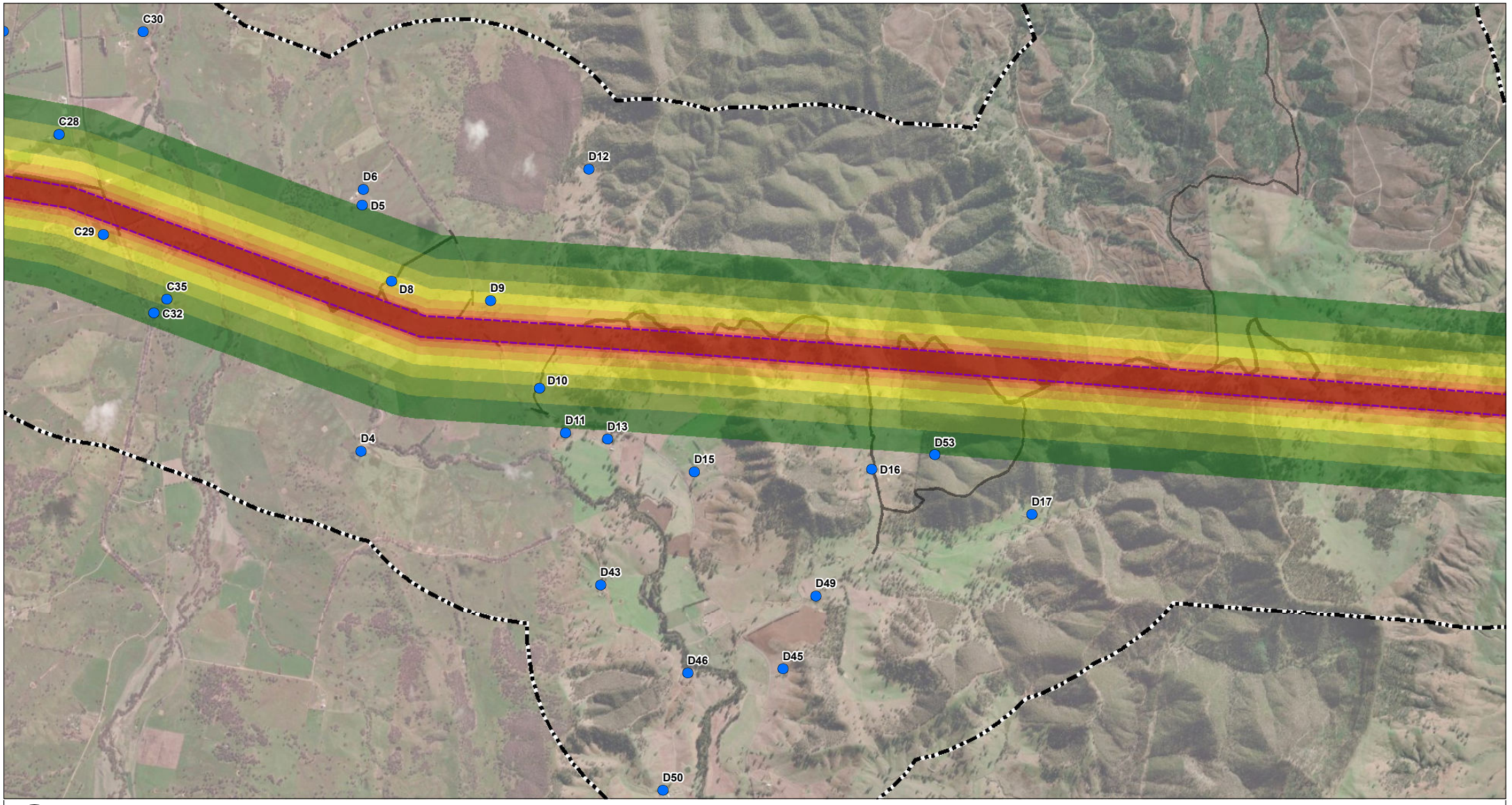

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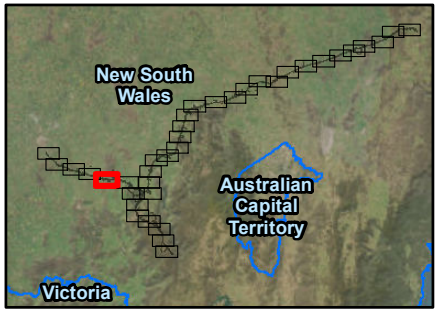

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NOISE AND VIBRATION IMPACT ASSESSMENT

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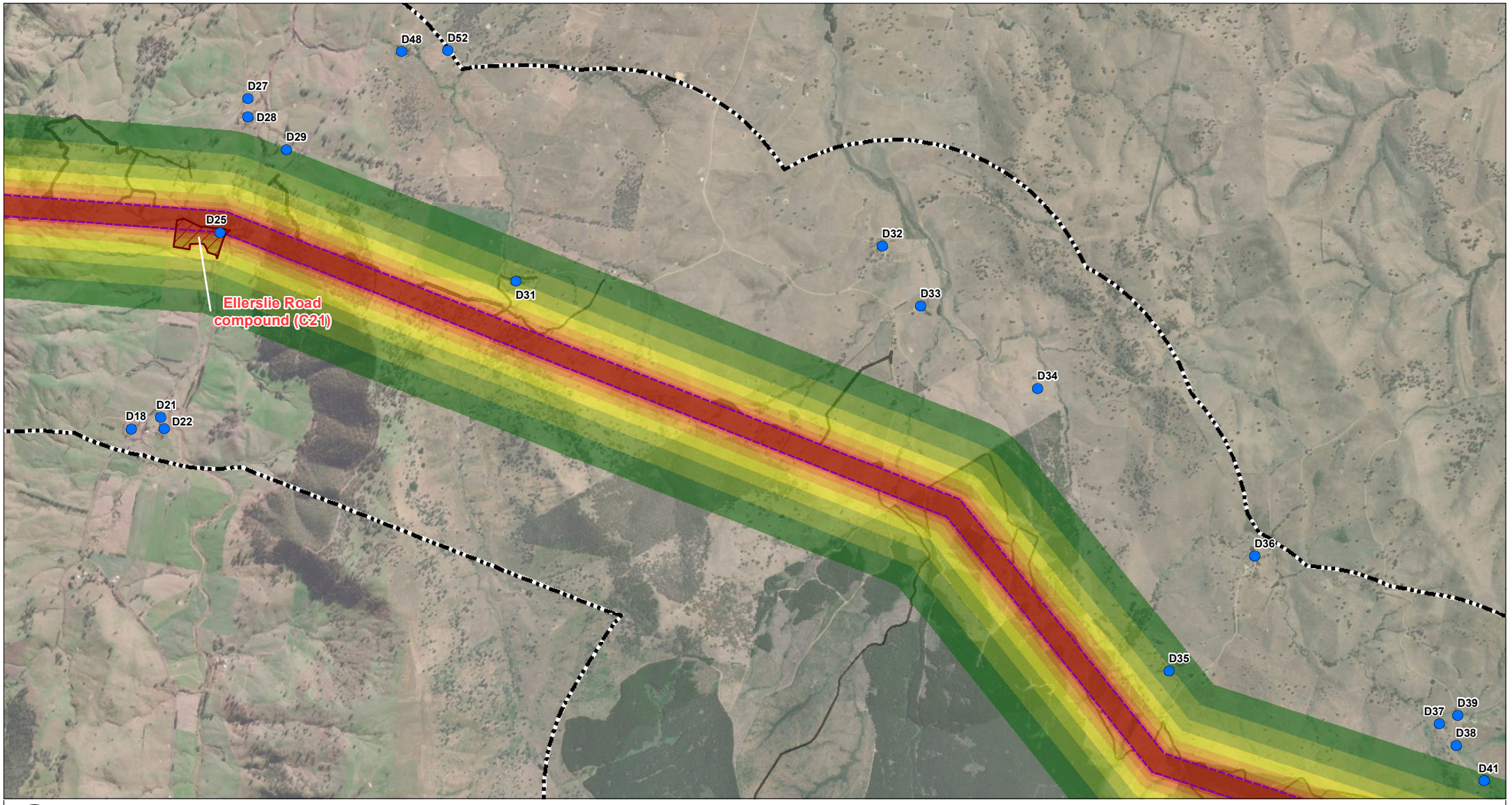
\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



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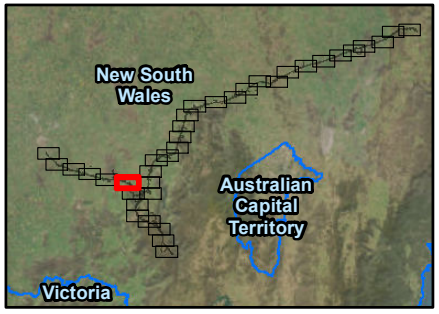

HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

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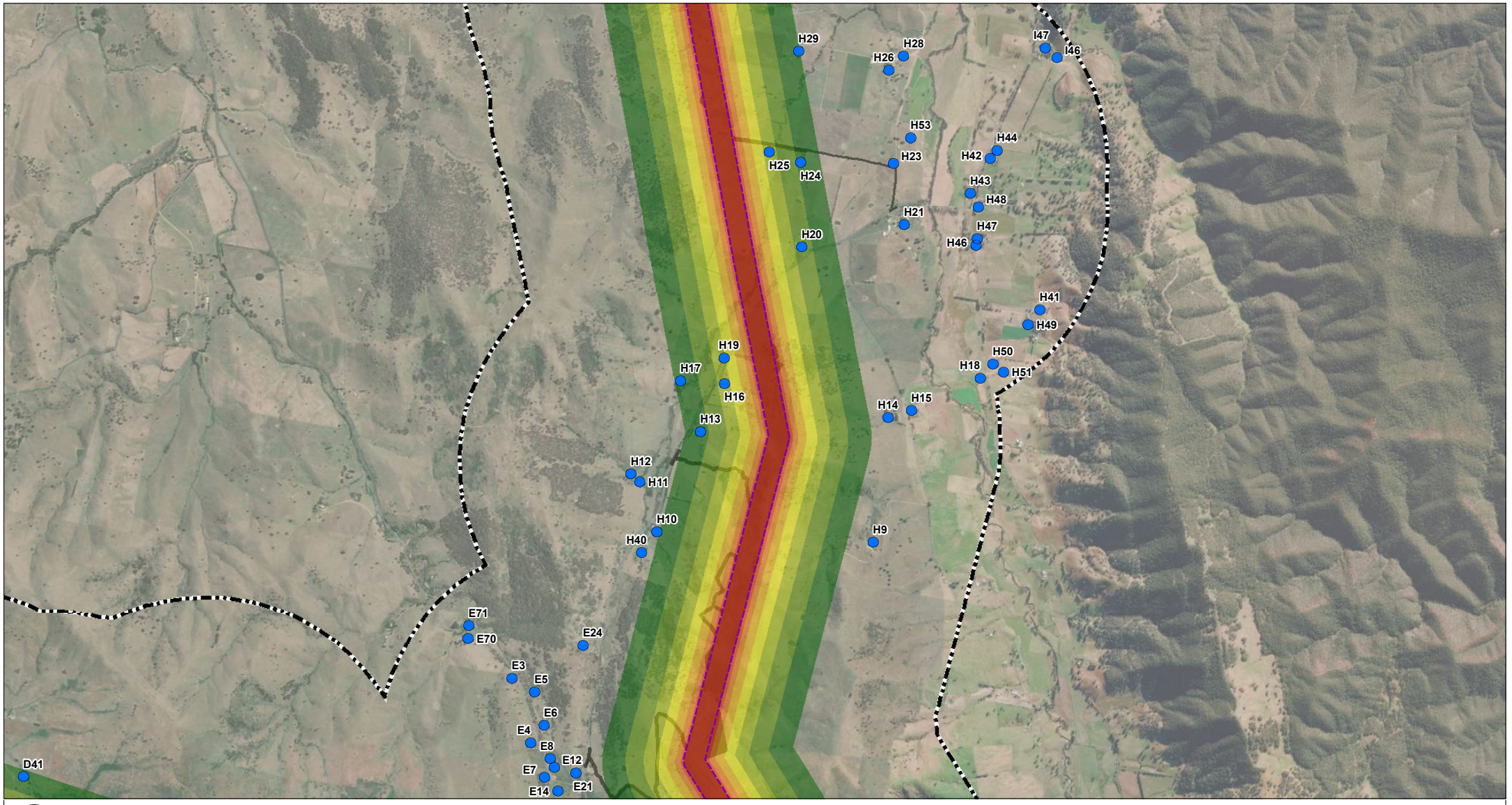
\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



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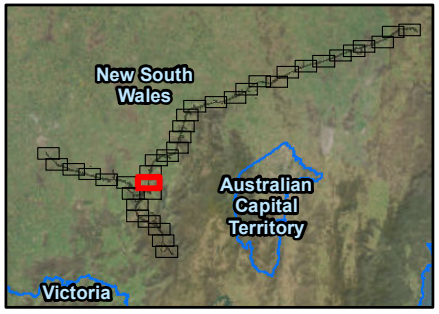

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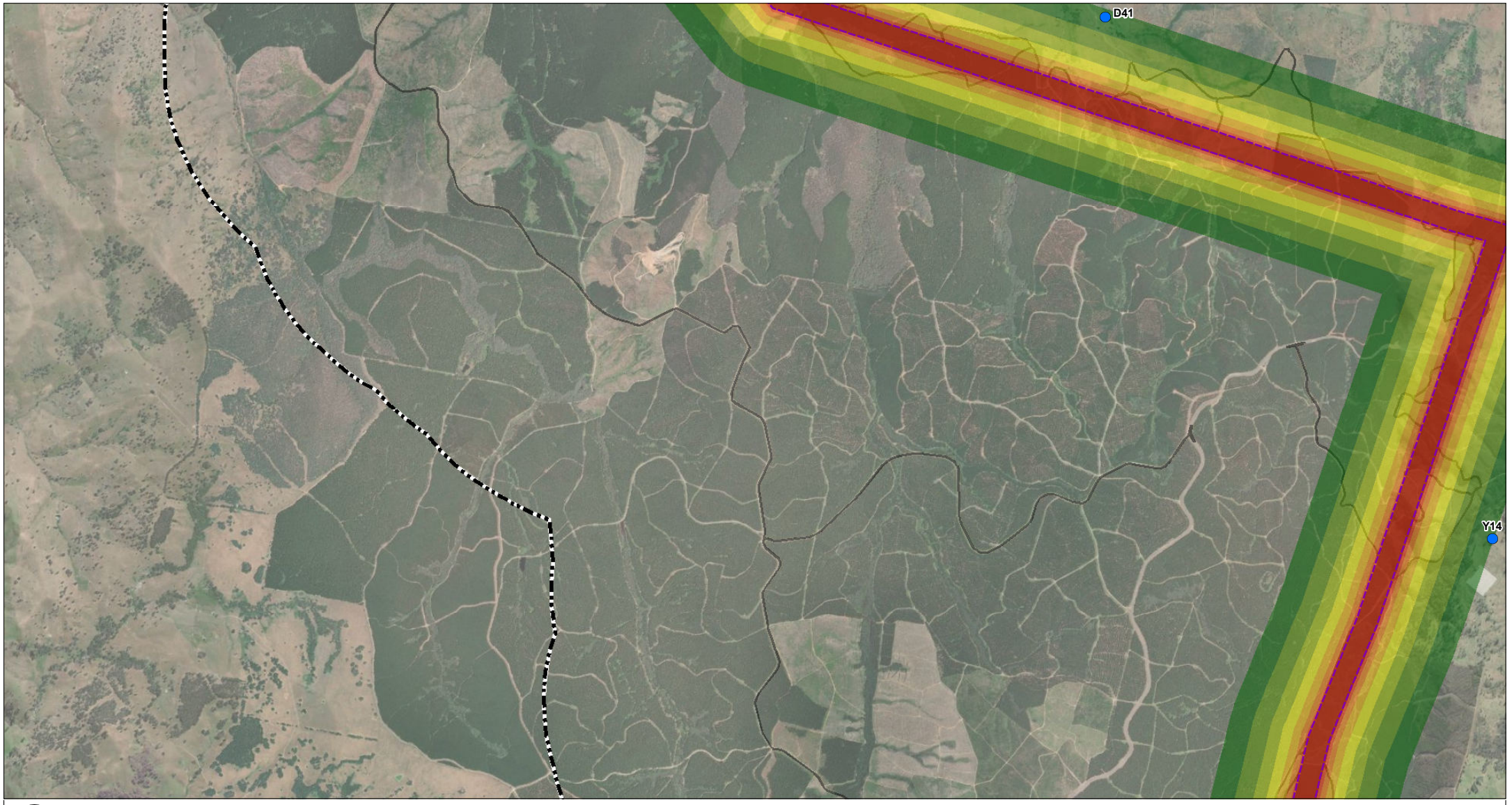

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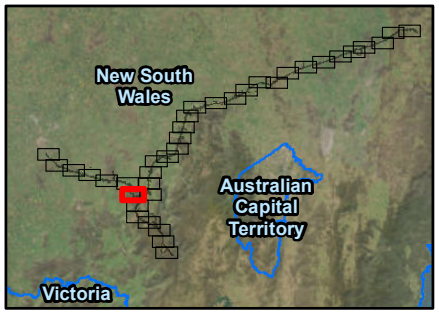
Project Components

Substation
Amended project footprint
Construction compound
Combined worker accomodation facility and construction compound
Telecommunications connection
Project corridor



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

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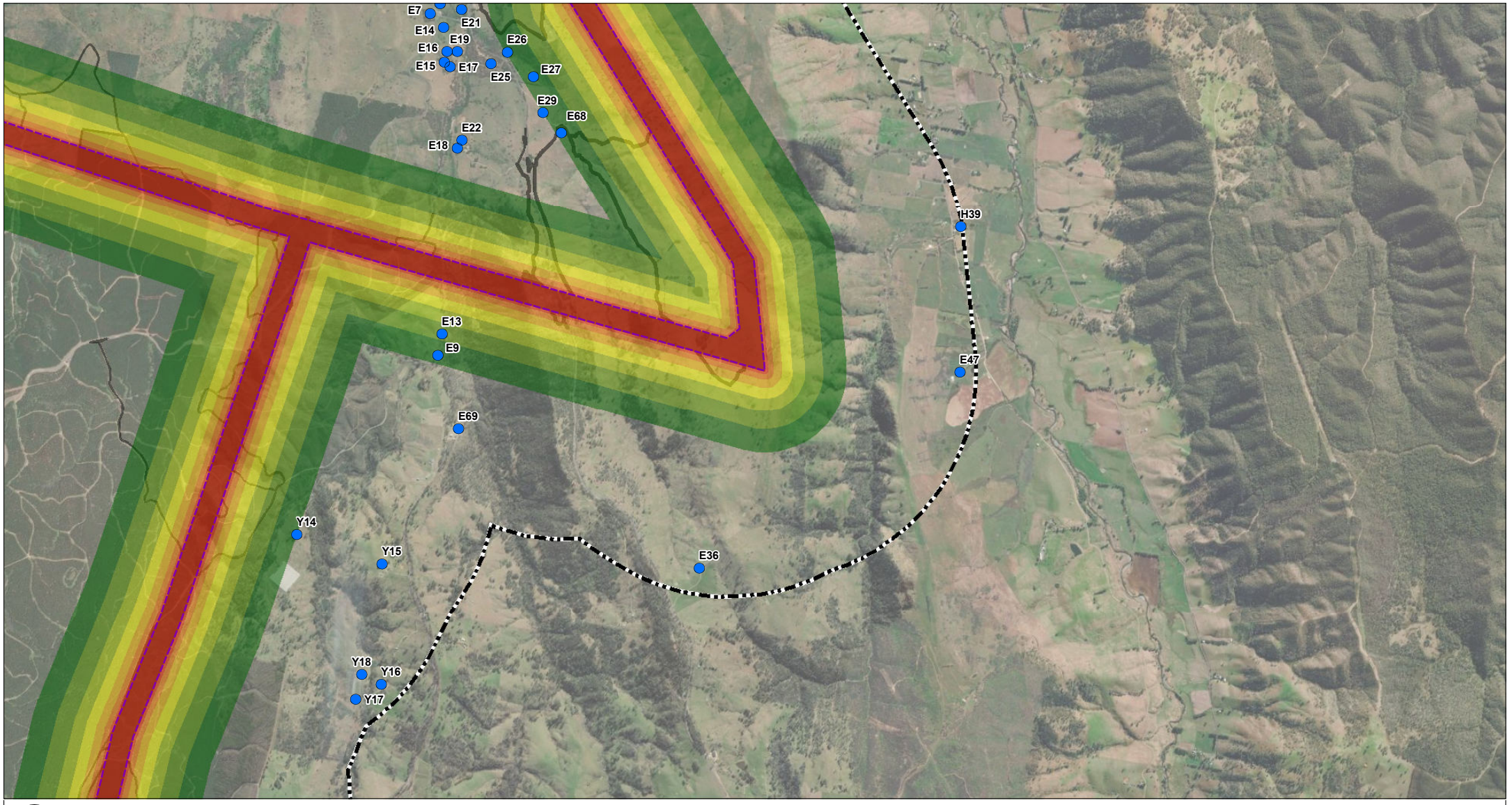

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Project Number:	610.30622
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Project Components

Substation
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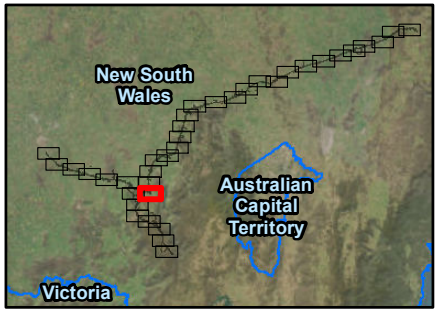
Construction compound
Combined worker accomodation facility and construction compound
Telecommunications connection
Project corridor



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NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

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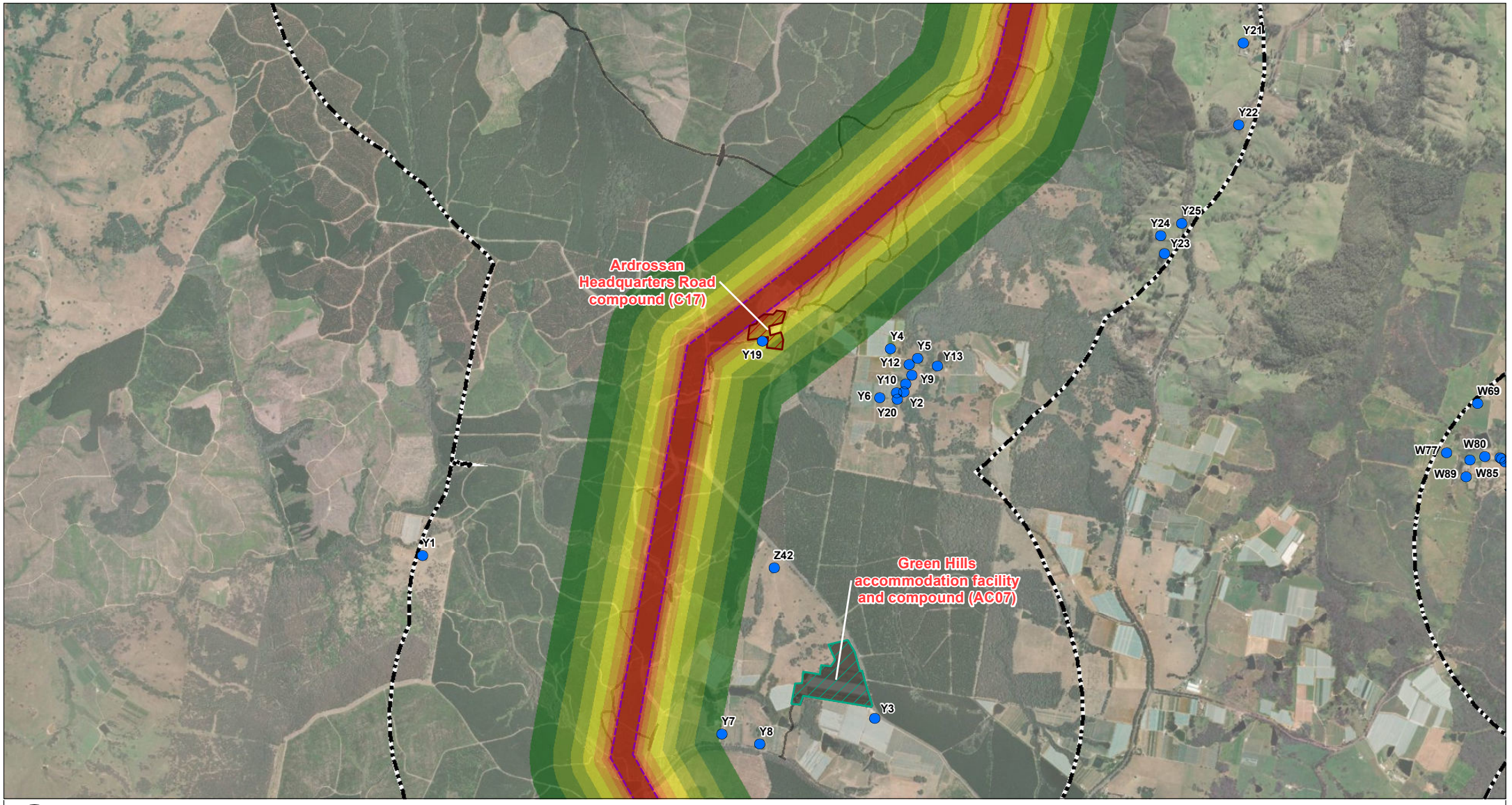

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Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
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Date:	06-Mar-2024
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Project Components

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- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
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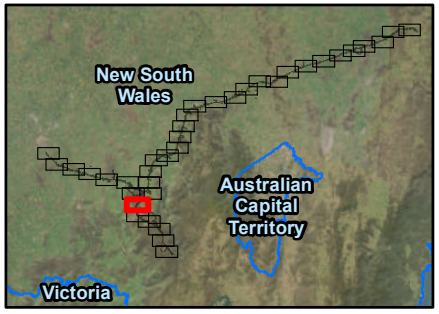

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NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

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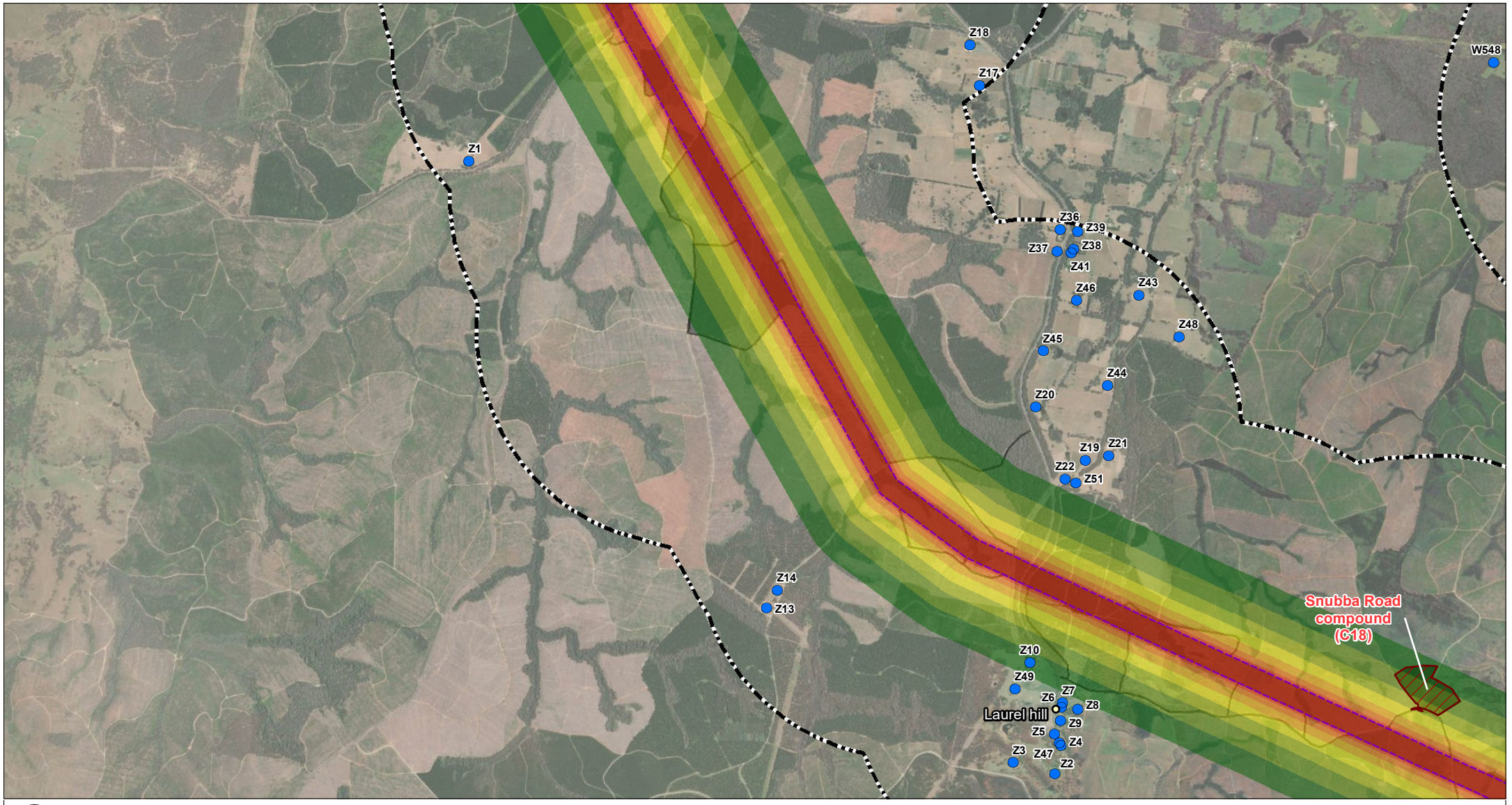

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Coordinate System:	GDA 1994 MGA Zone 55
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Project Components

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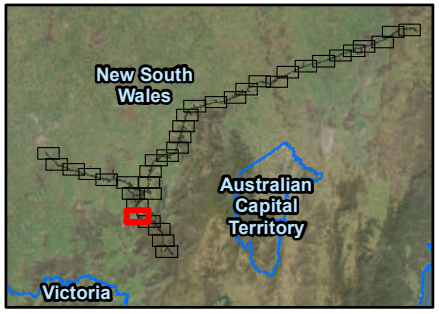

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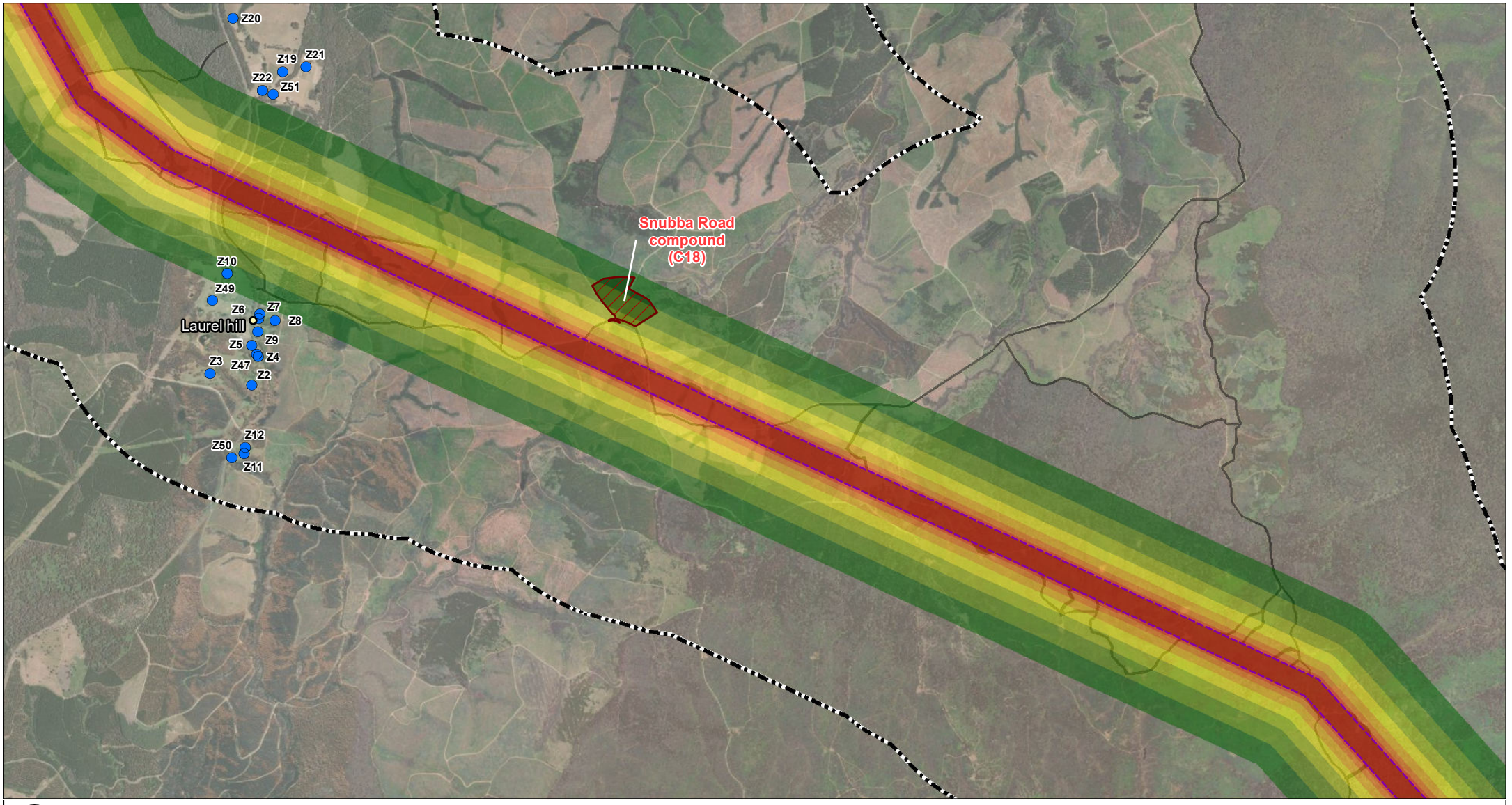

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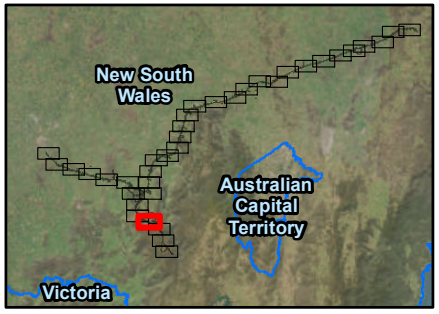
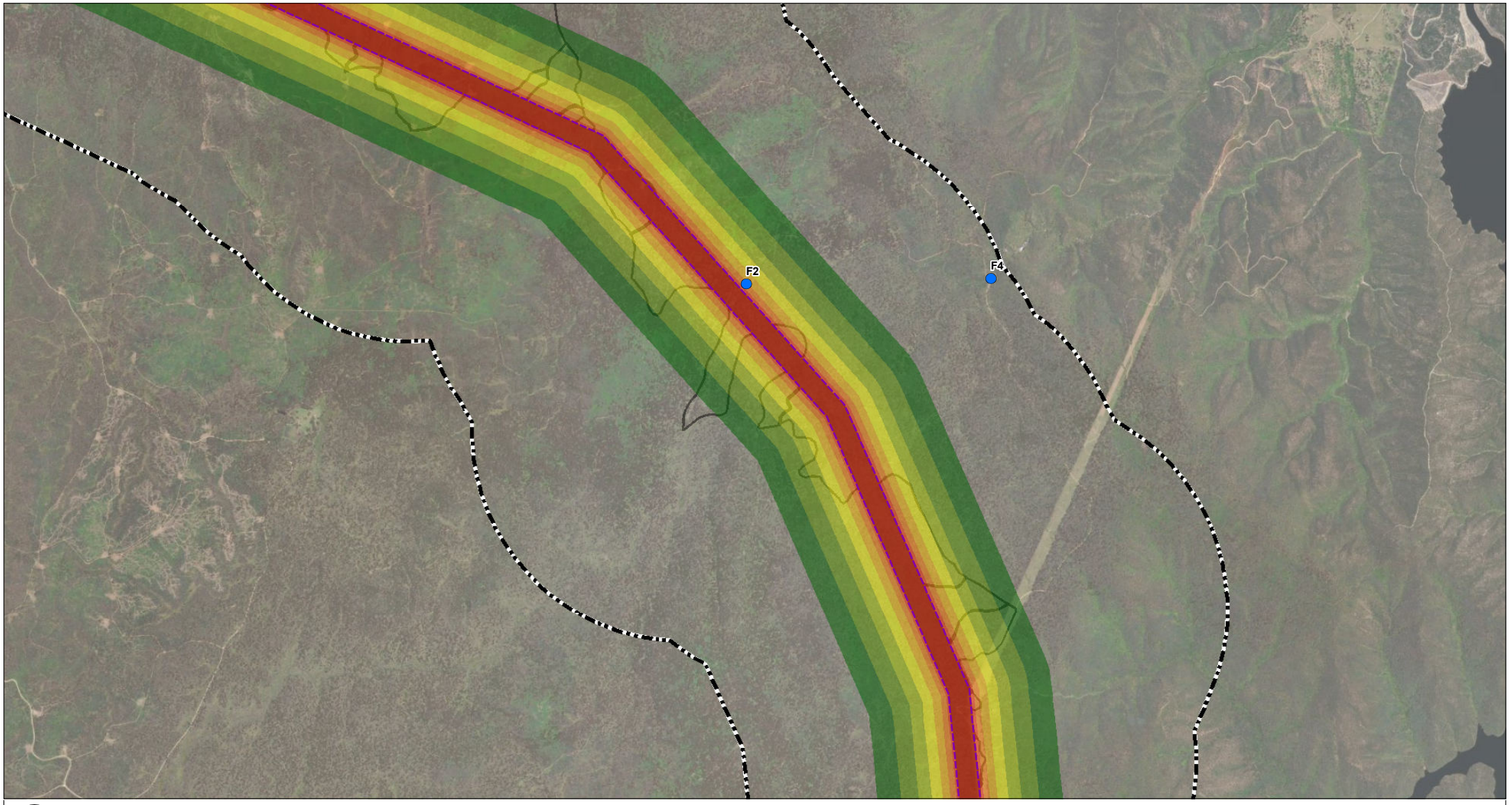


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



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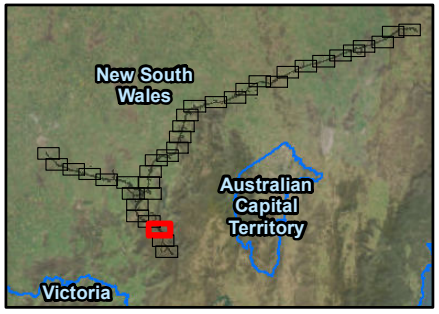

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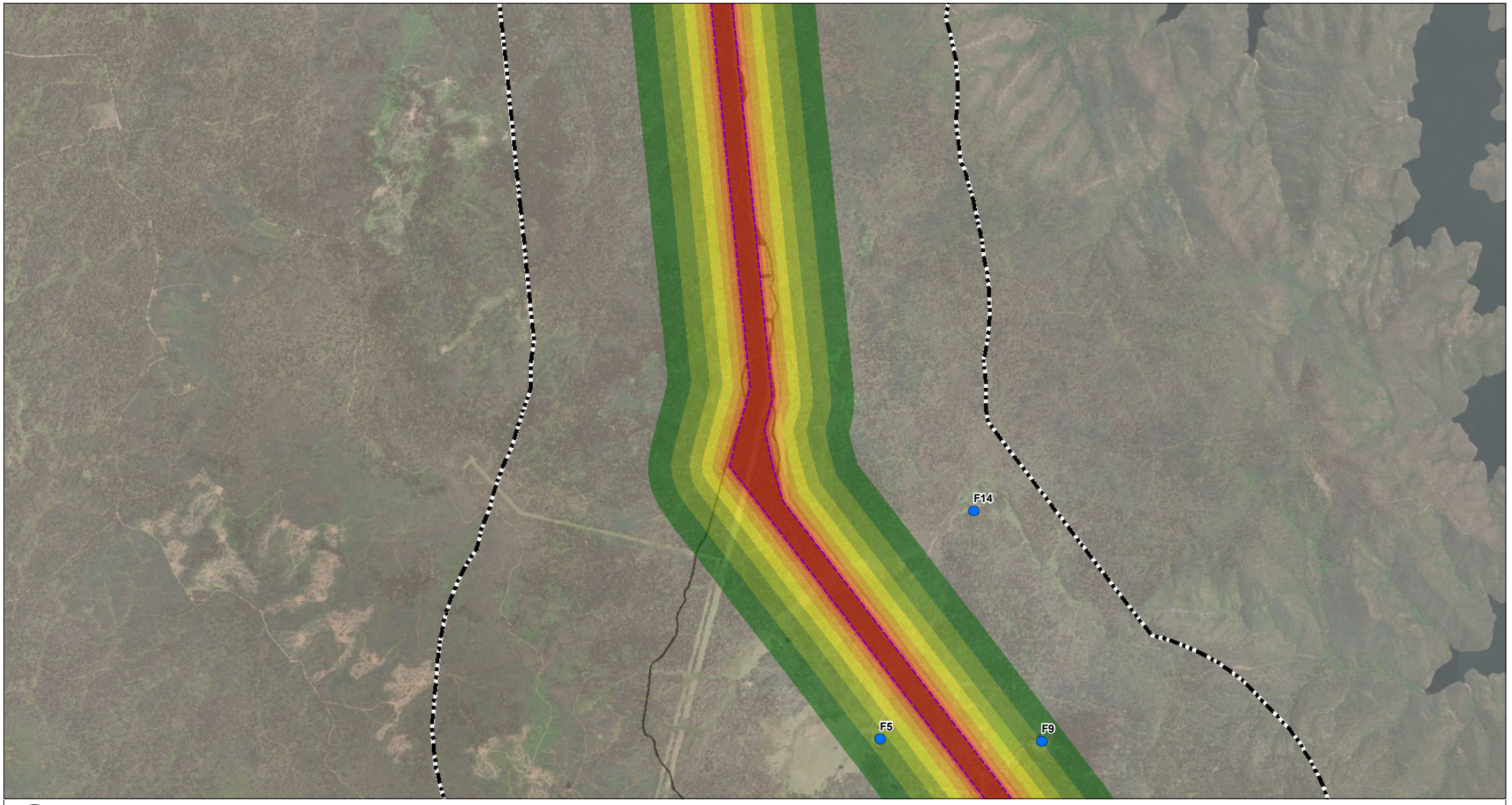
HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
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- Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
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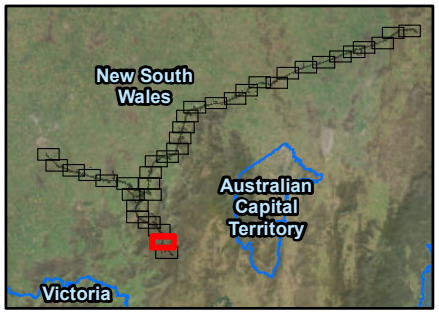

HUMELINK
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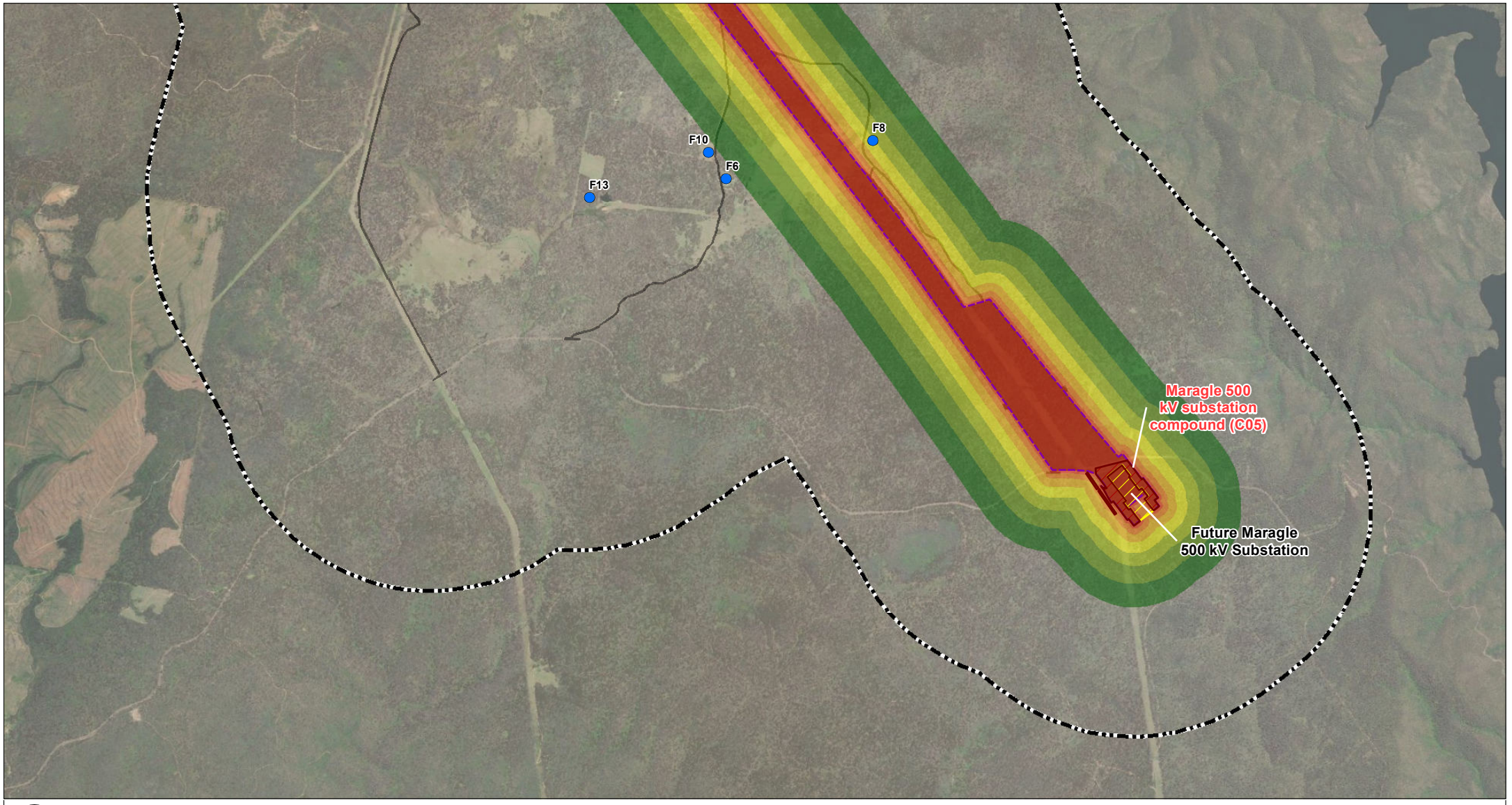

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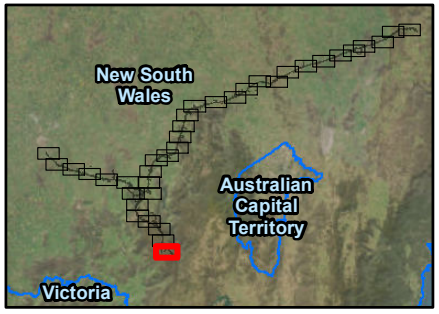

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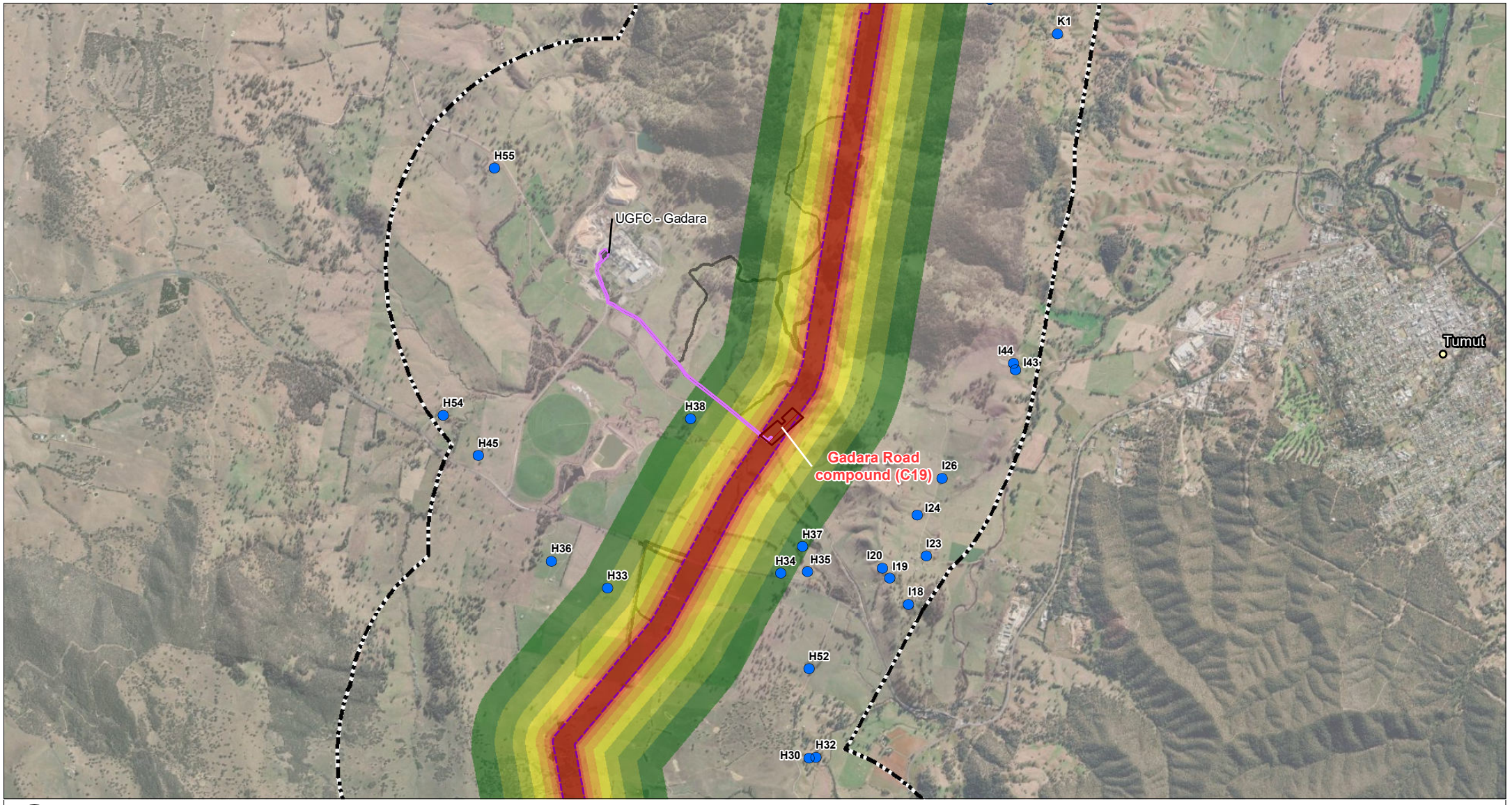

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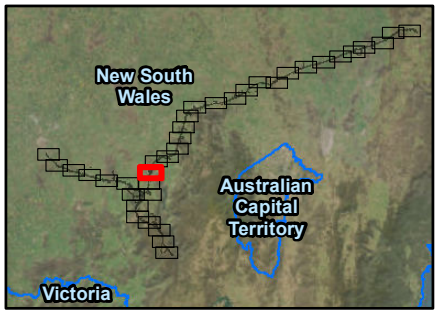

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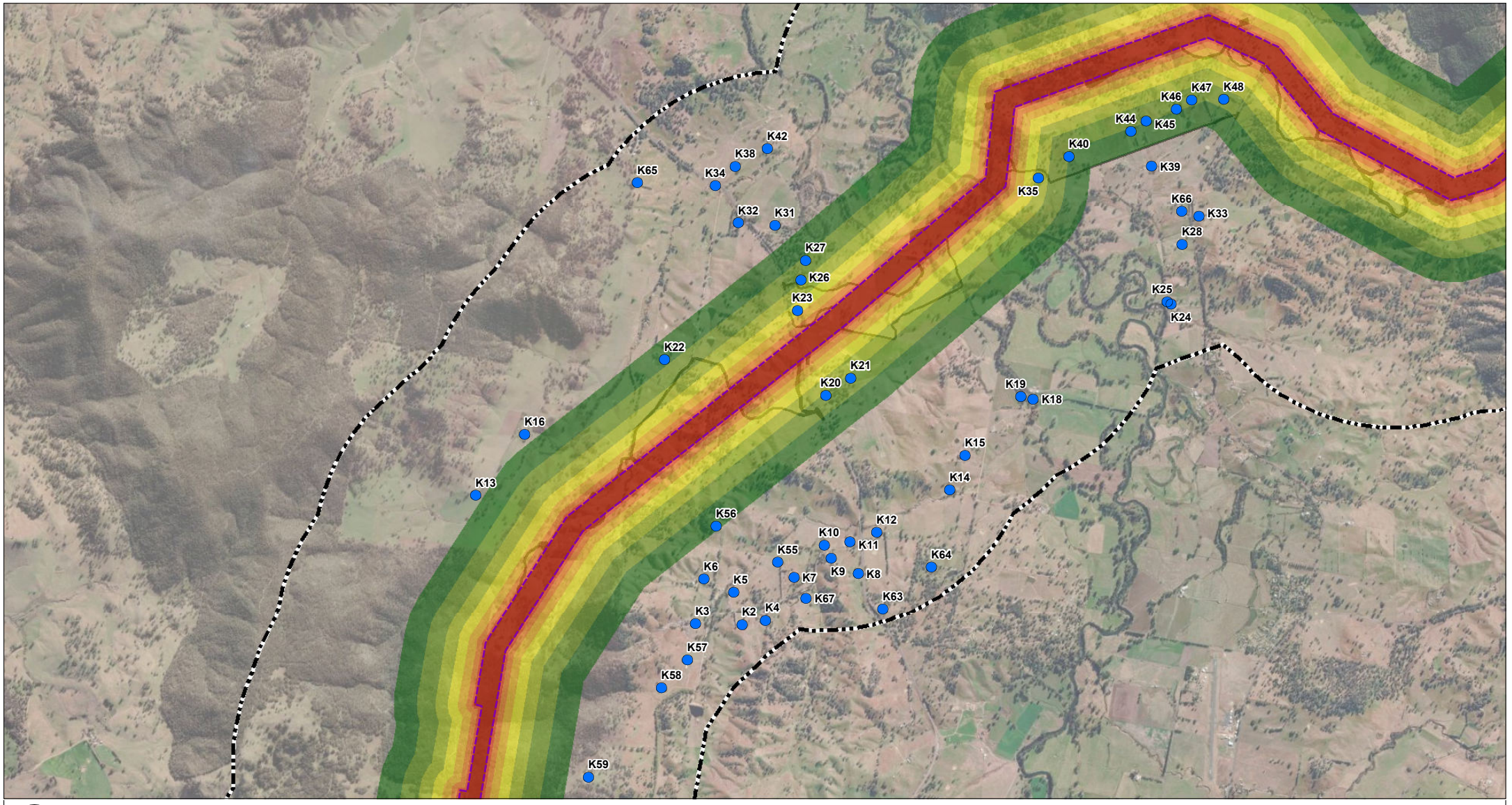

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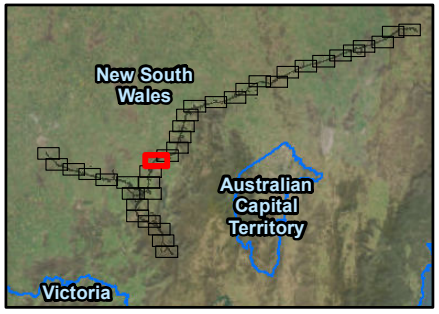

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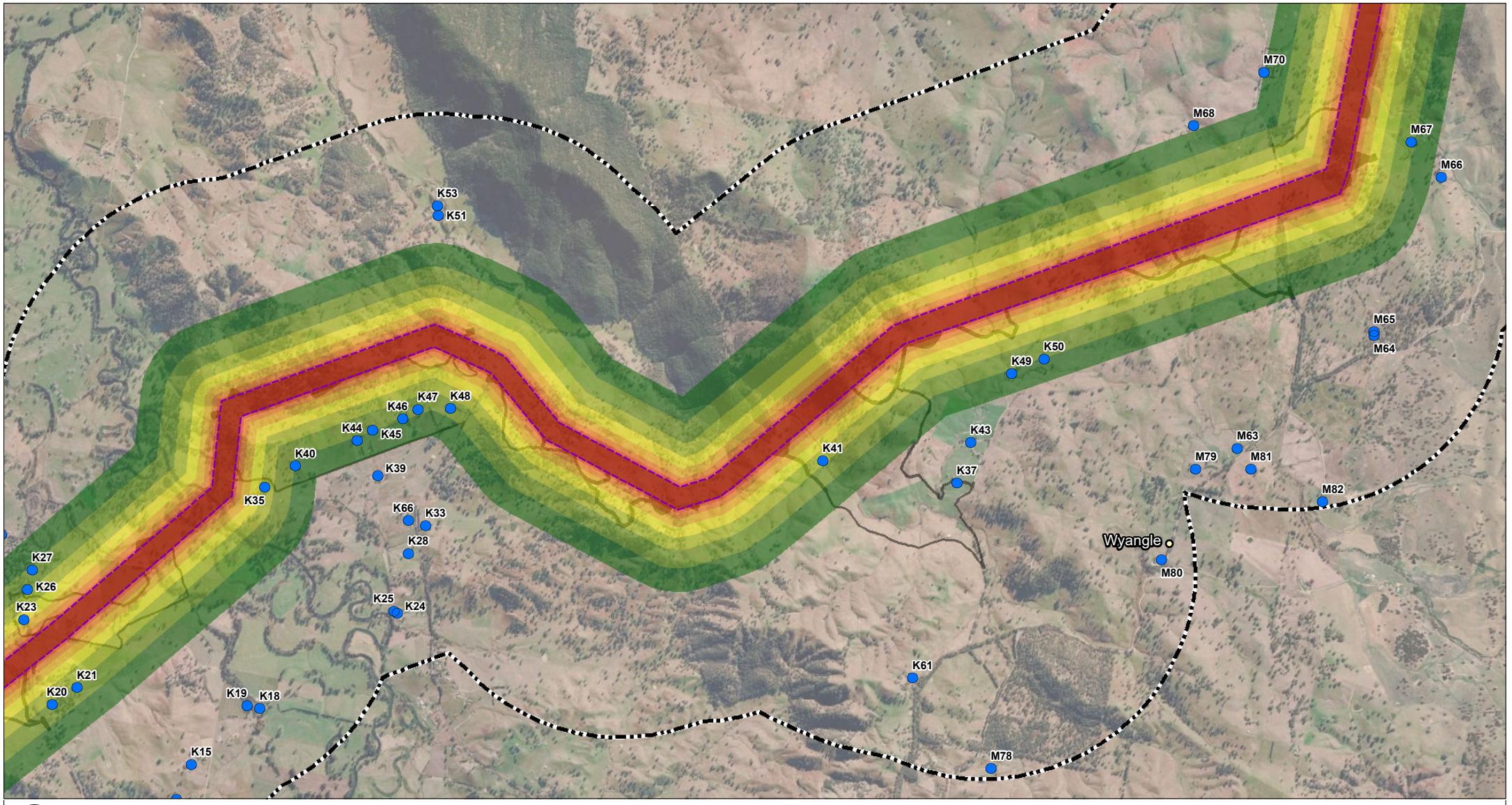

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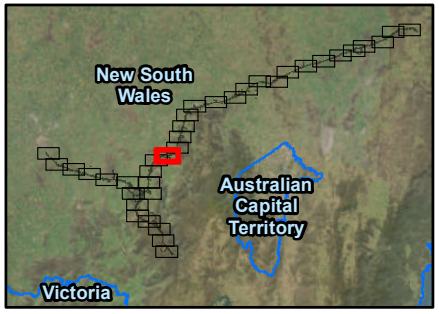

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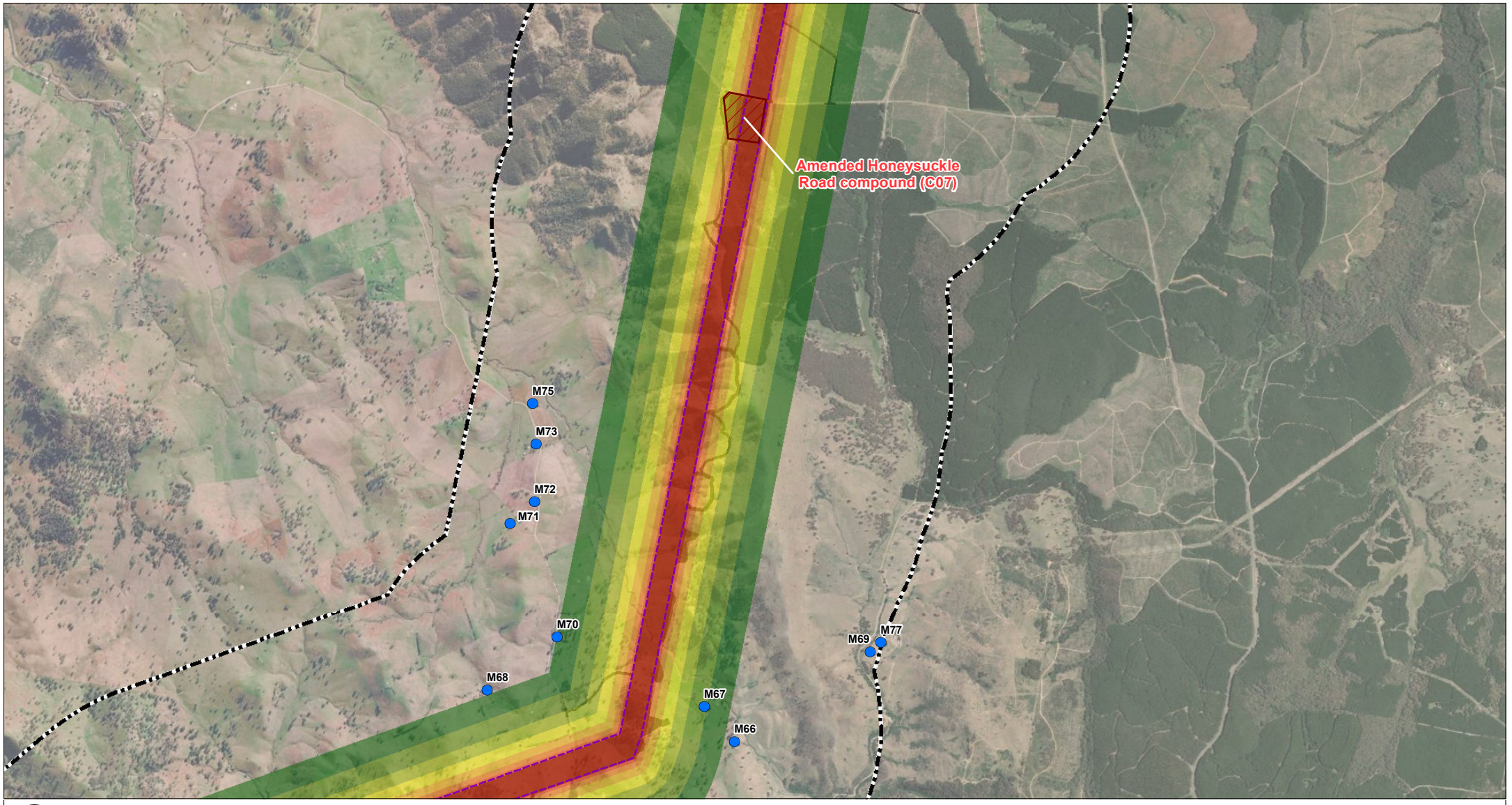

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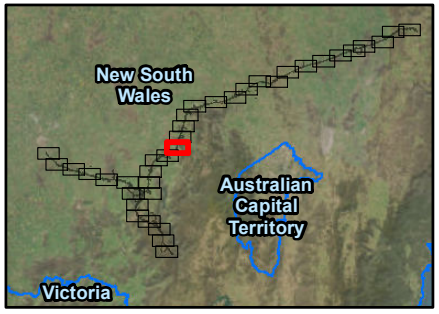

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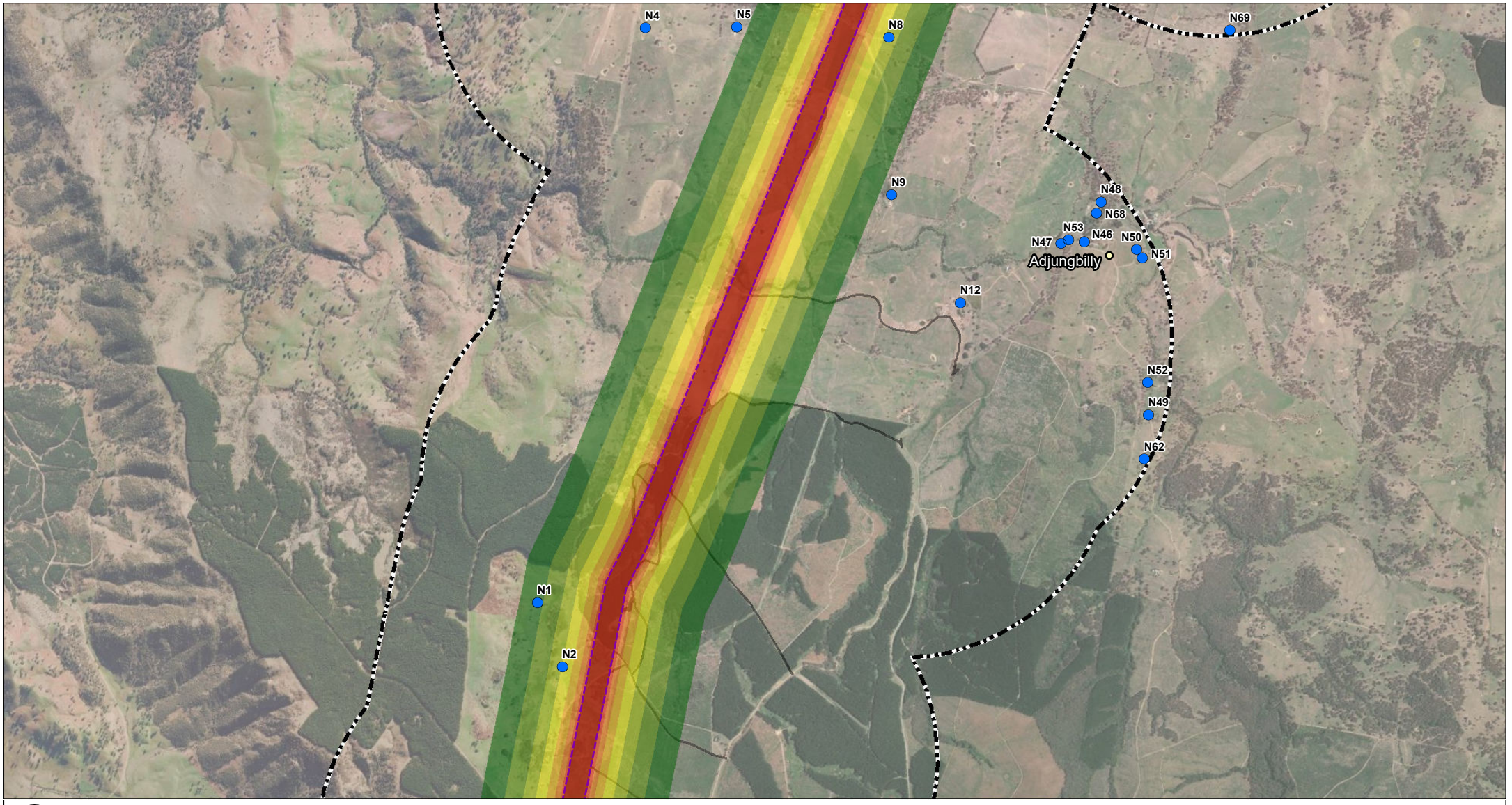

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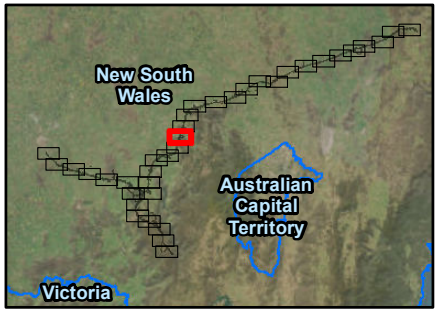

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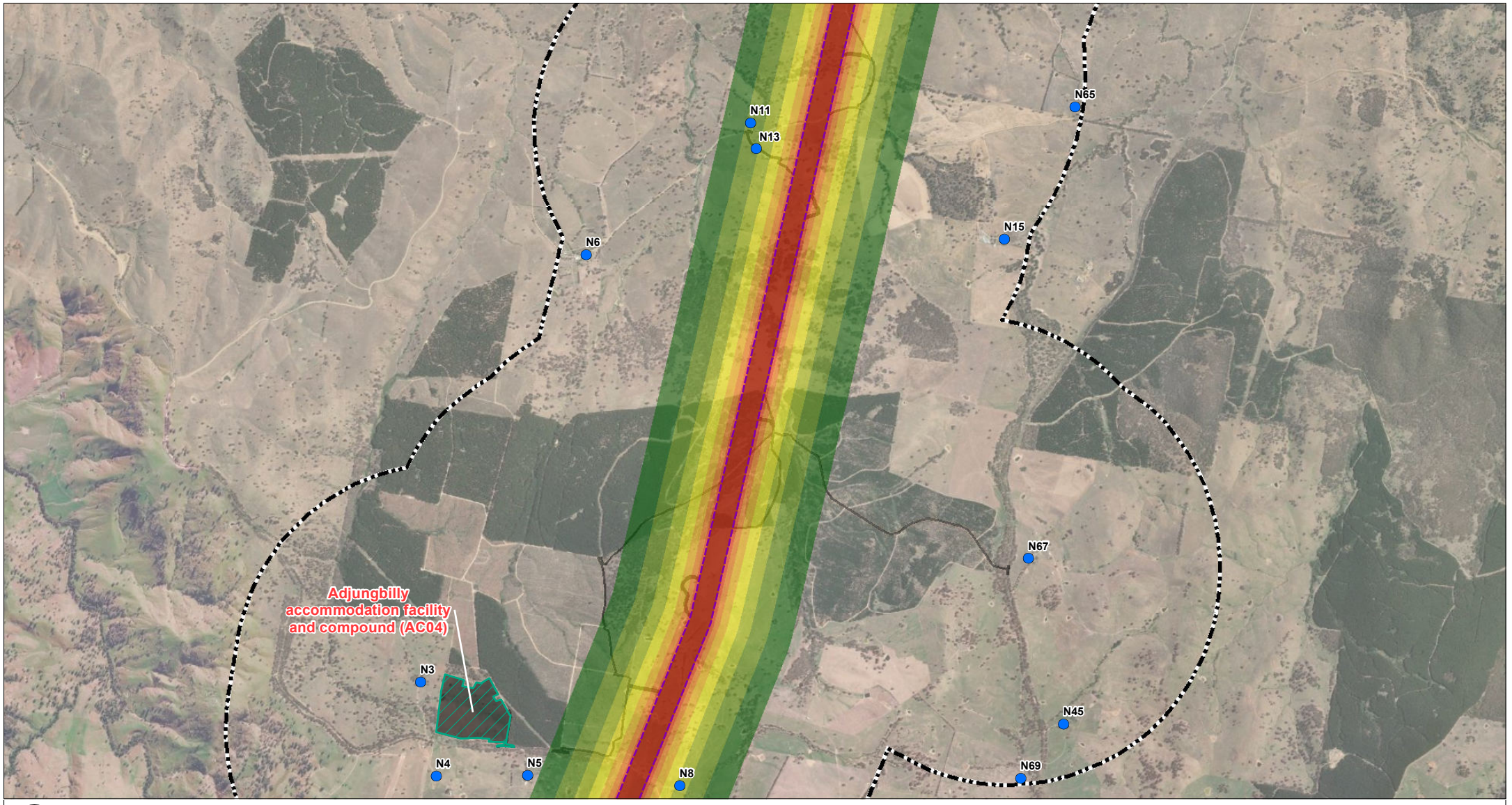

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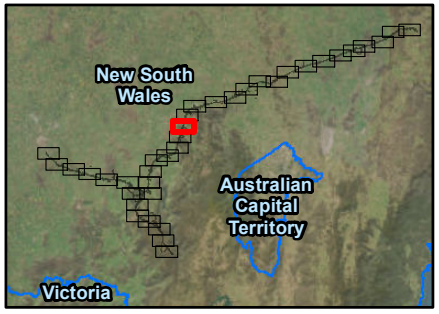

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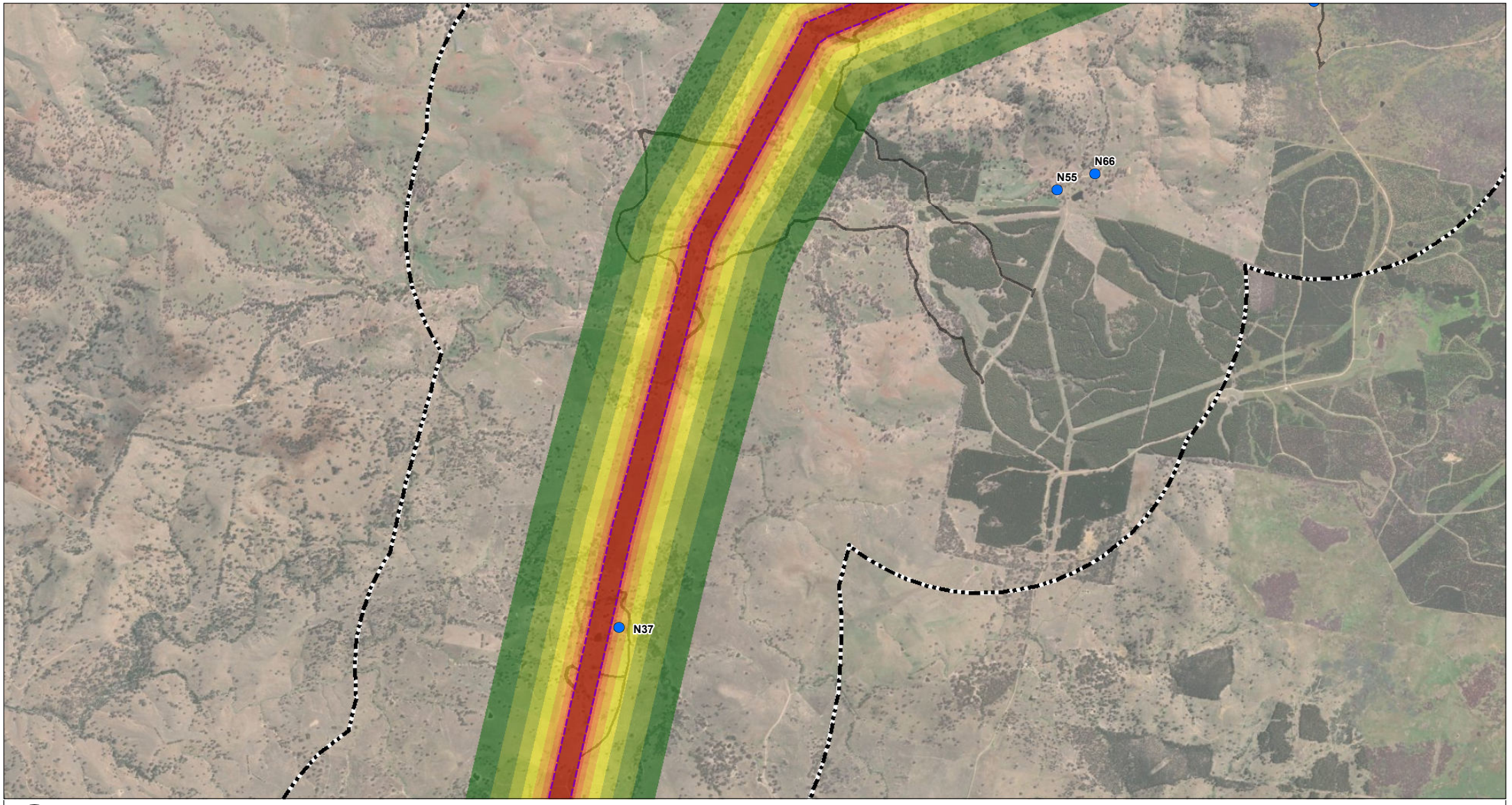

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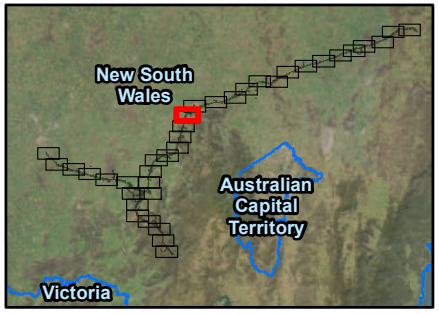

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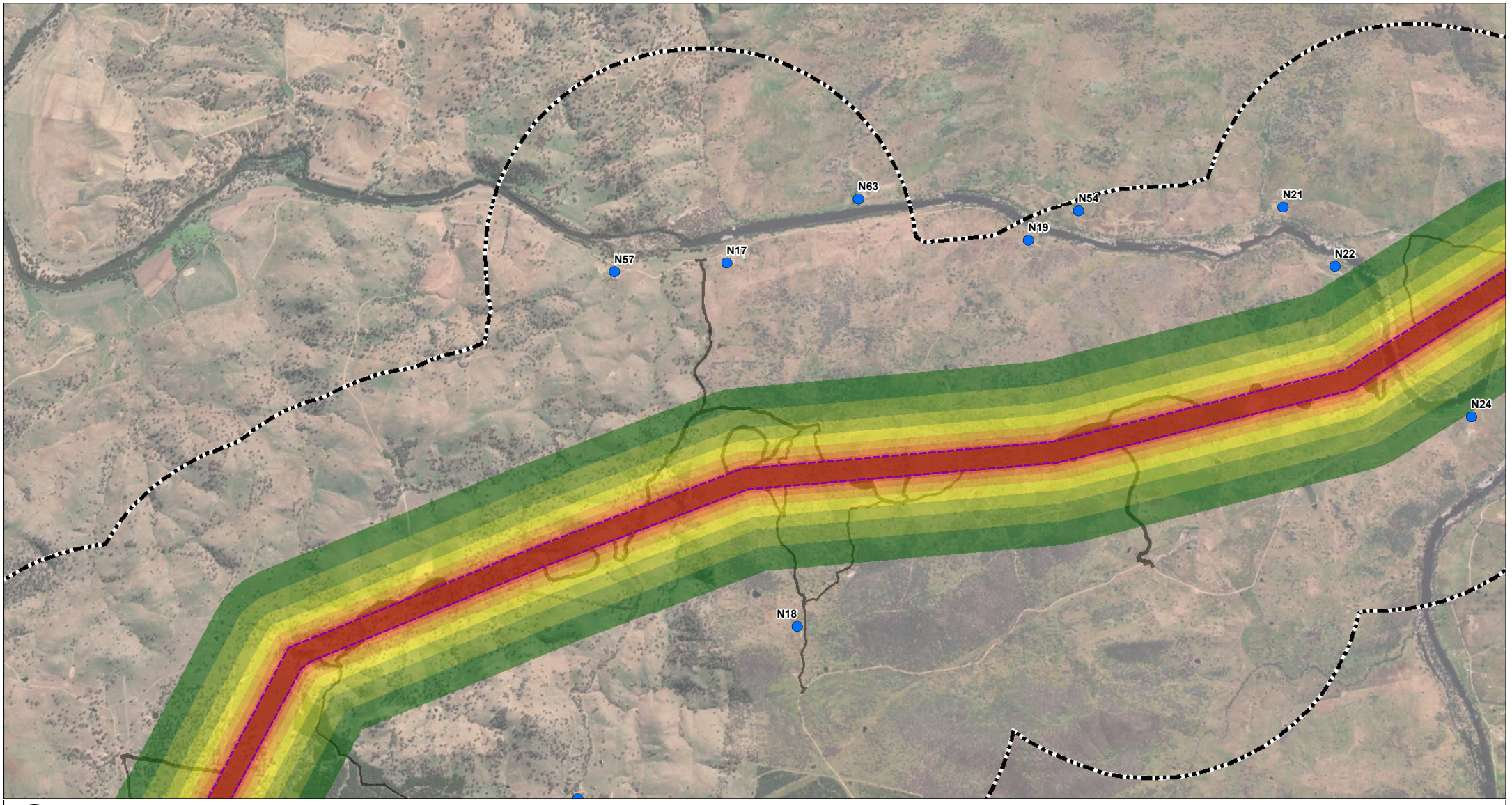

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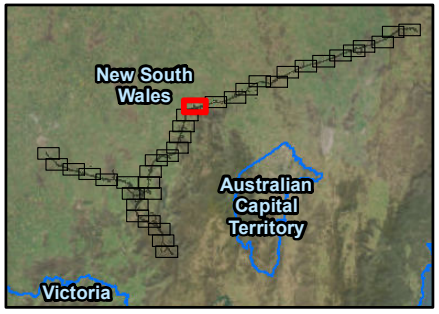

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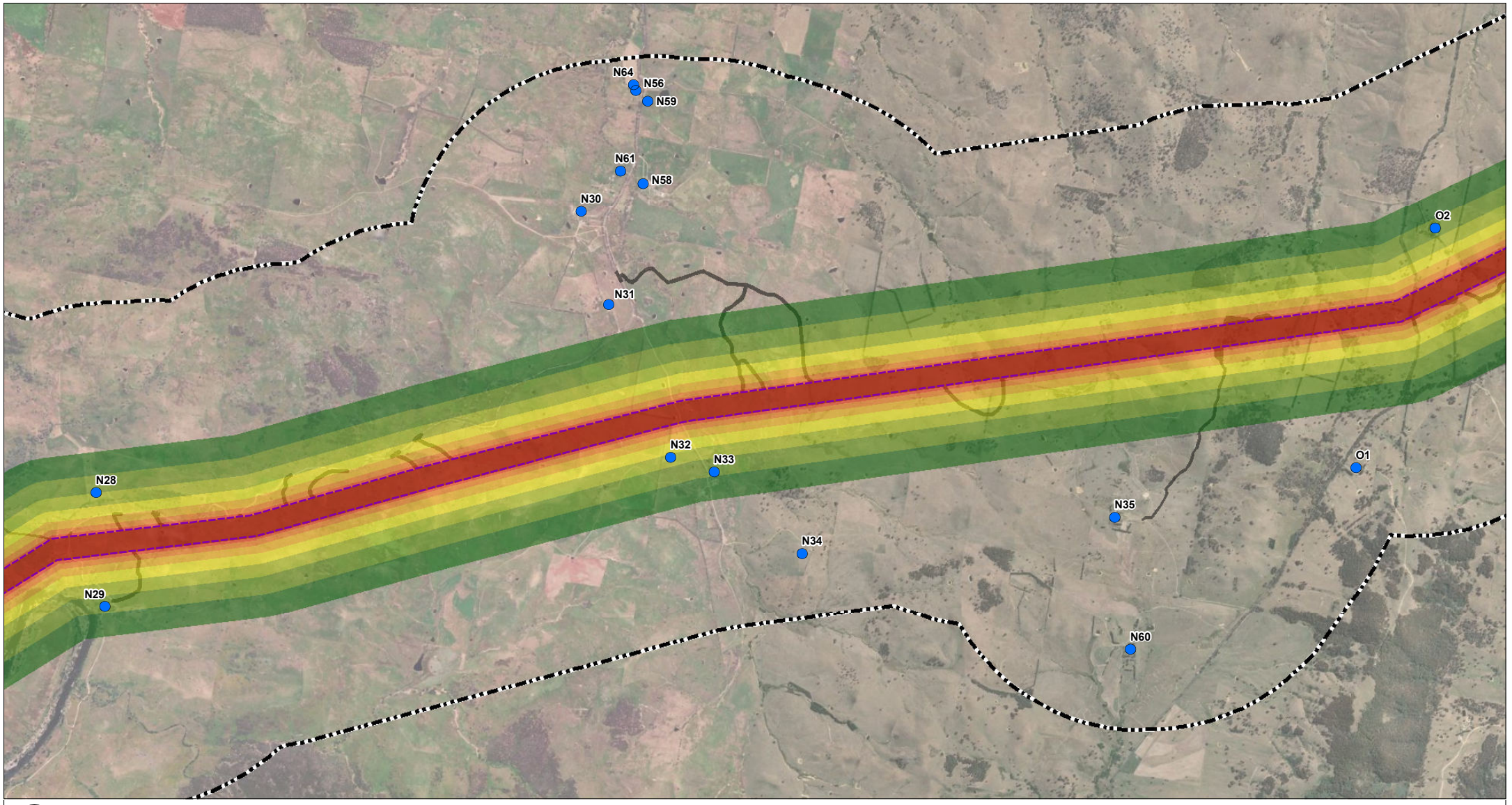

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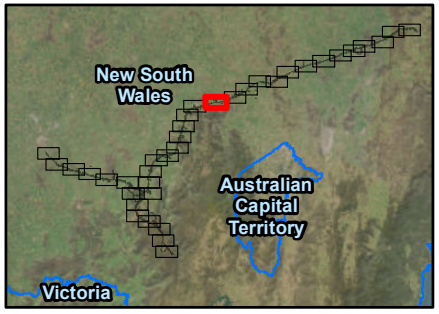

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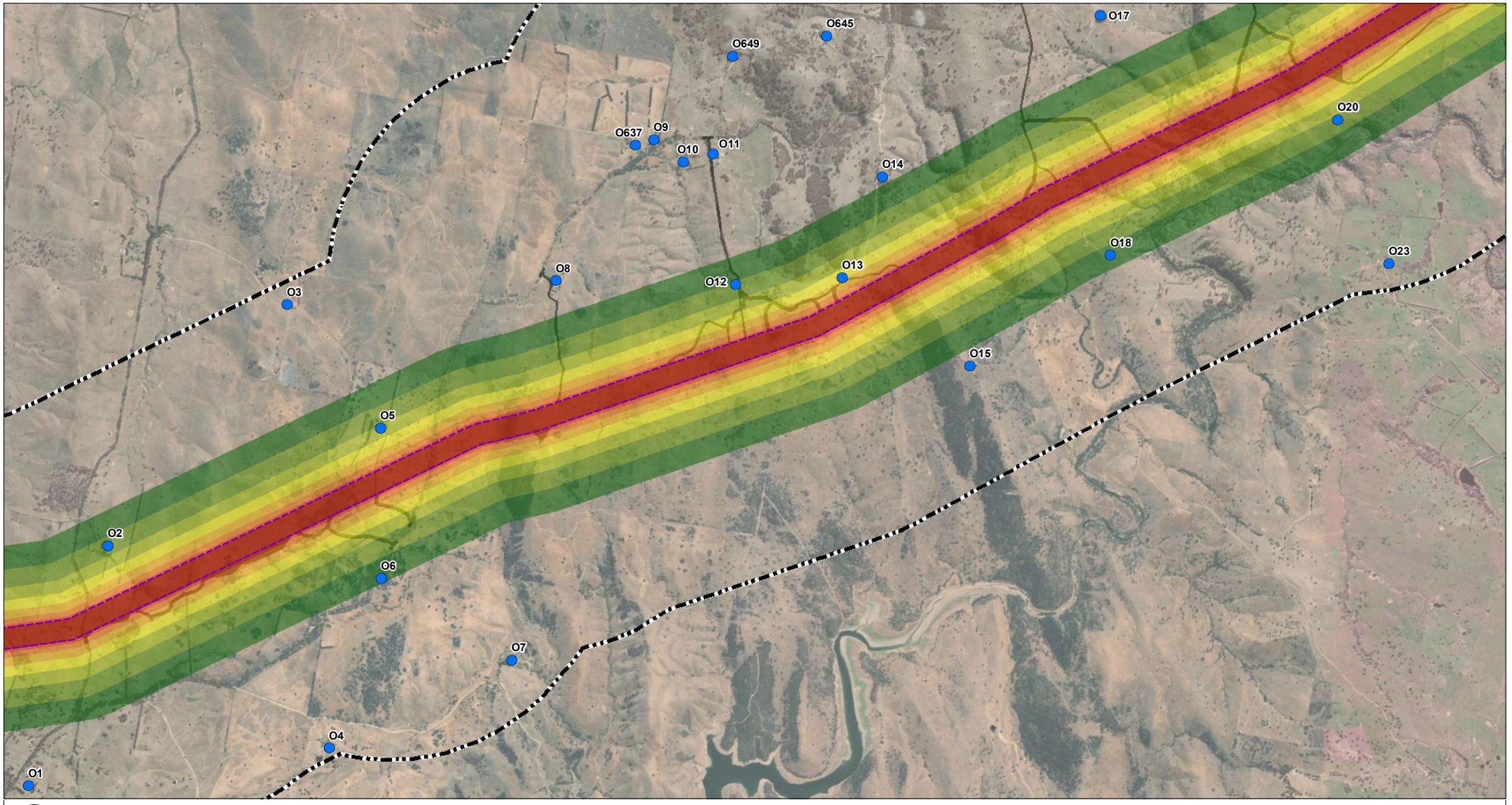

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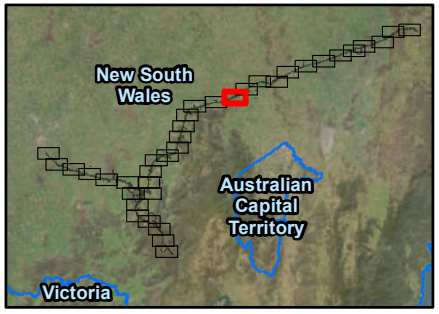

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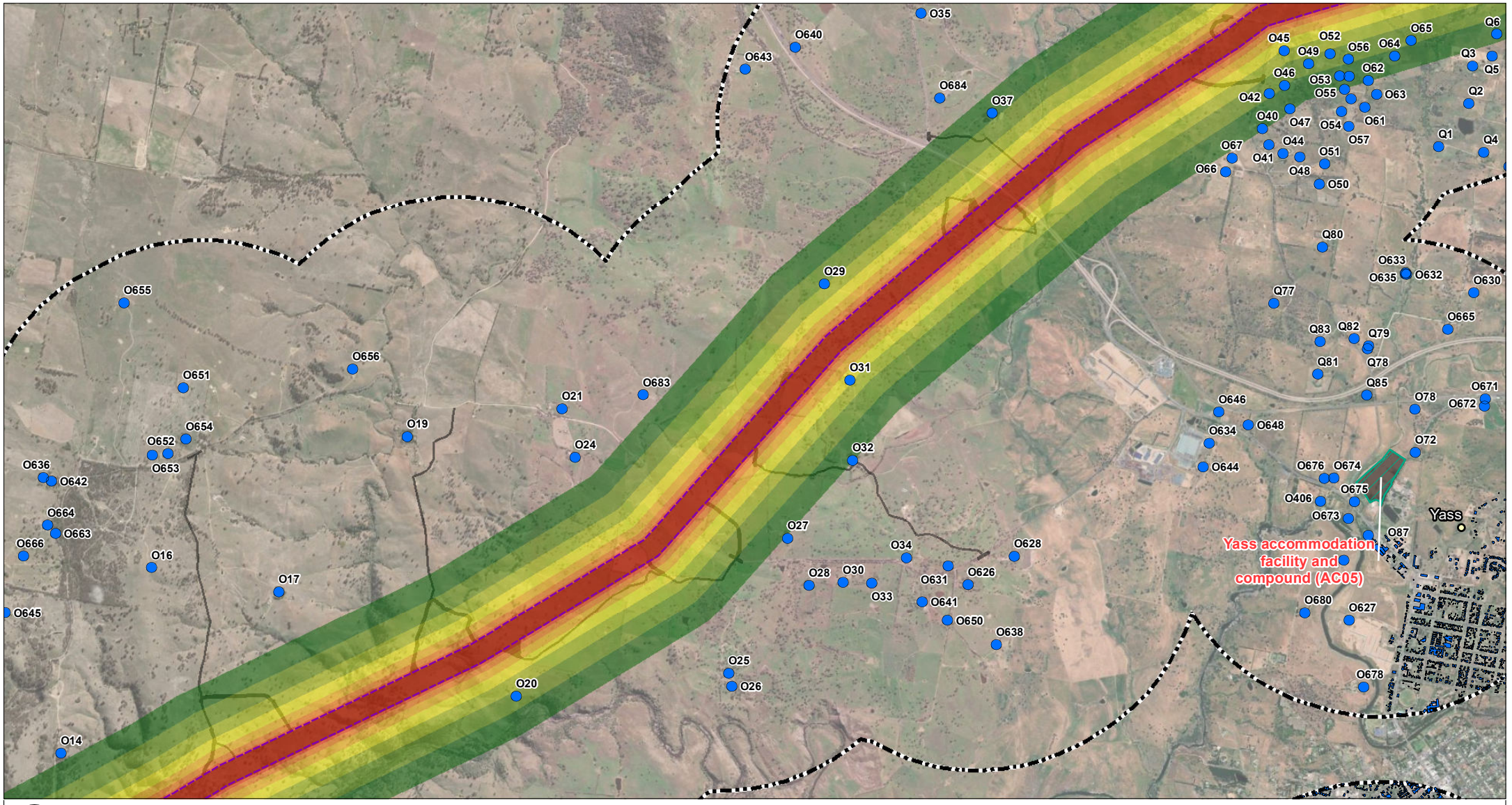

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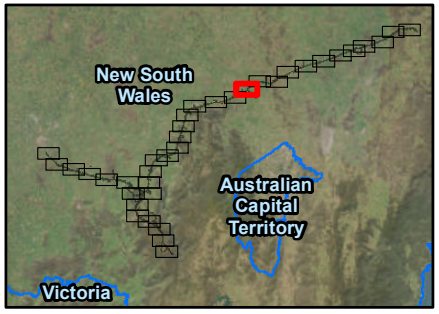

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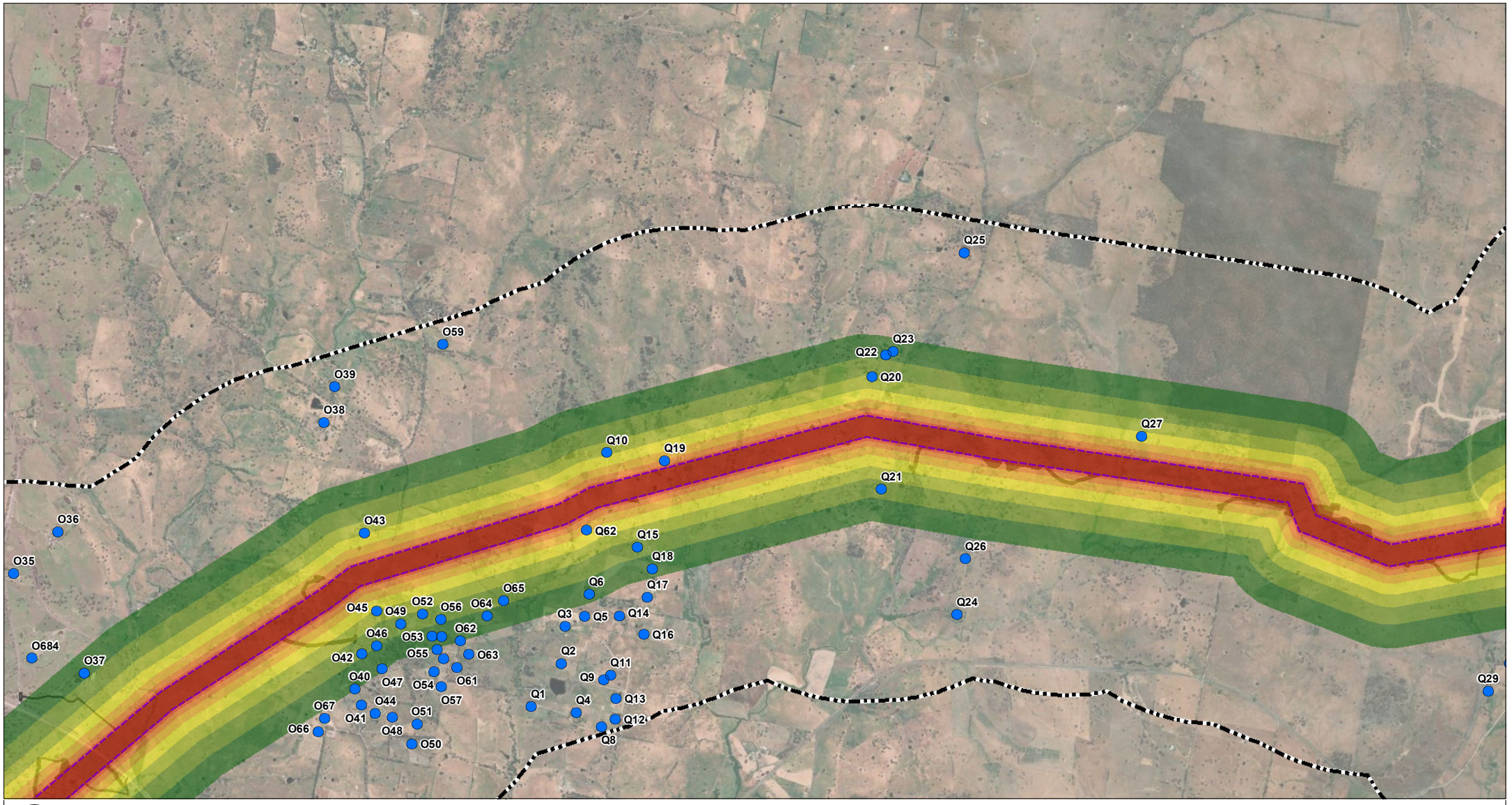

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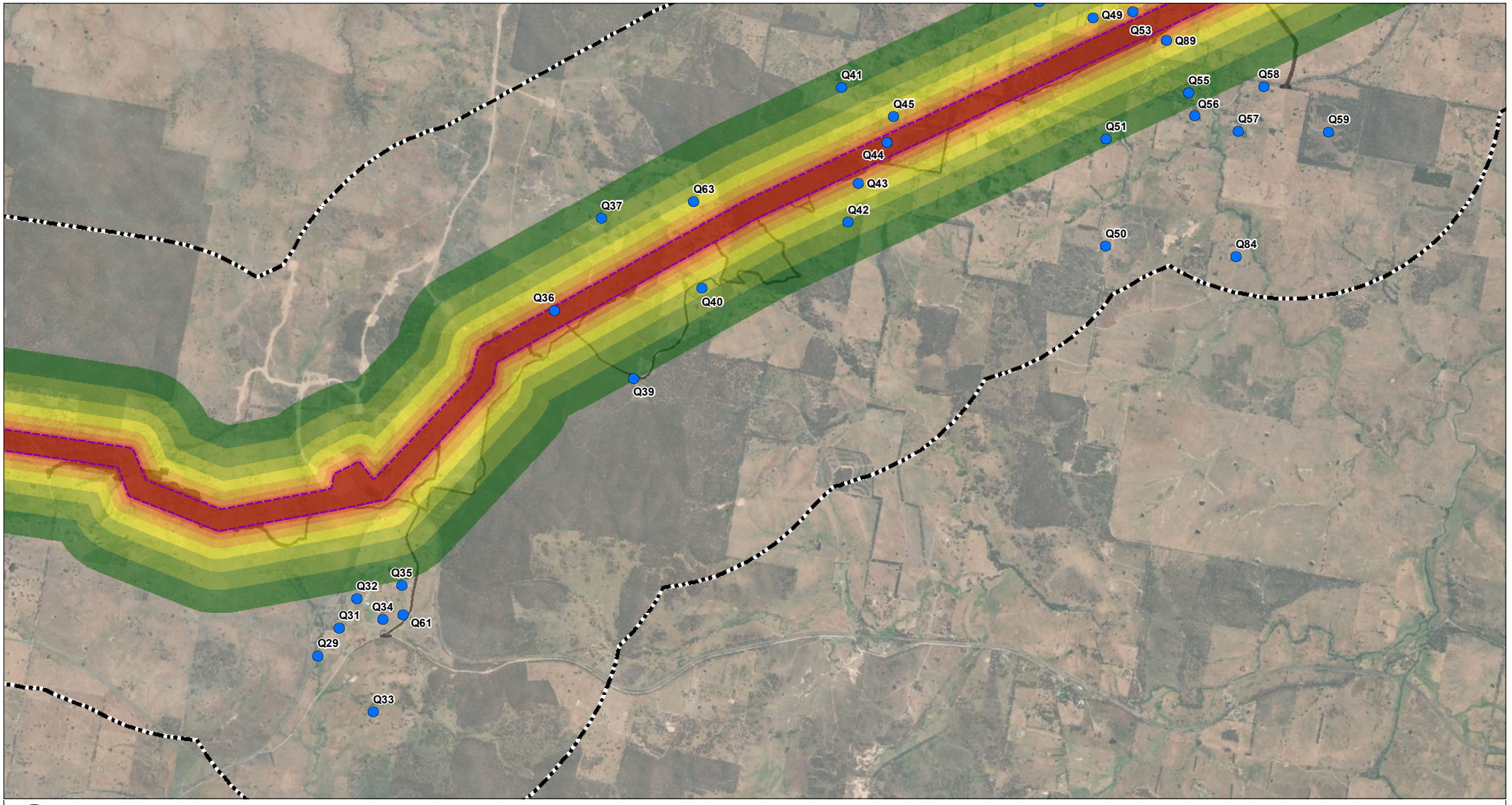

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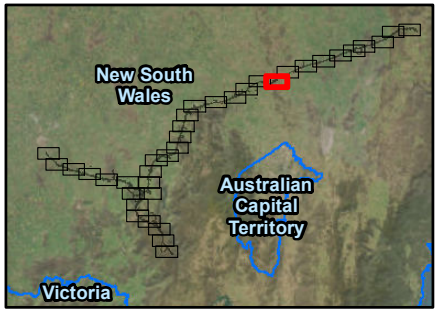
- 70 - 75 dBA
- 75 - 80 dBA
- 80 - 85 dBA
- 85 - 90 dBA
- >90 dBA

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Project corridor

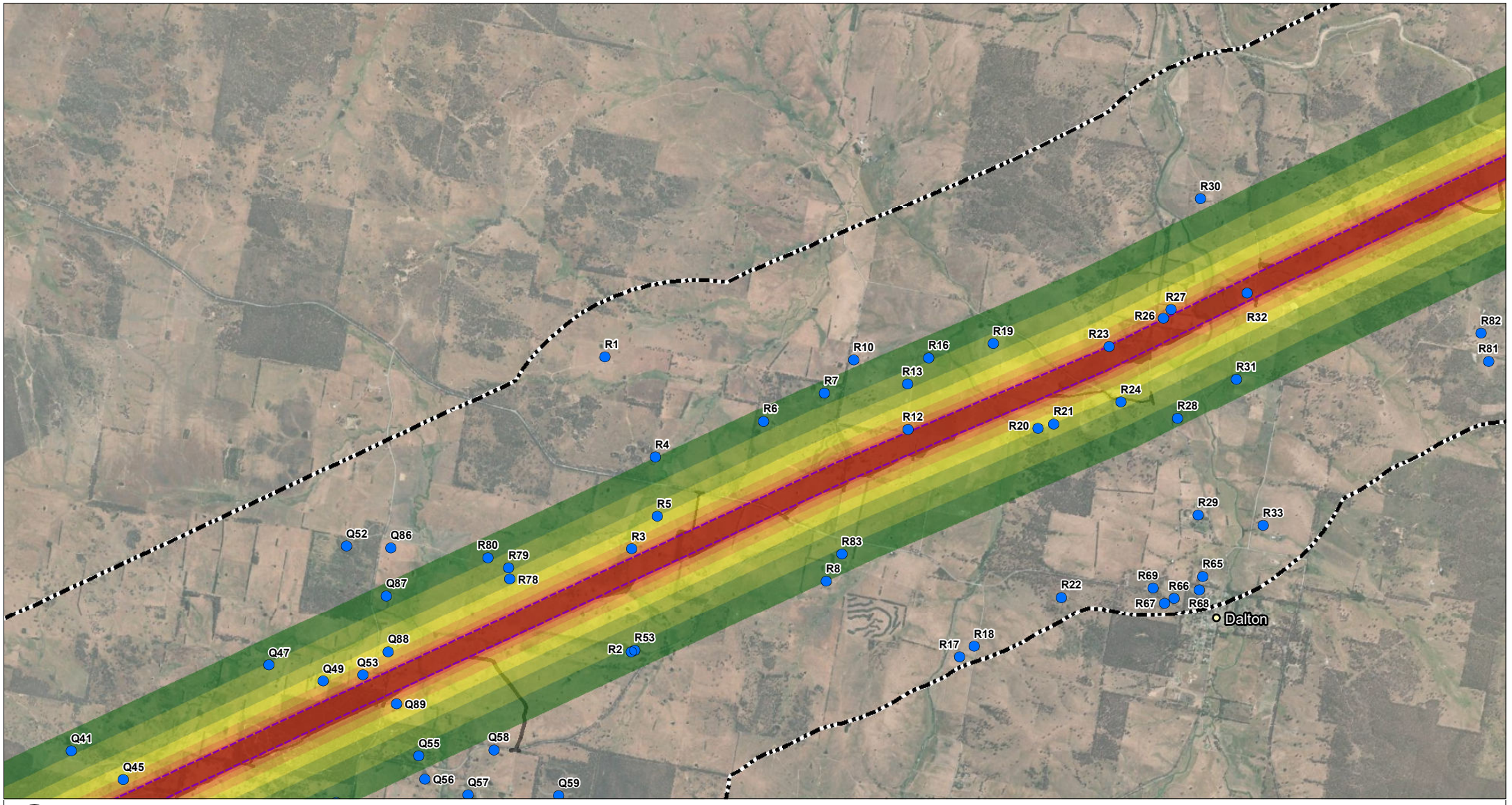


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.2

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I2_Helicopter noise from corridor work at 170ft.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

Population centre
Receiver
Existing substation fence line
Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
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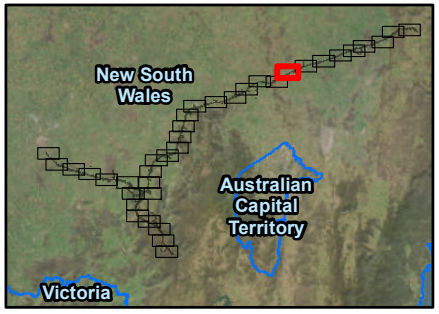

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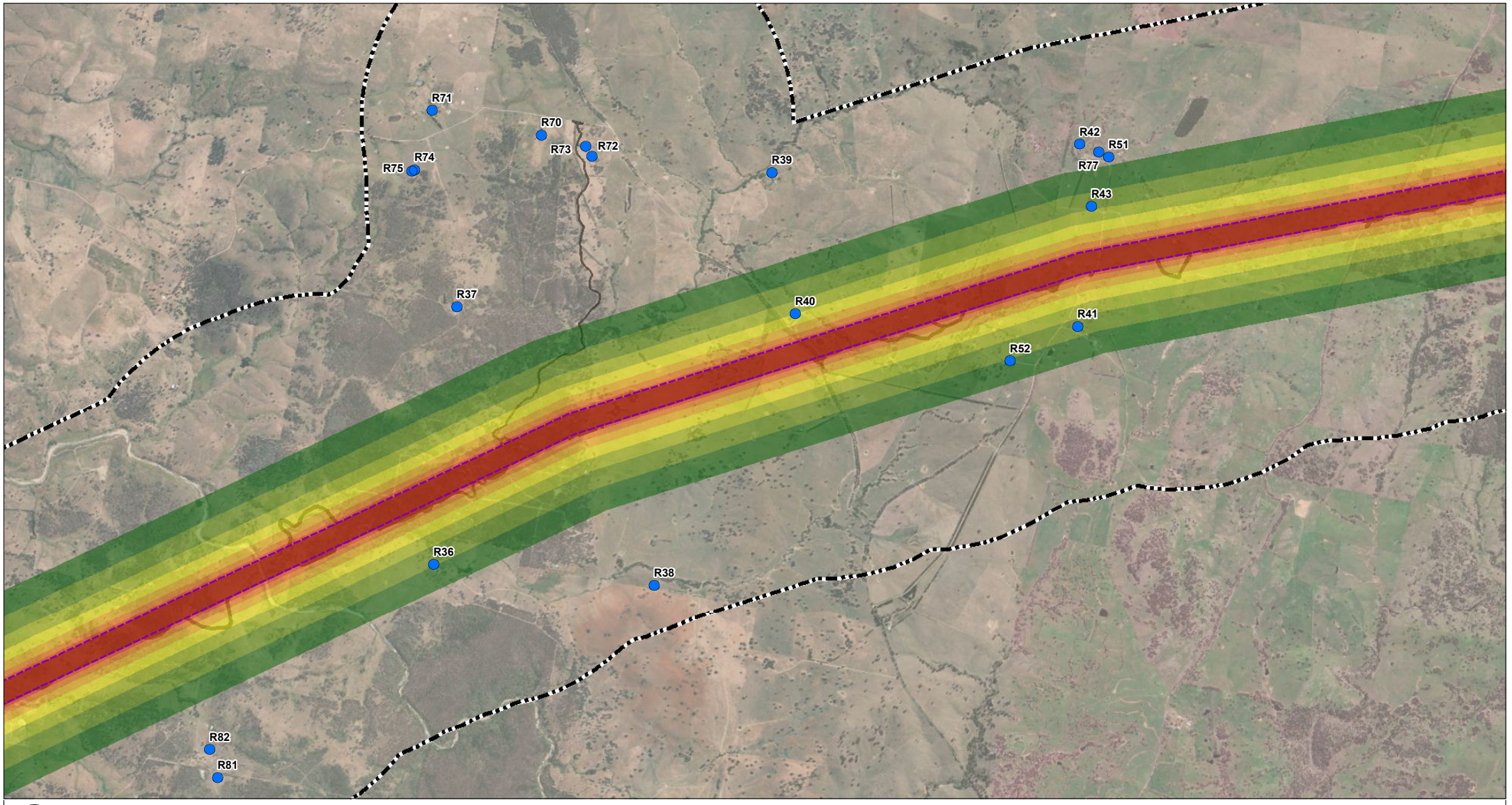

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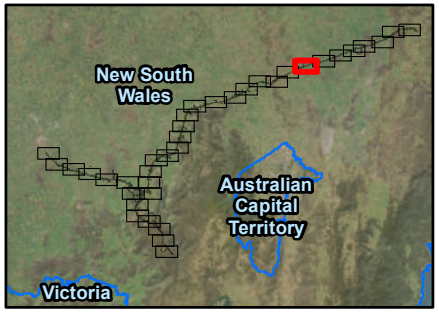

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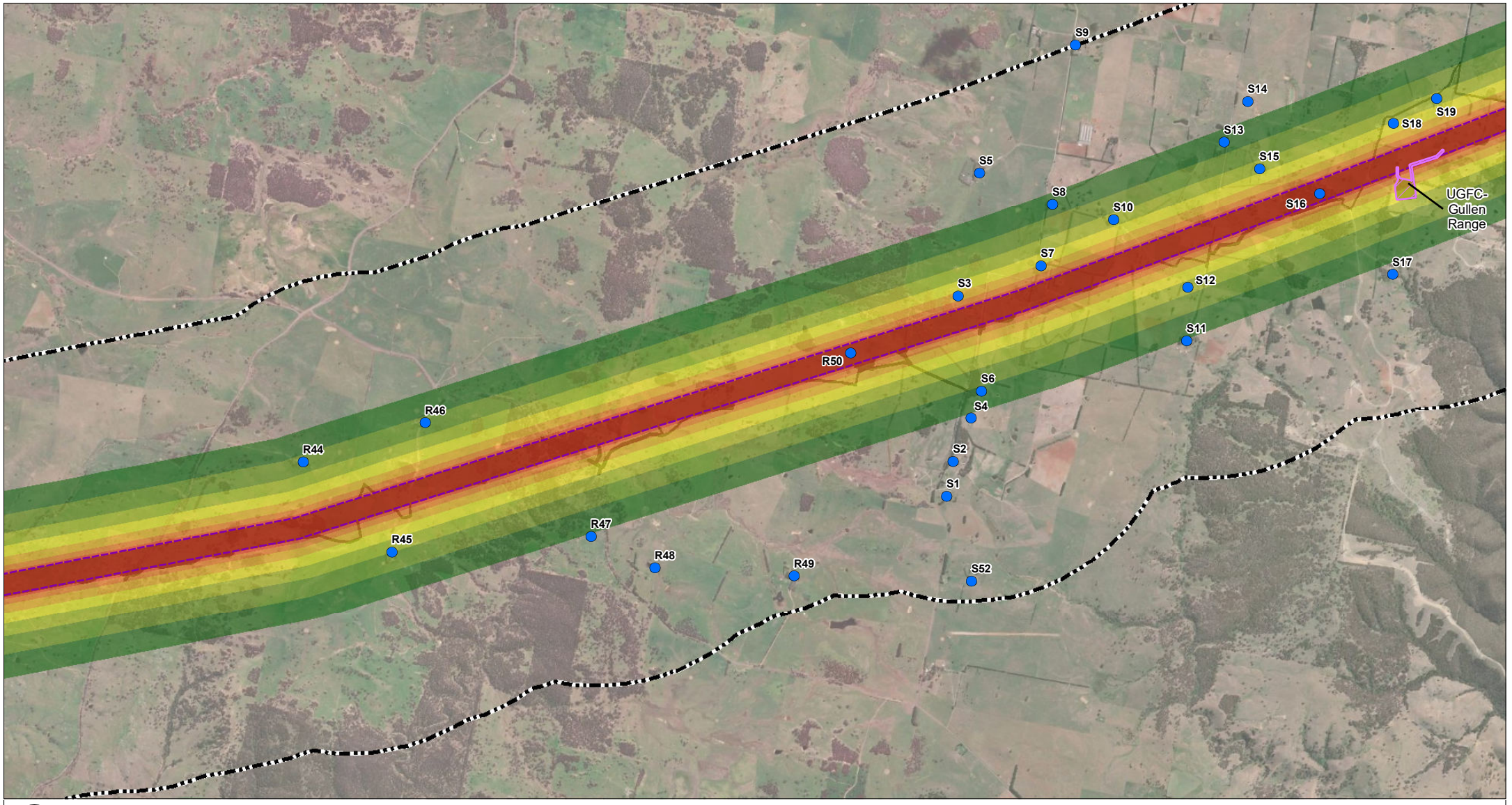

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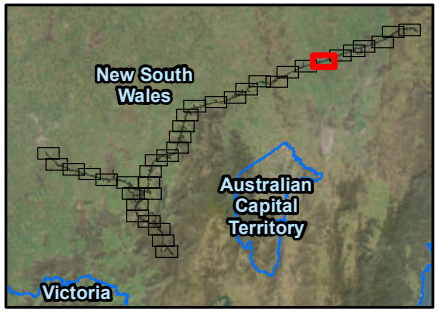

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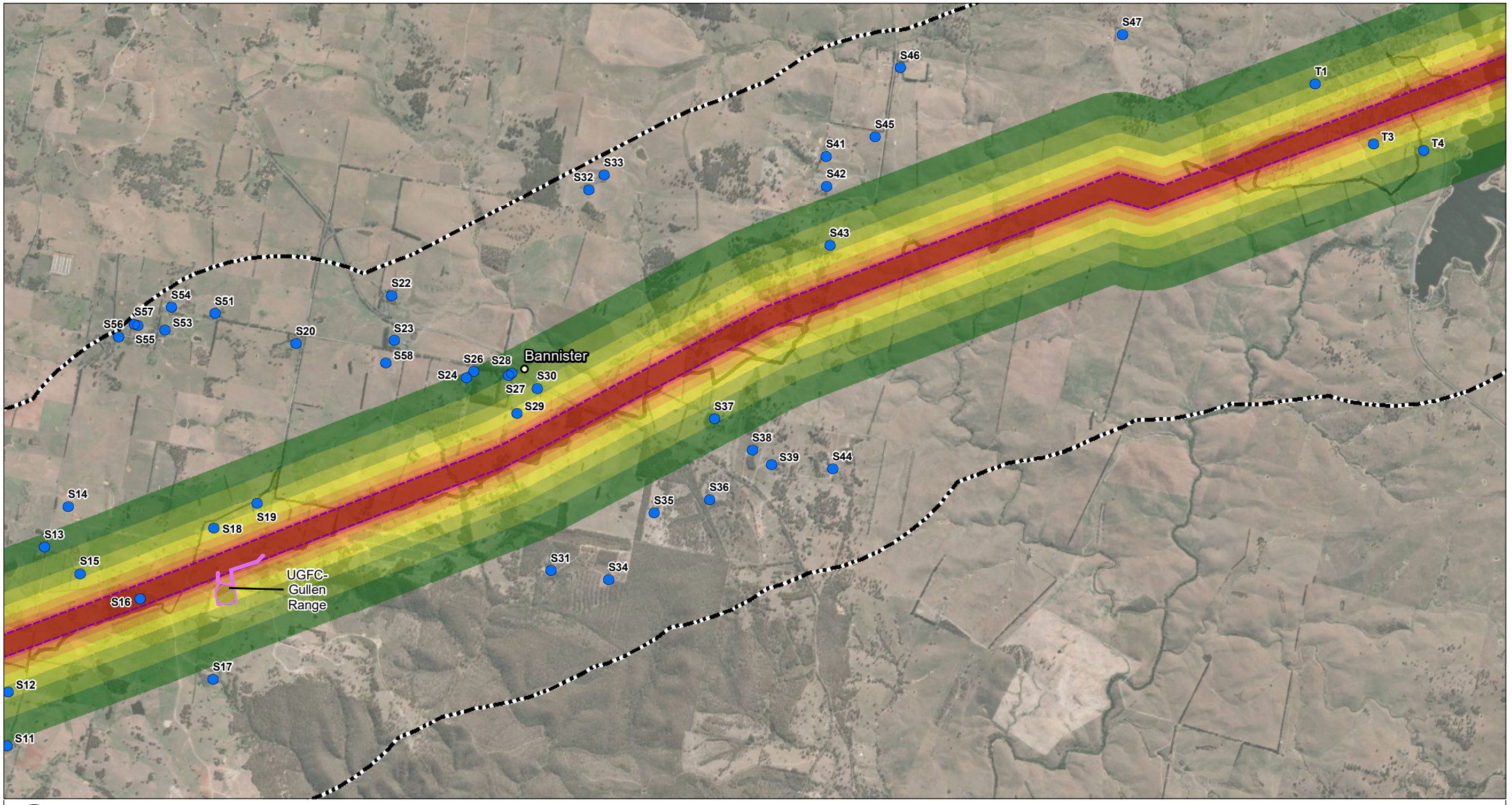

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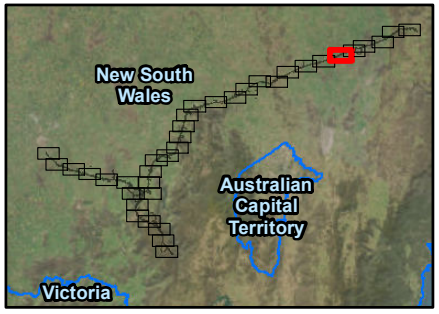

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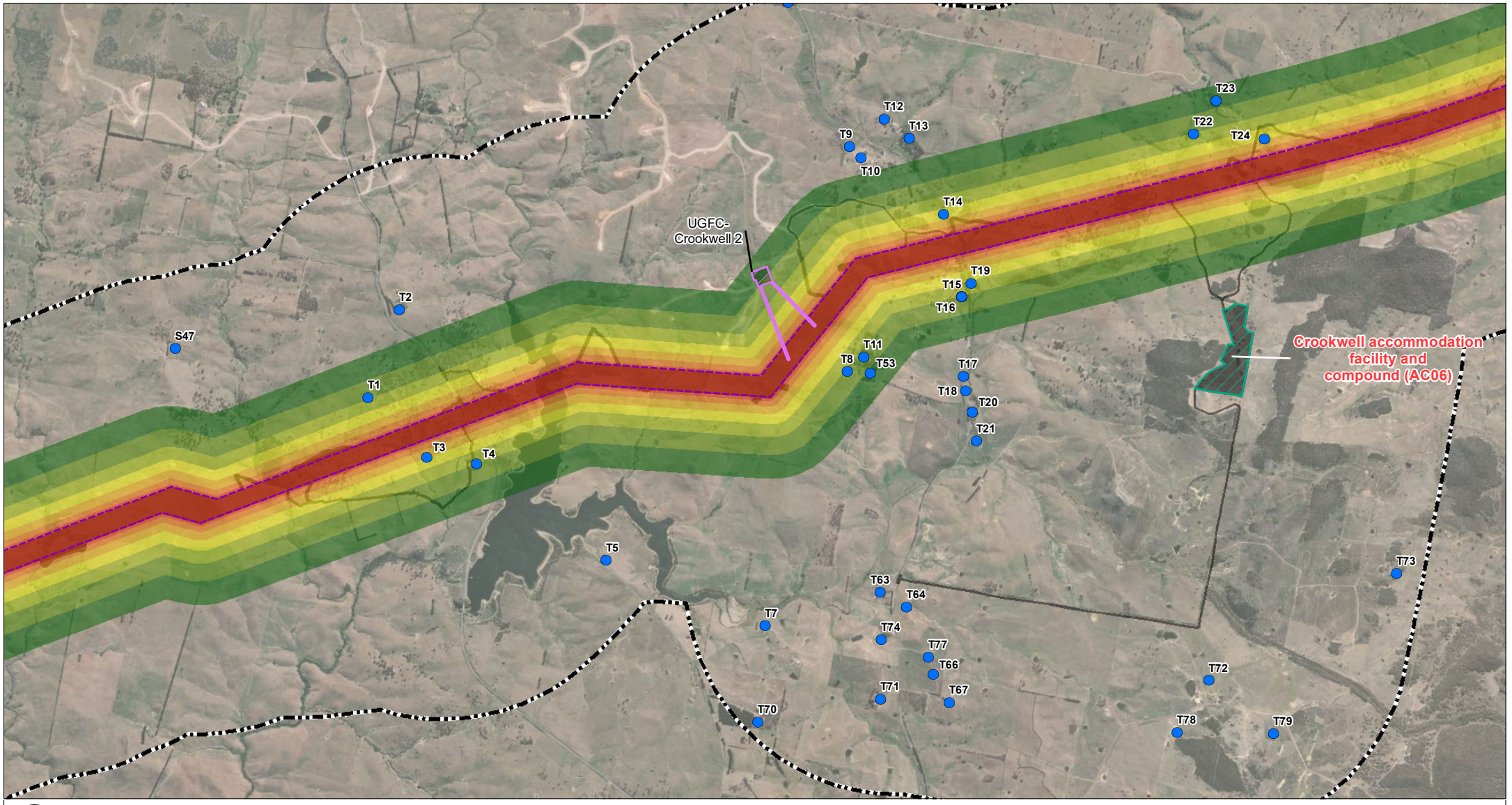

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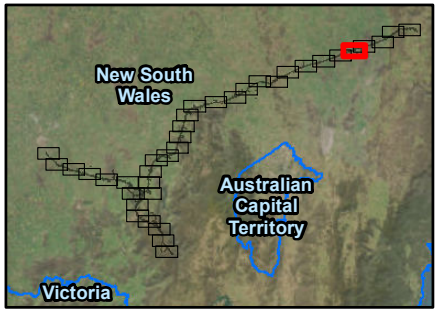

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NOISE AND VIBRATION IMPACT ASSESSMENT

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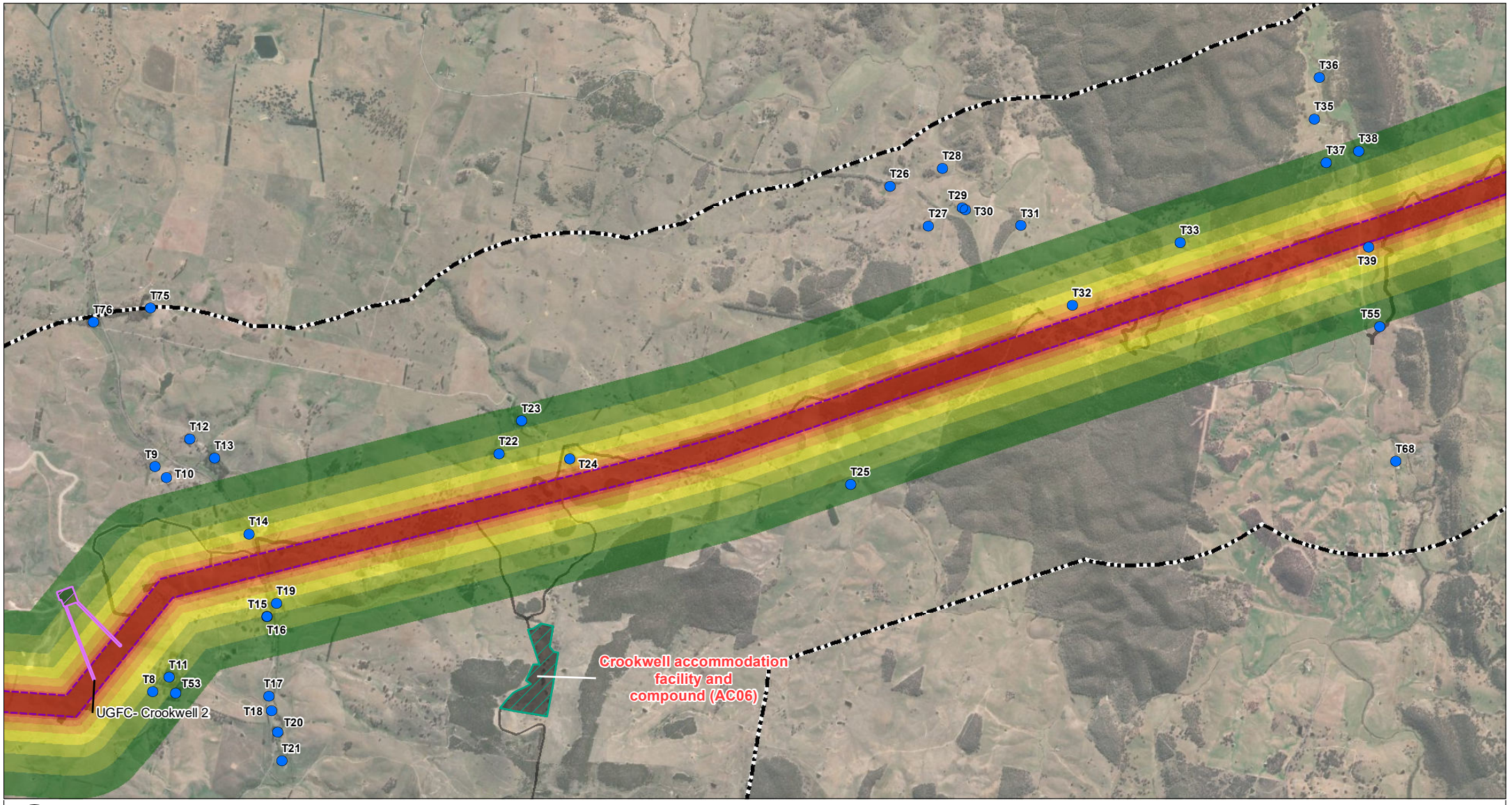

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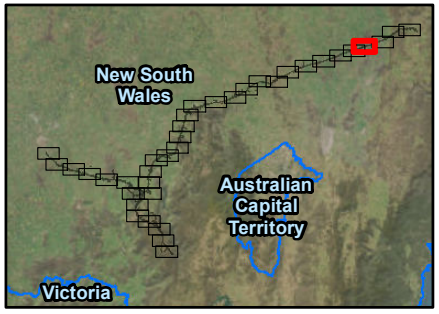

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NOISE AND VIBRATION IMPACT ASSESSMENT

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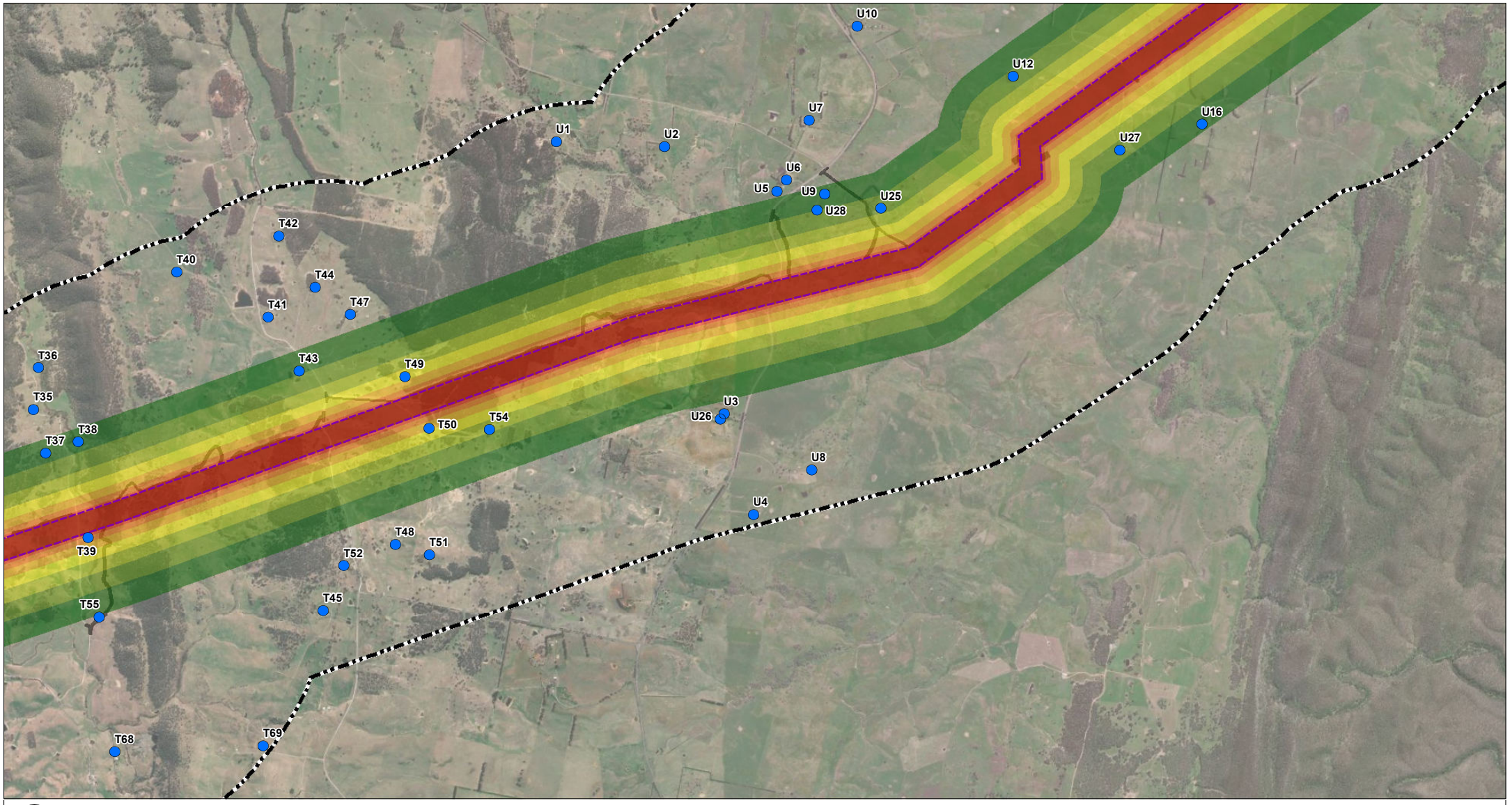

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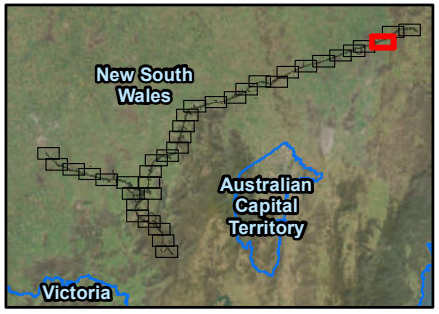

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NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

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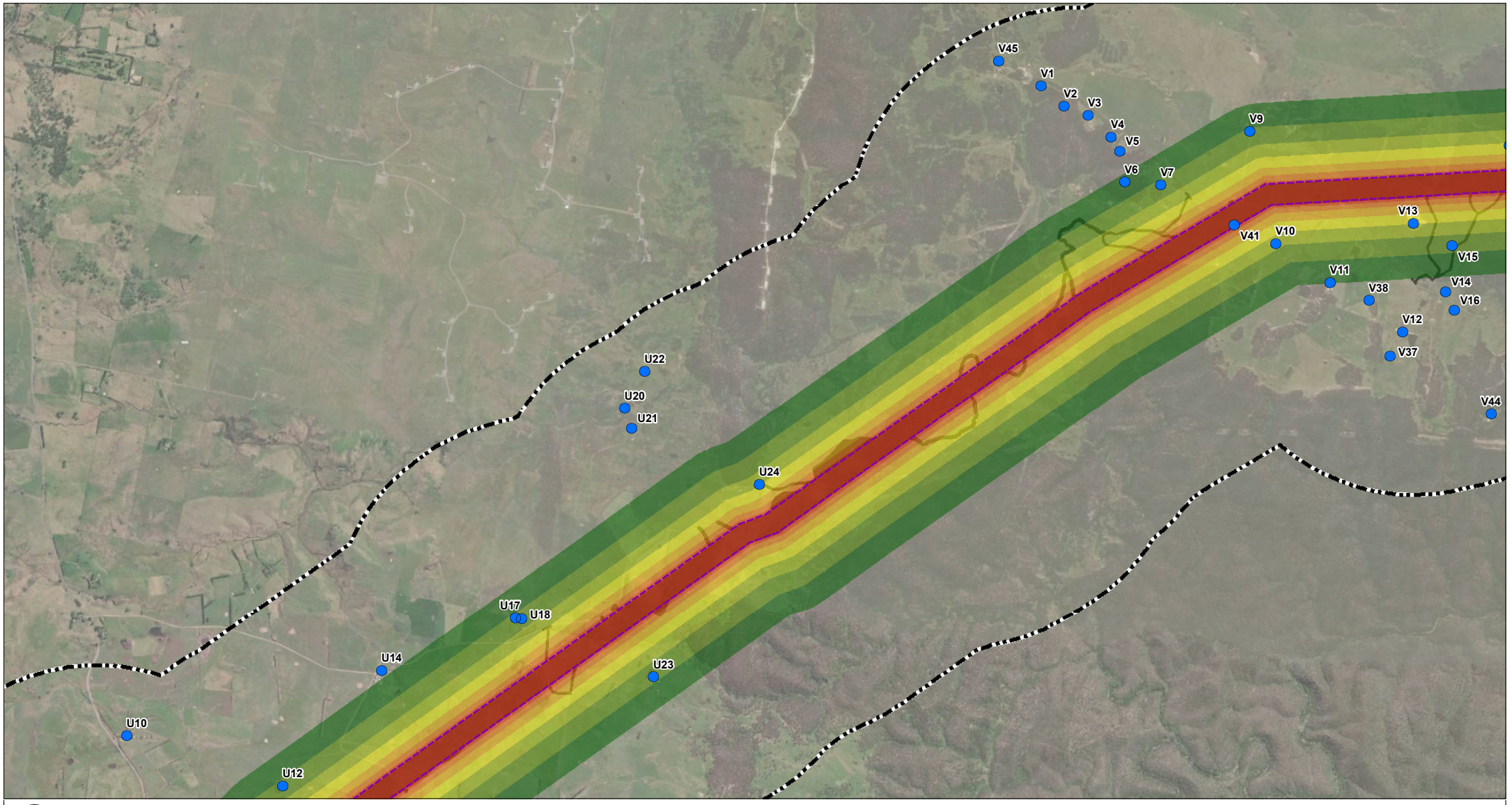

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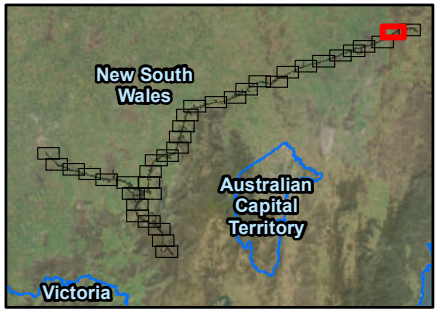

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

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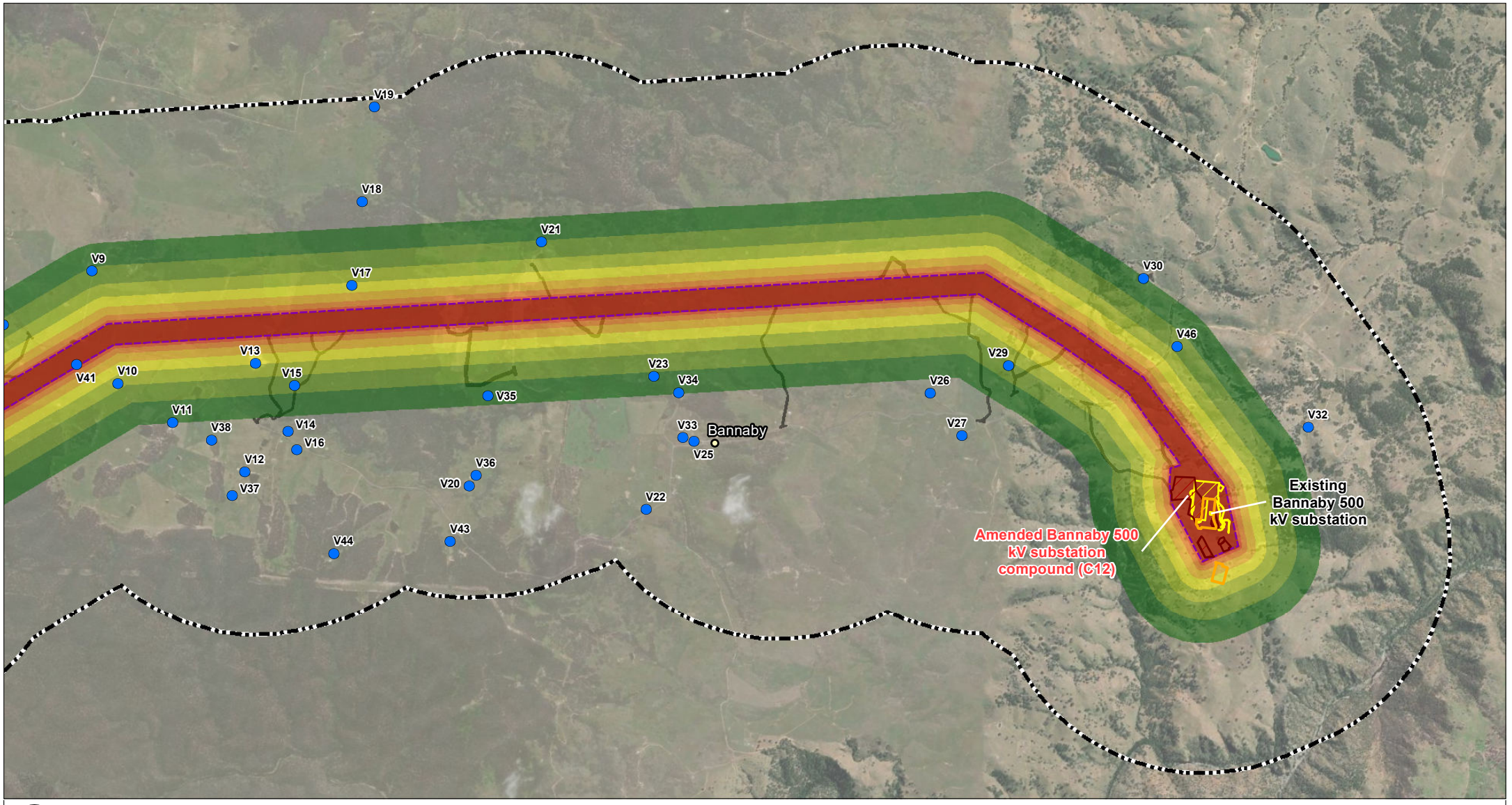

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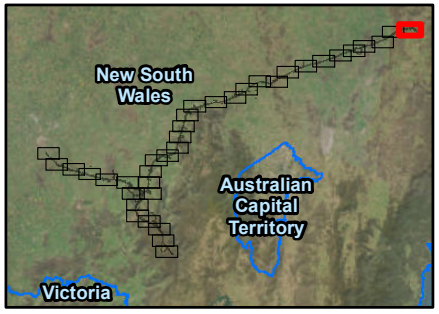

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

HELICOPTER NOISE FROM CORRIDOR WORK AT 170FT

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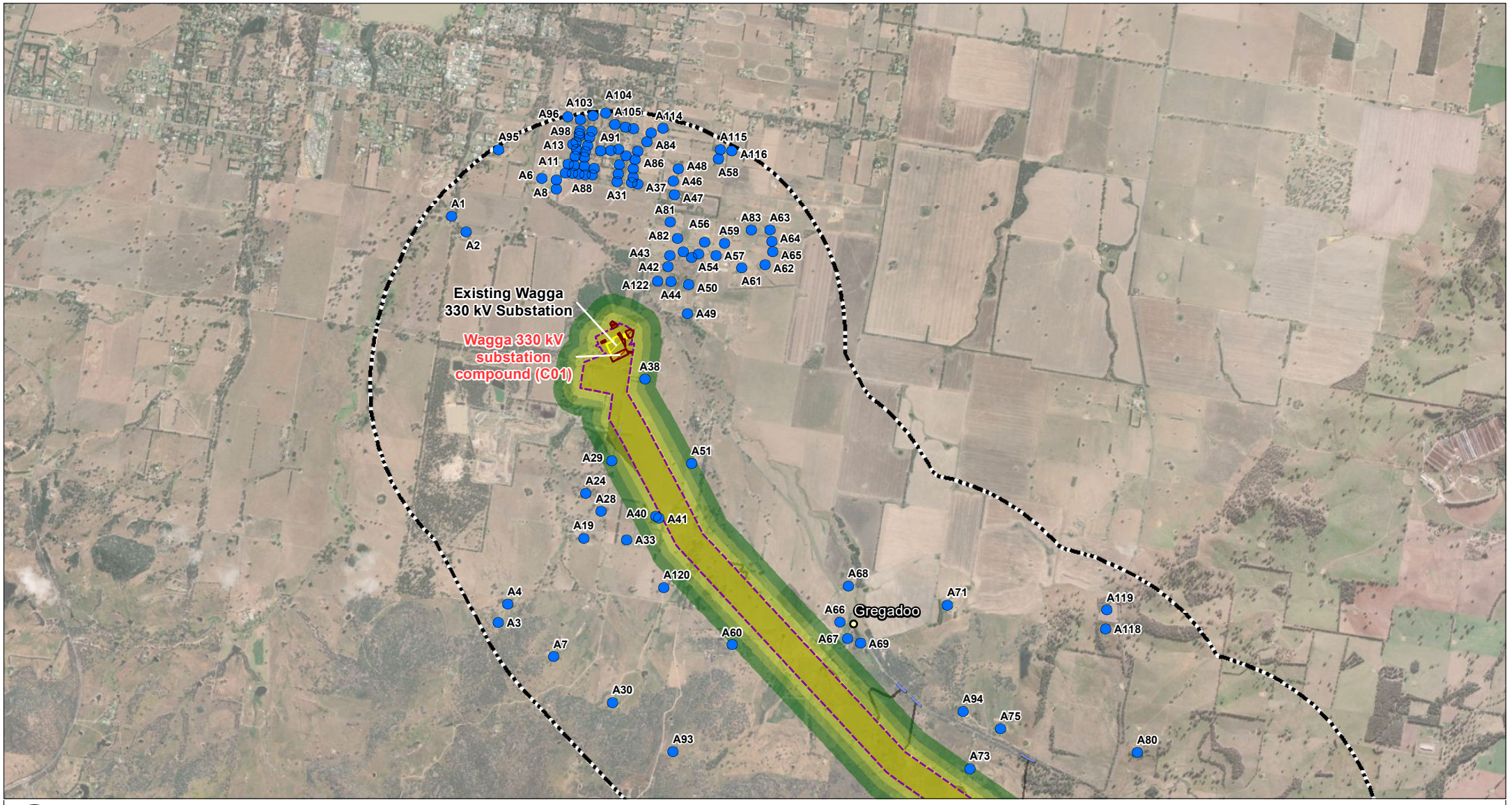

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SLR

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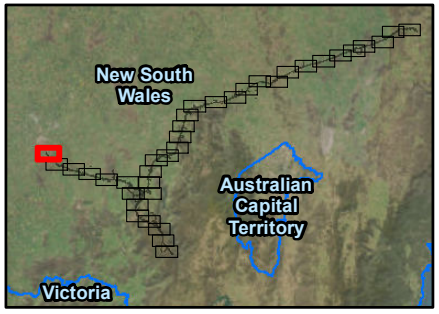
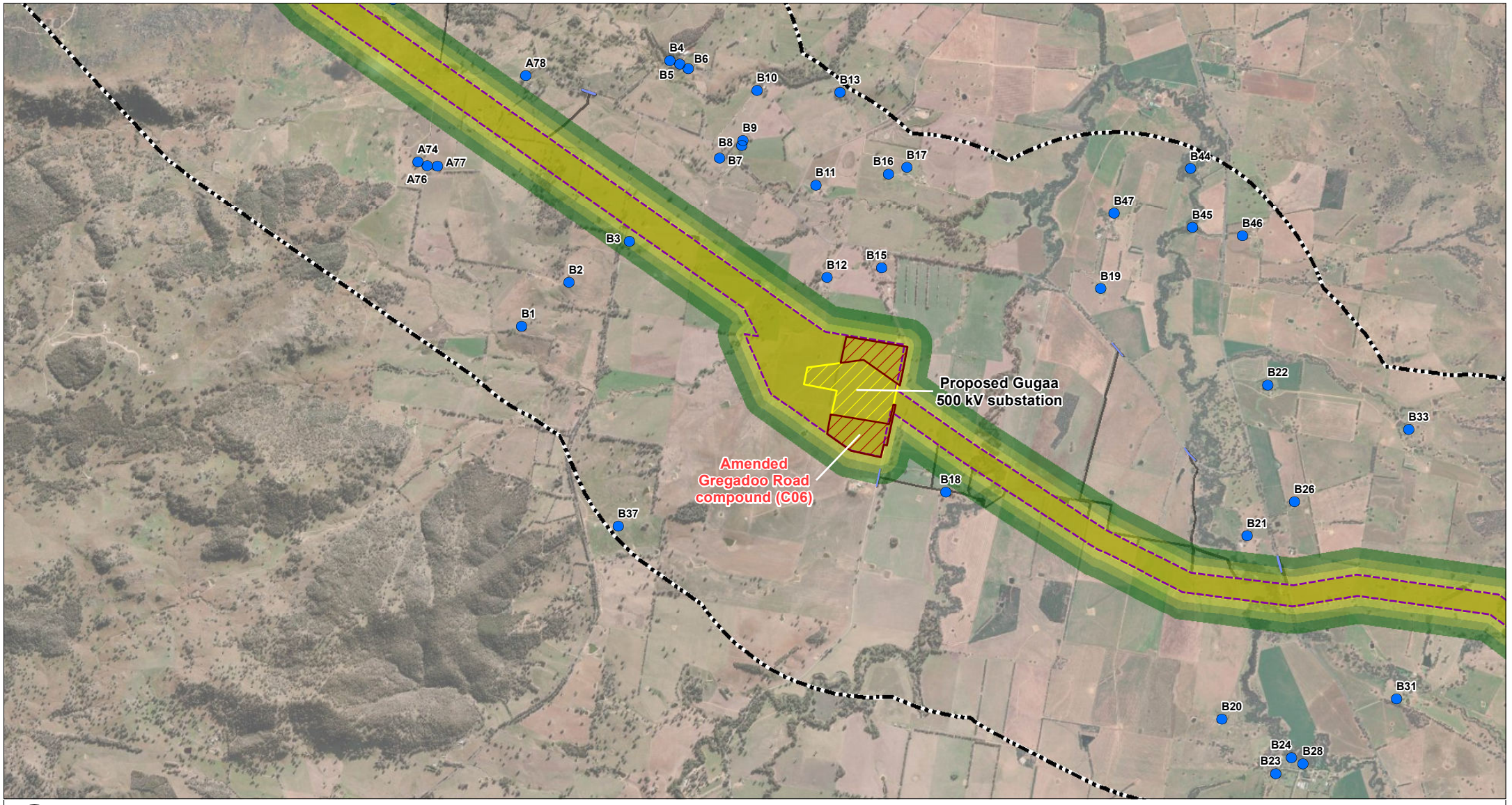


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

DRONE NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I3_Drone noise from corridor work at 170ft.mxd



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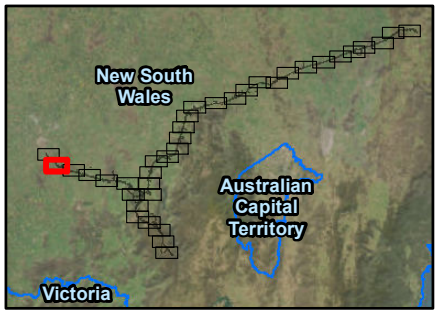
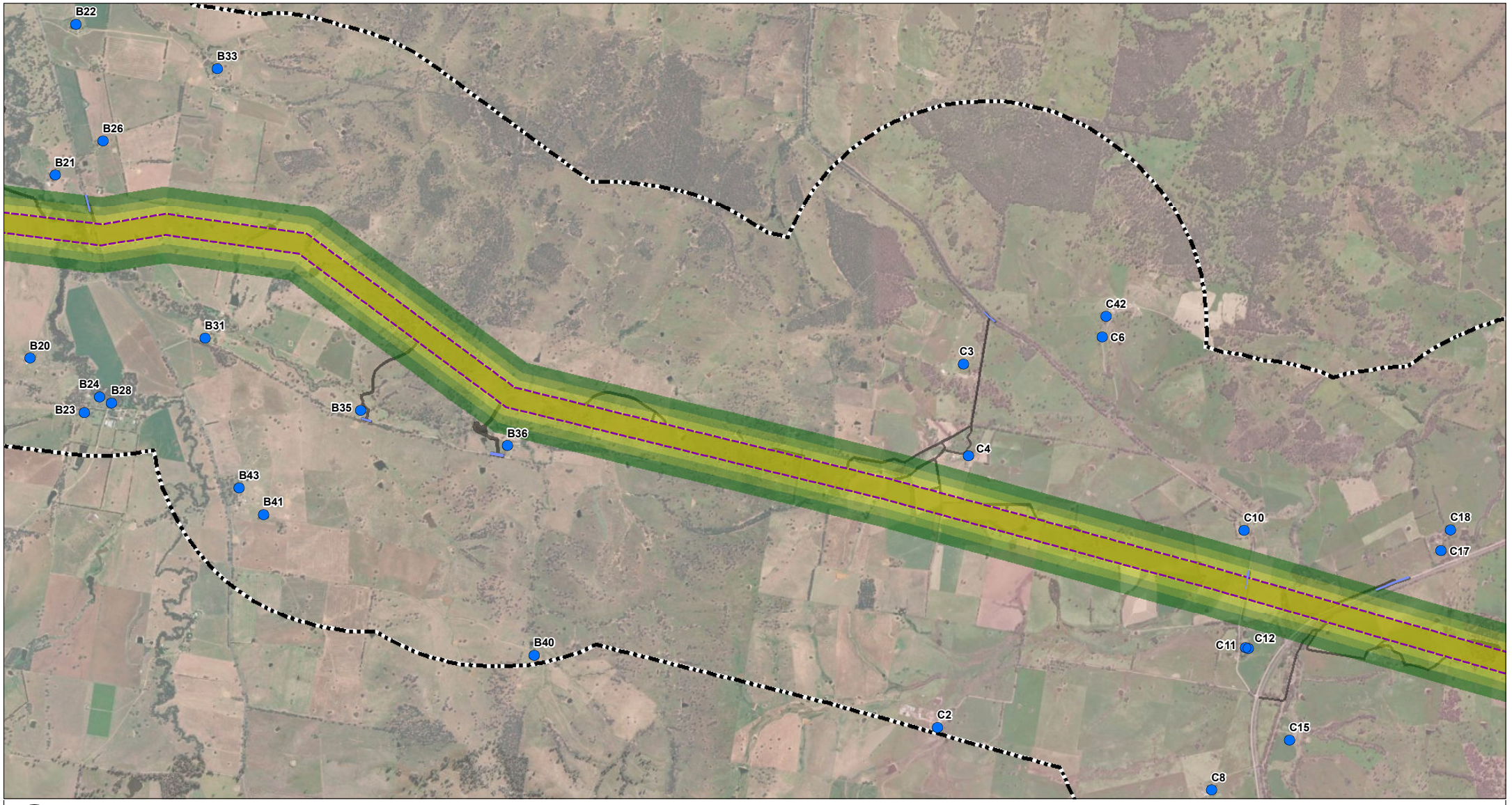


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

DRONE NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.3



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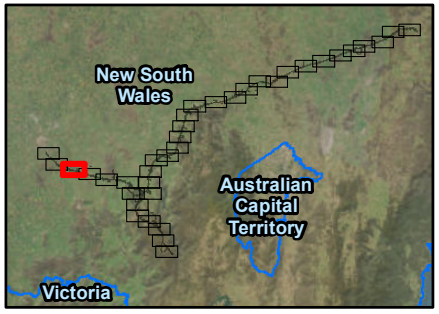

HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

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ATTACHMENT I.3

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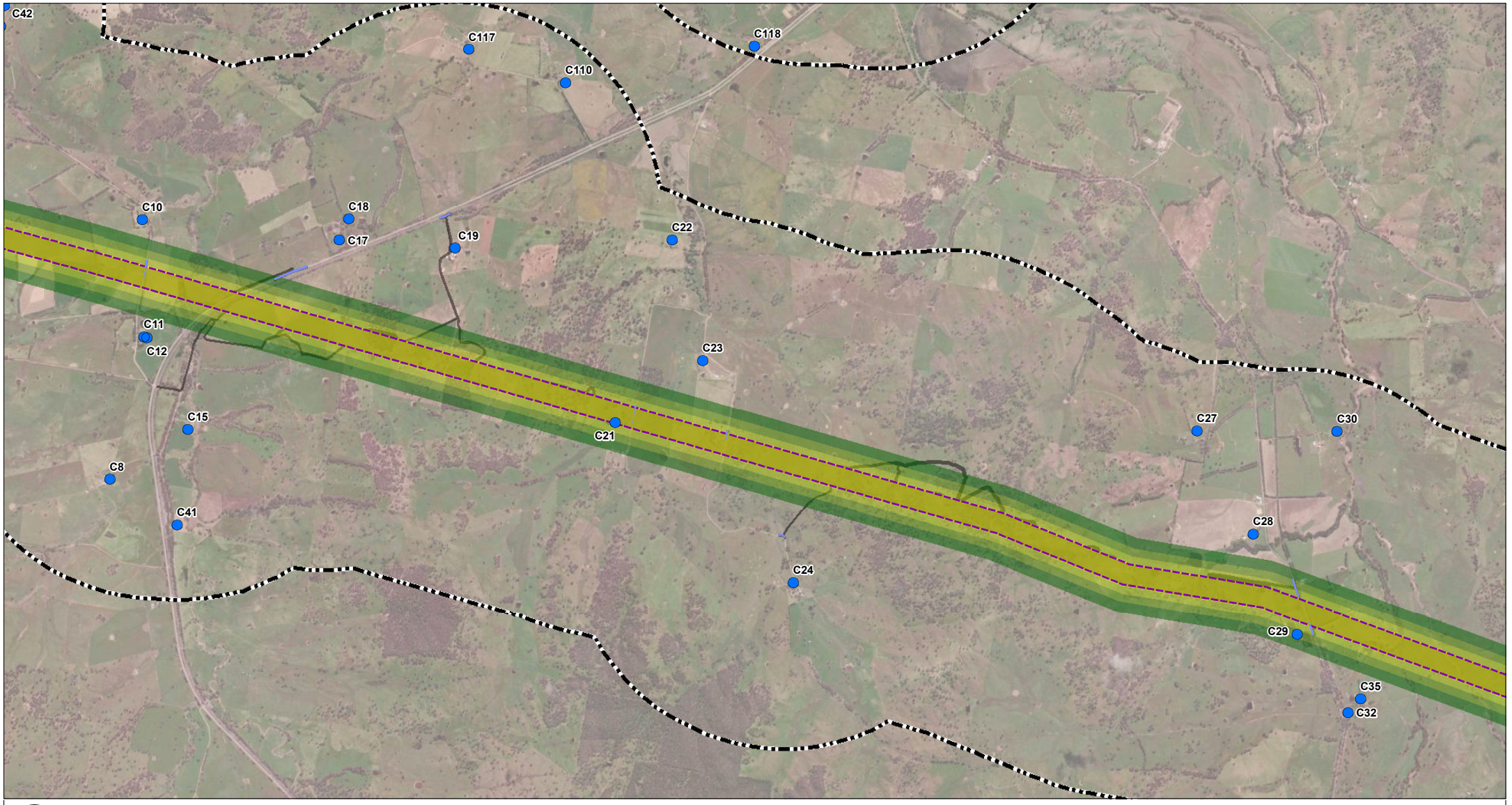

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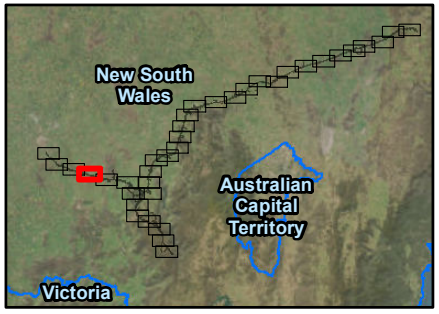

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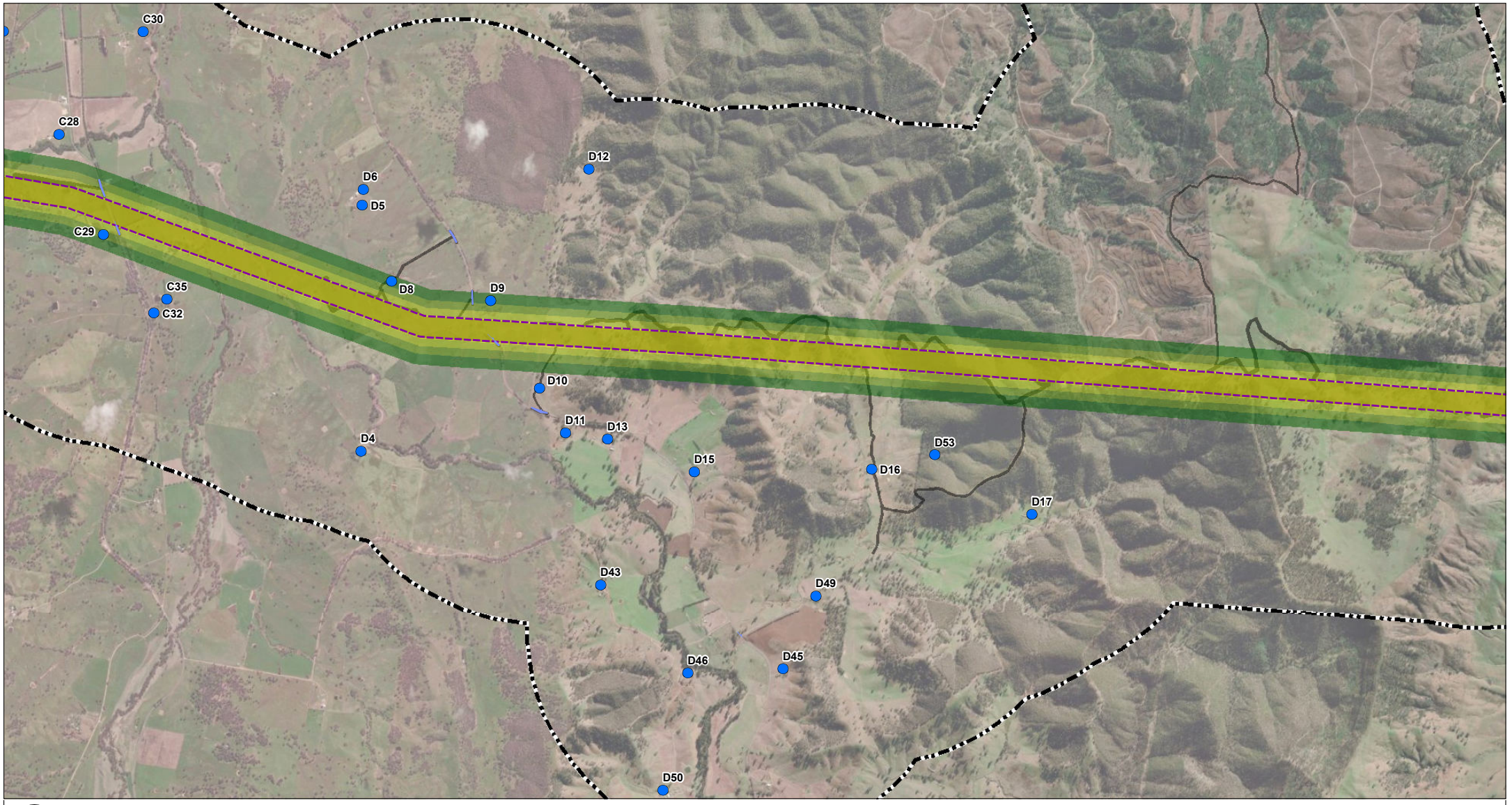

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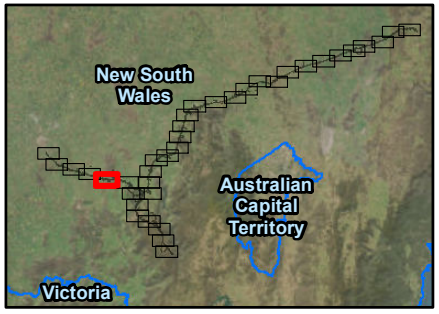
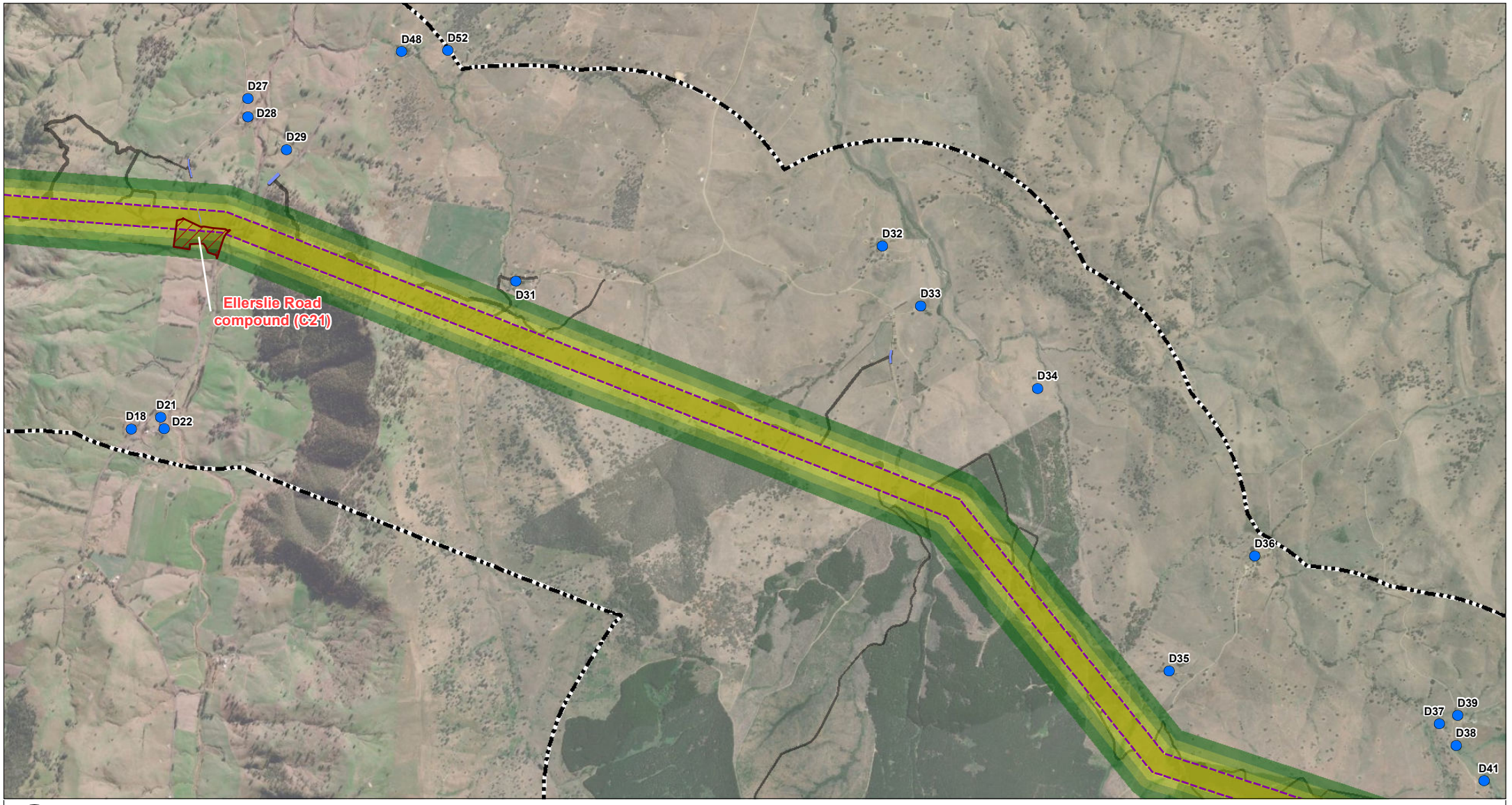


HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

DRONE NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I3_Drone noise from corridor work at 170ft.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
- Receiver
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- Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
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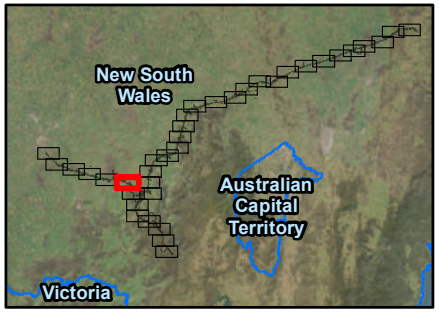

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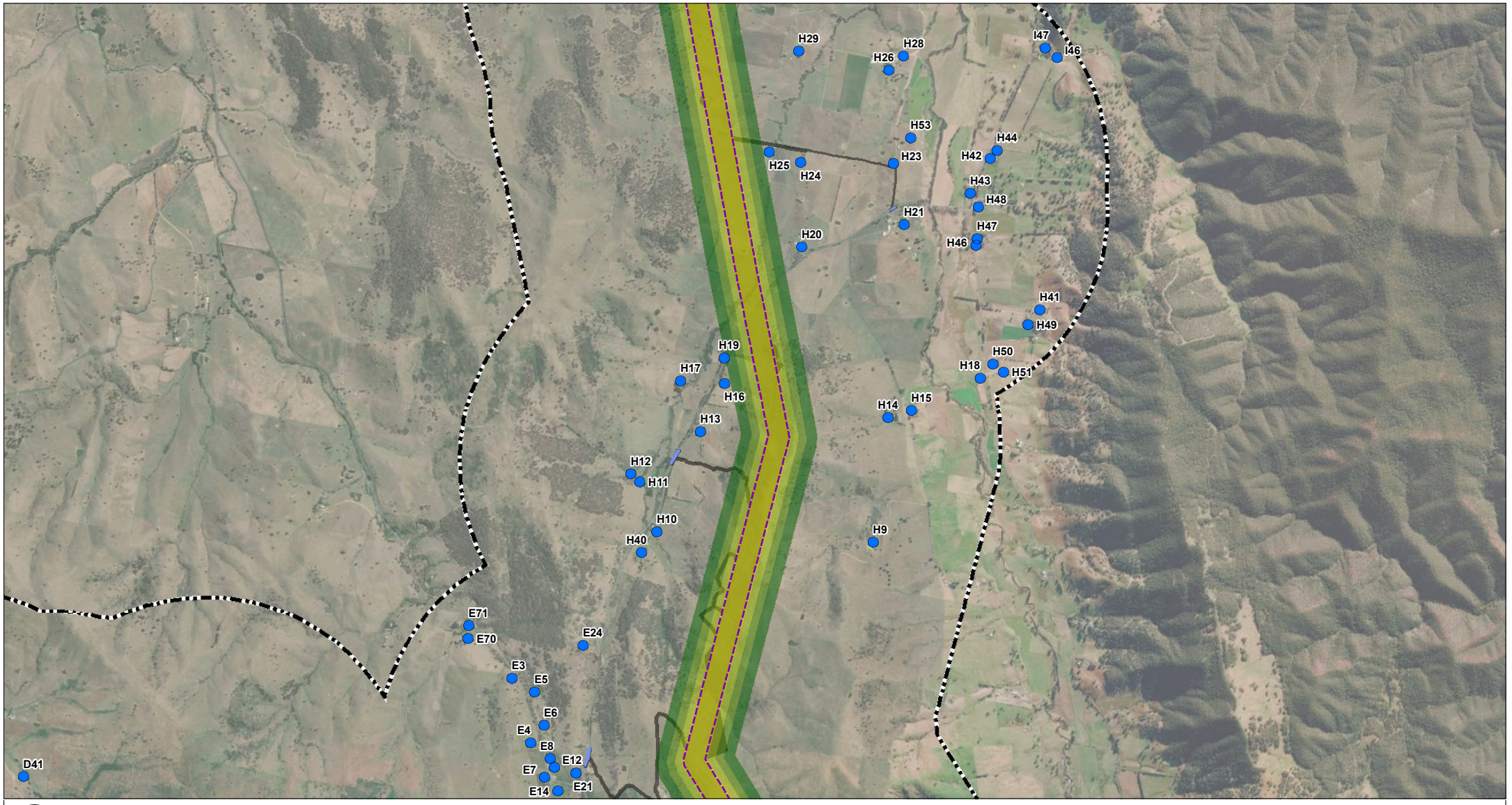

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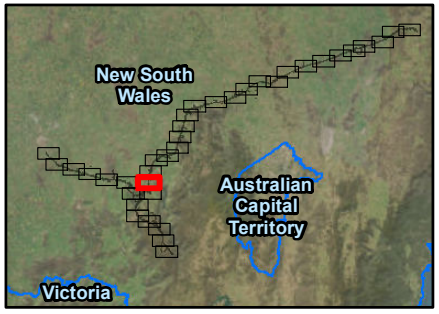

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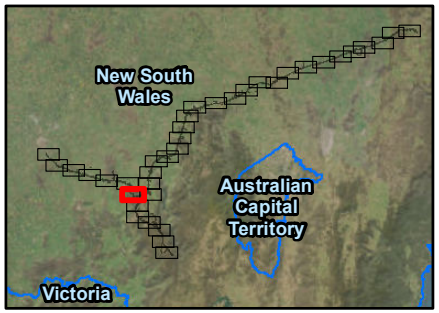

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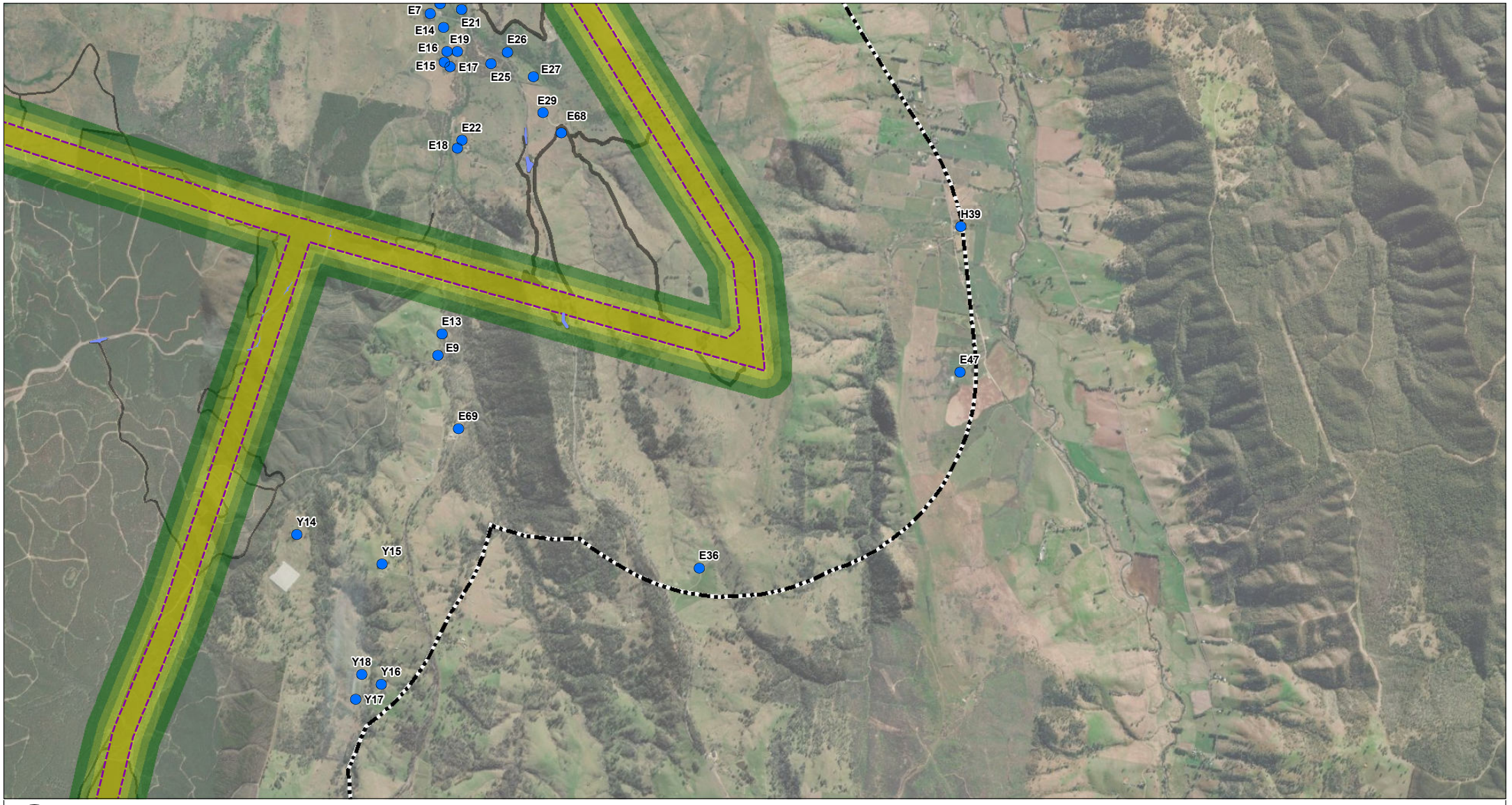

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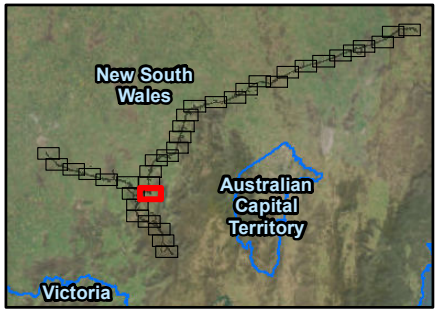

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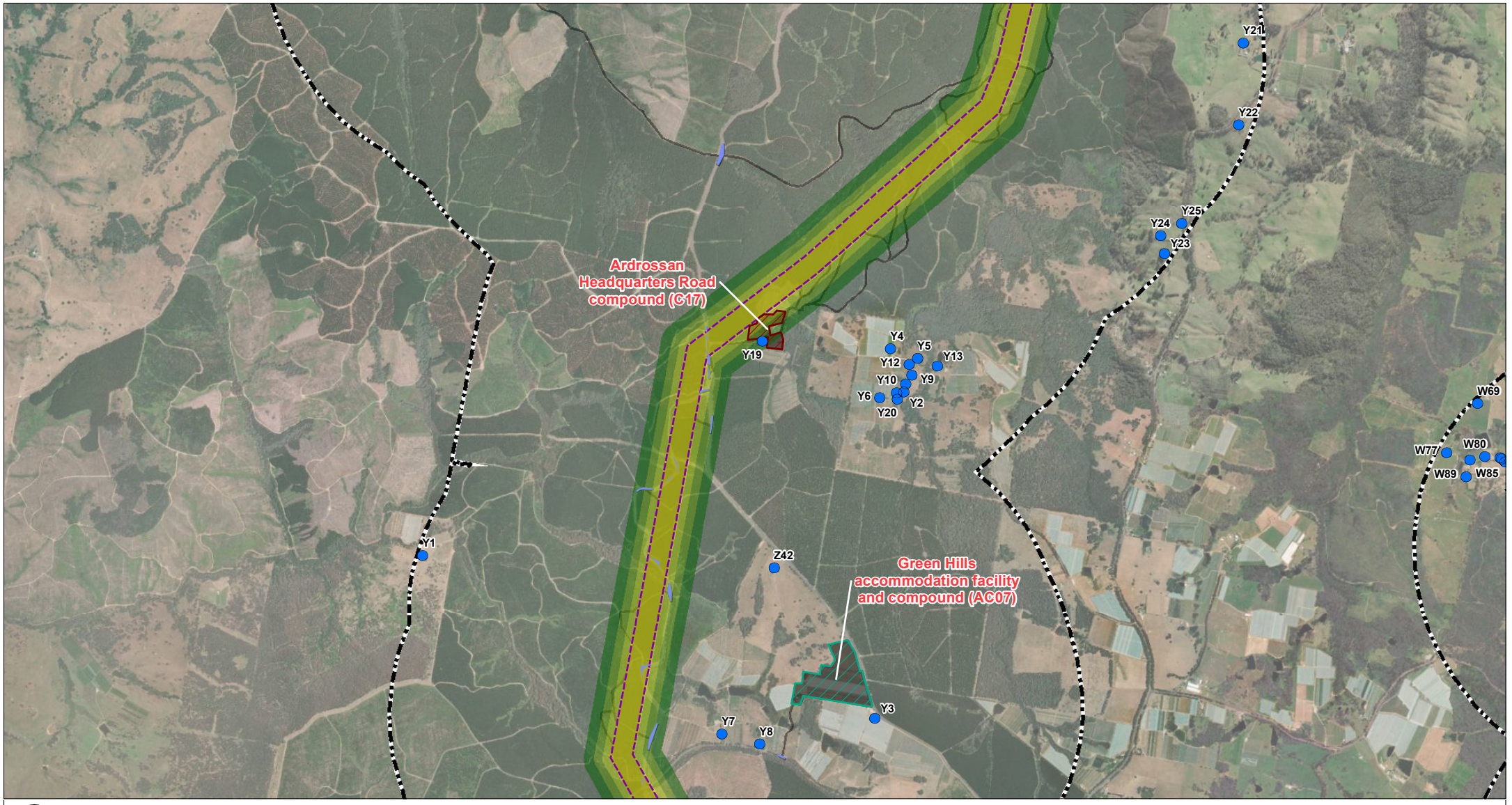

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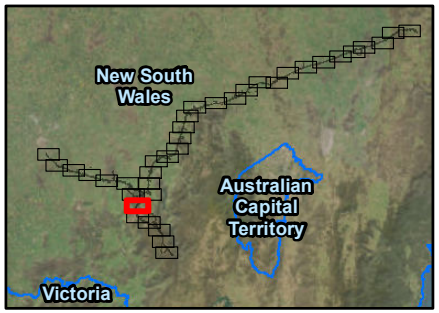

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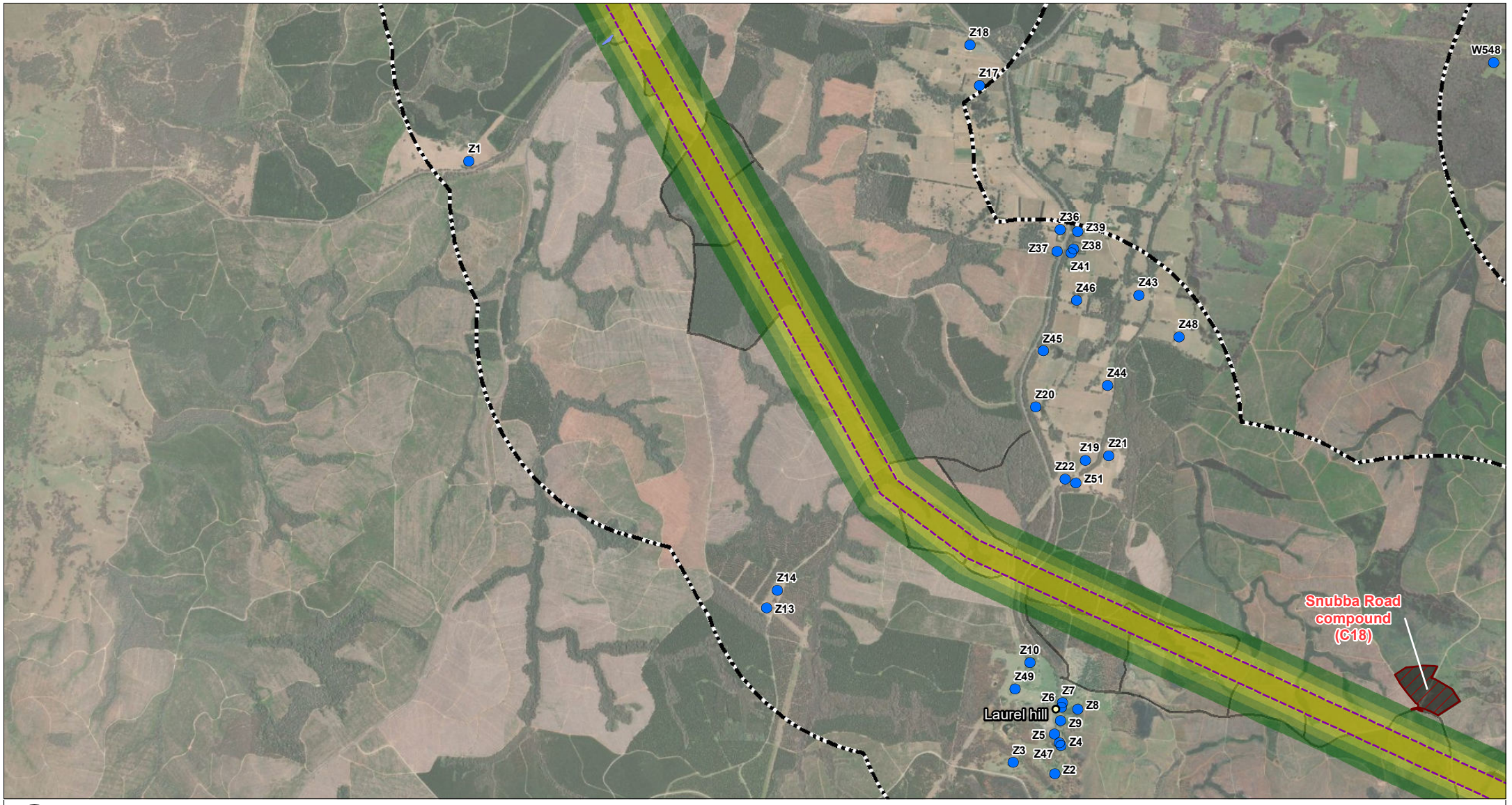

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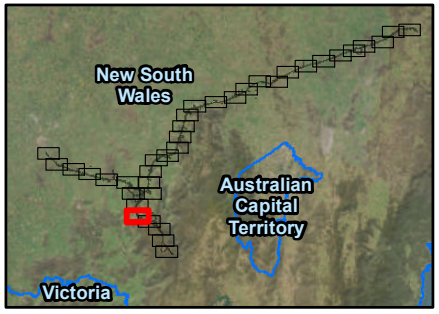

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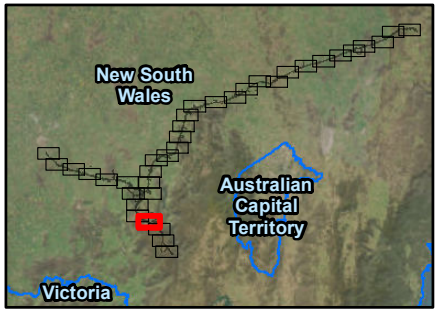

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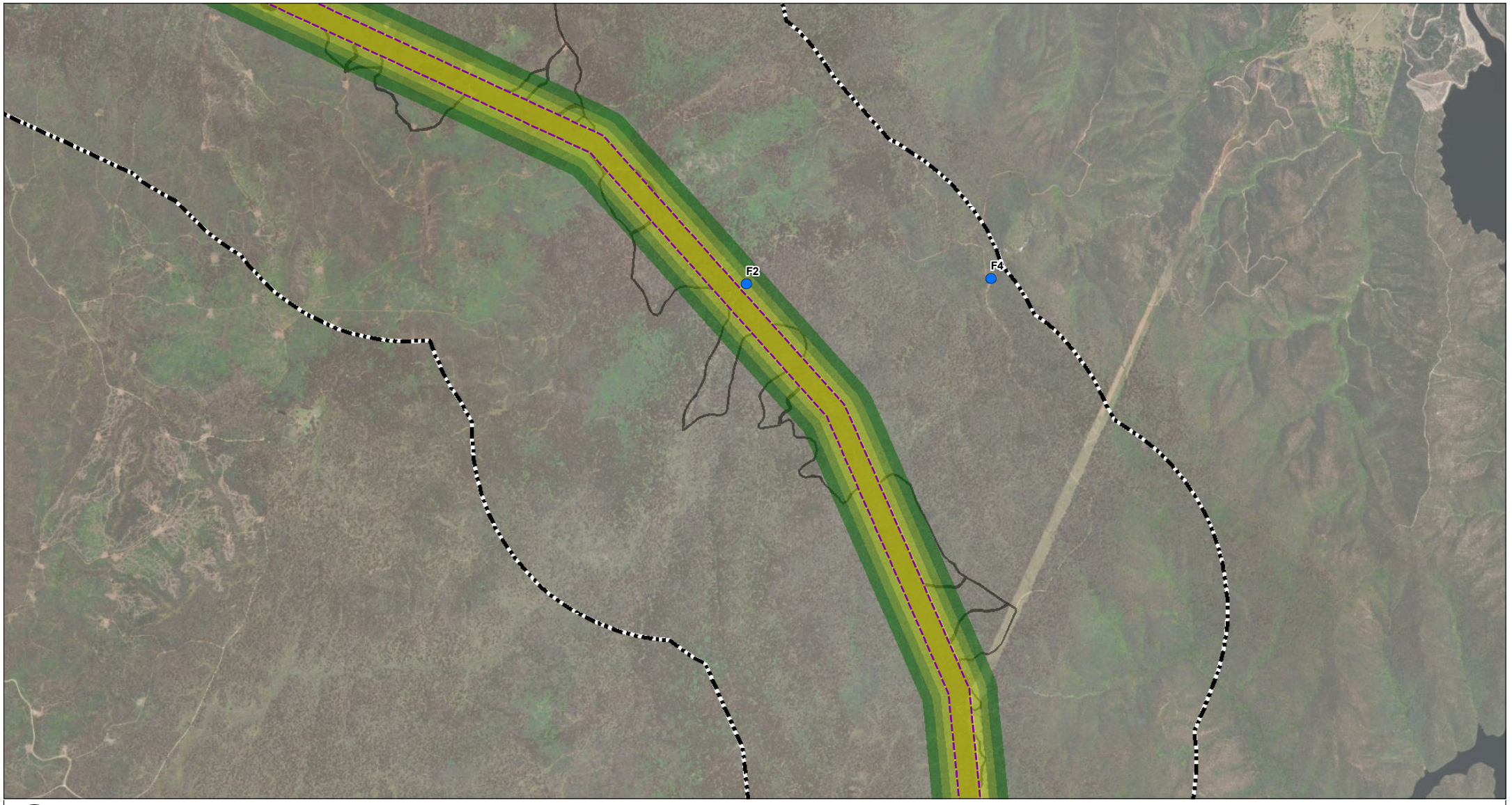

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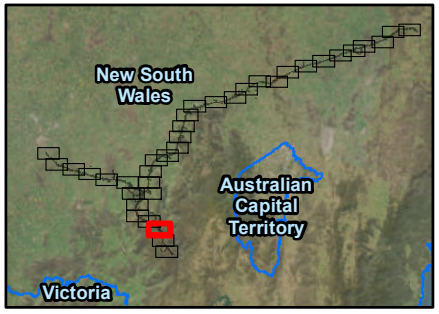

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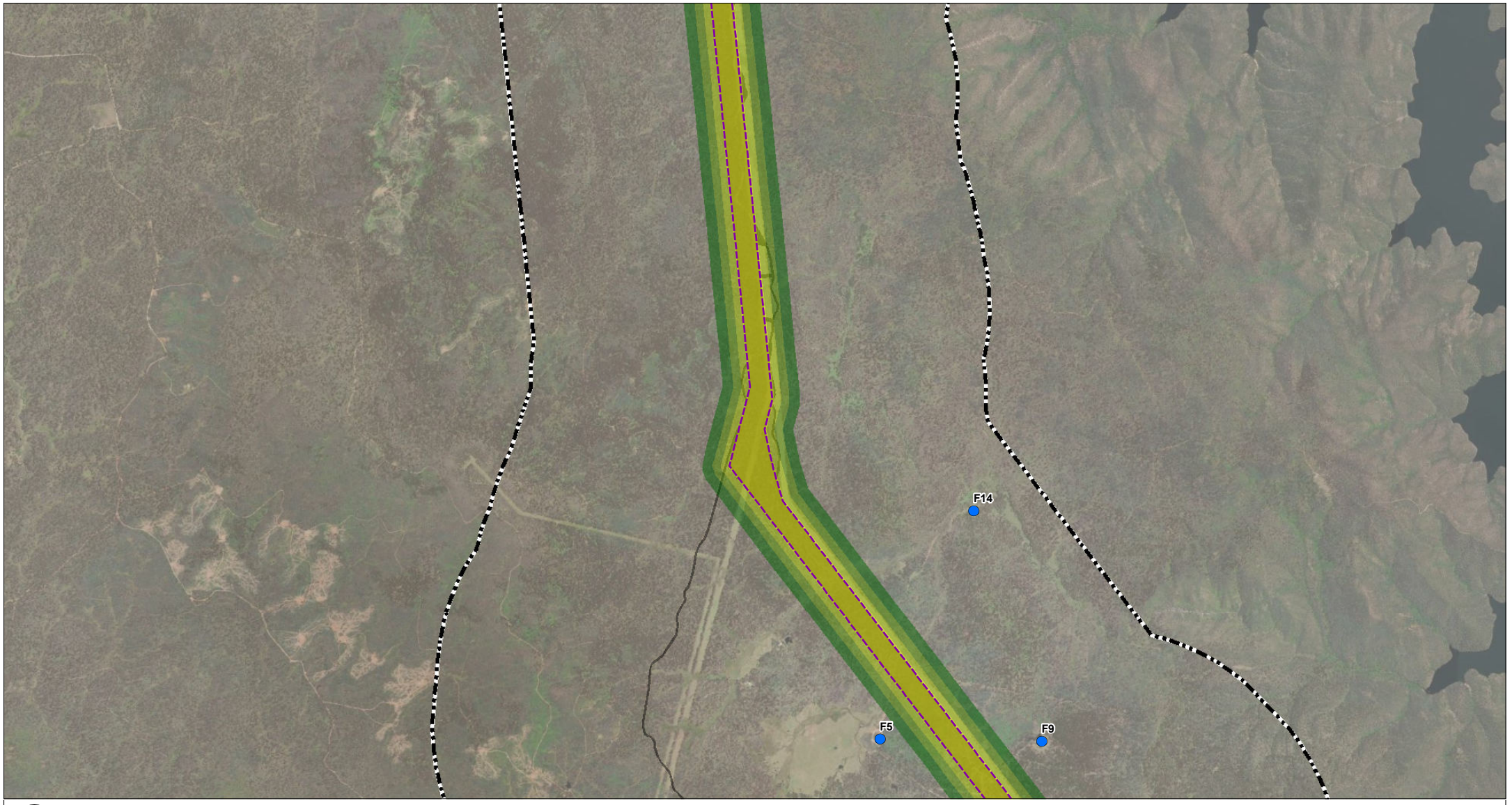

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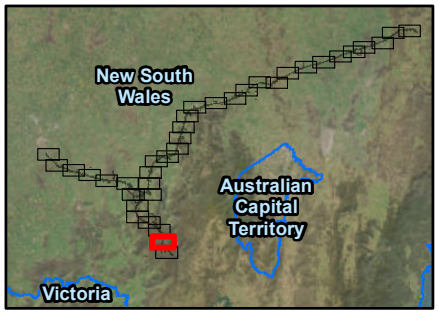

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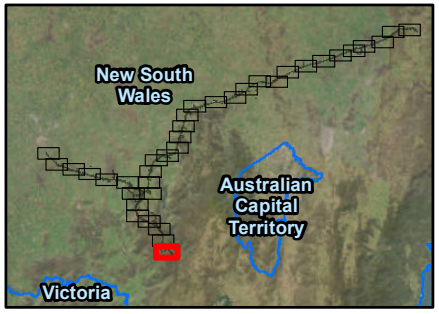

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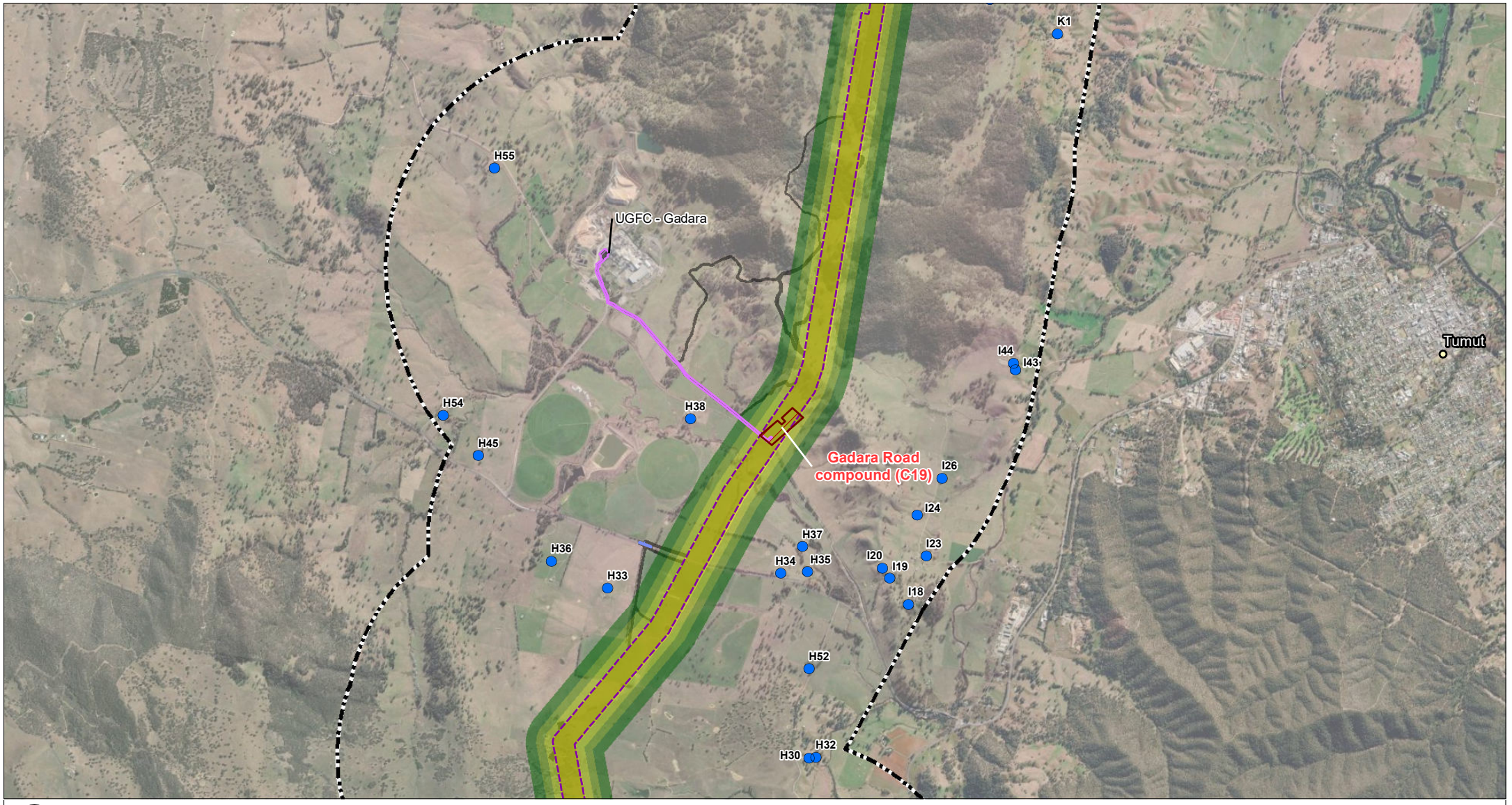

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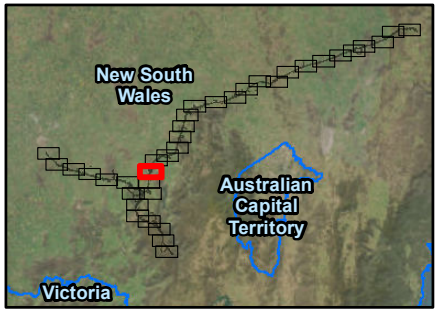

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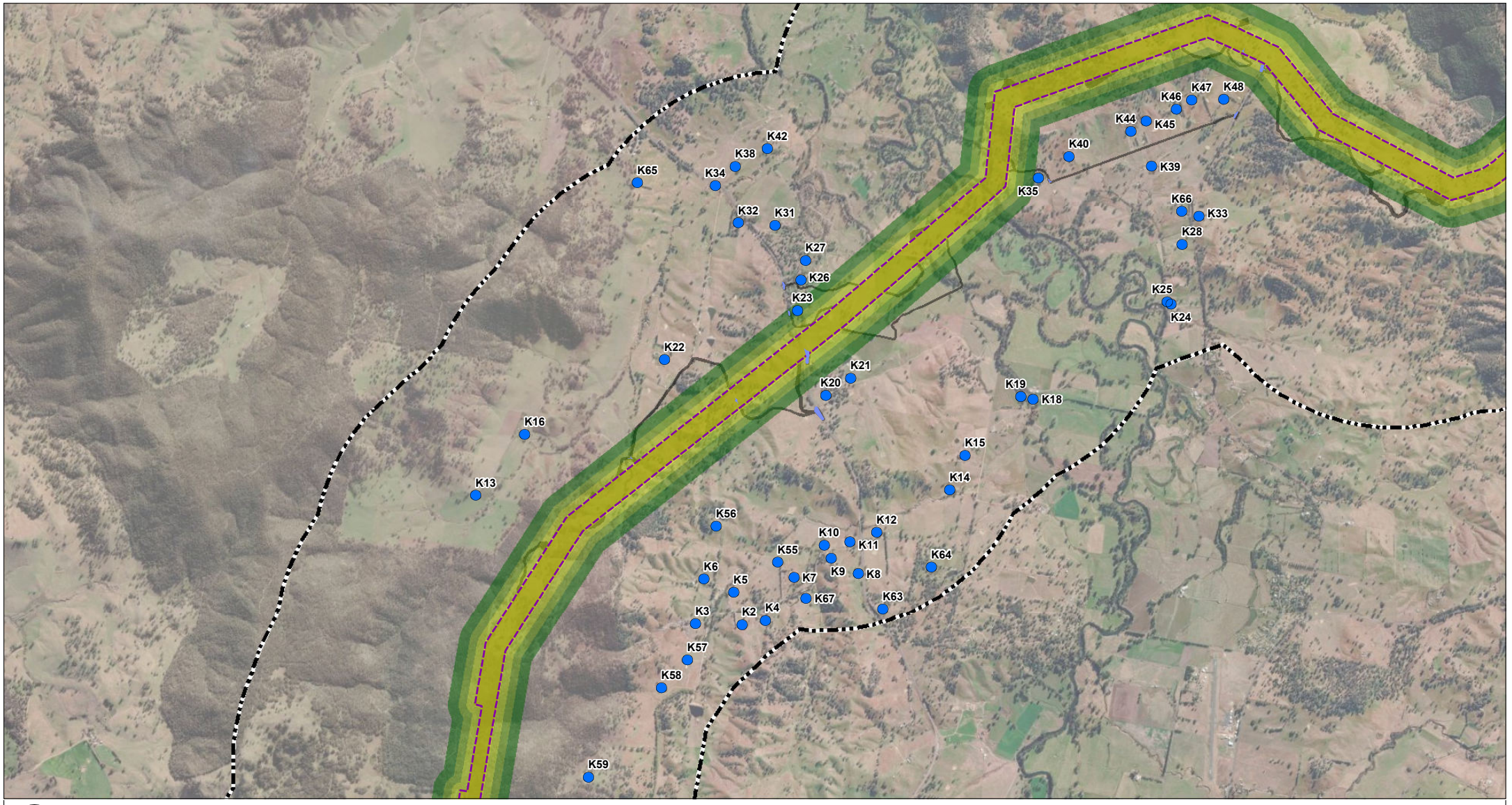

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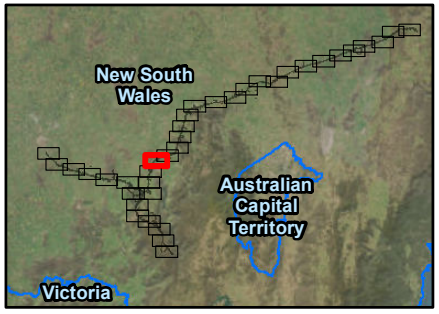

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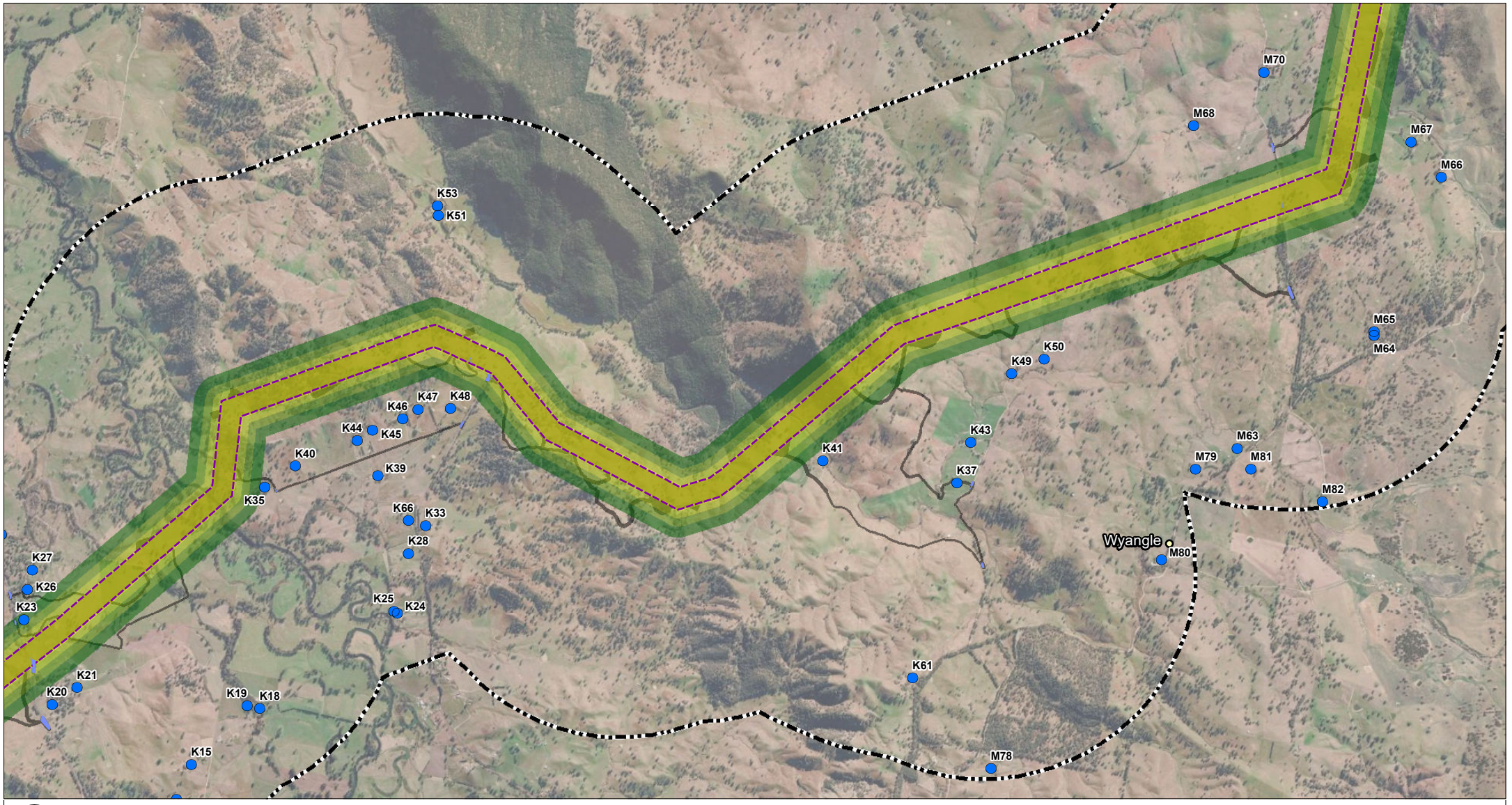

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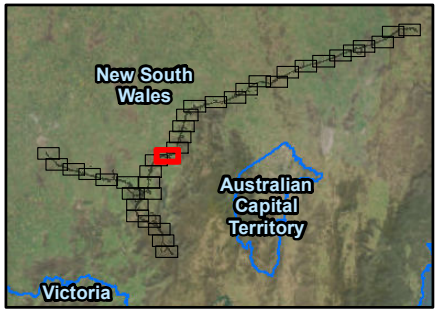

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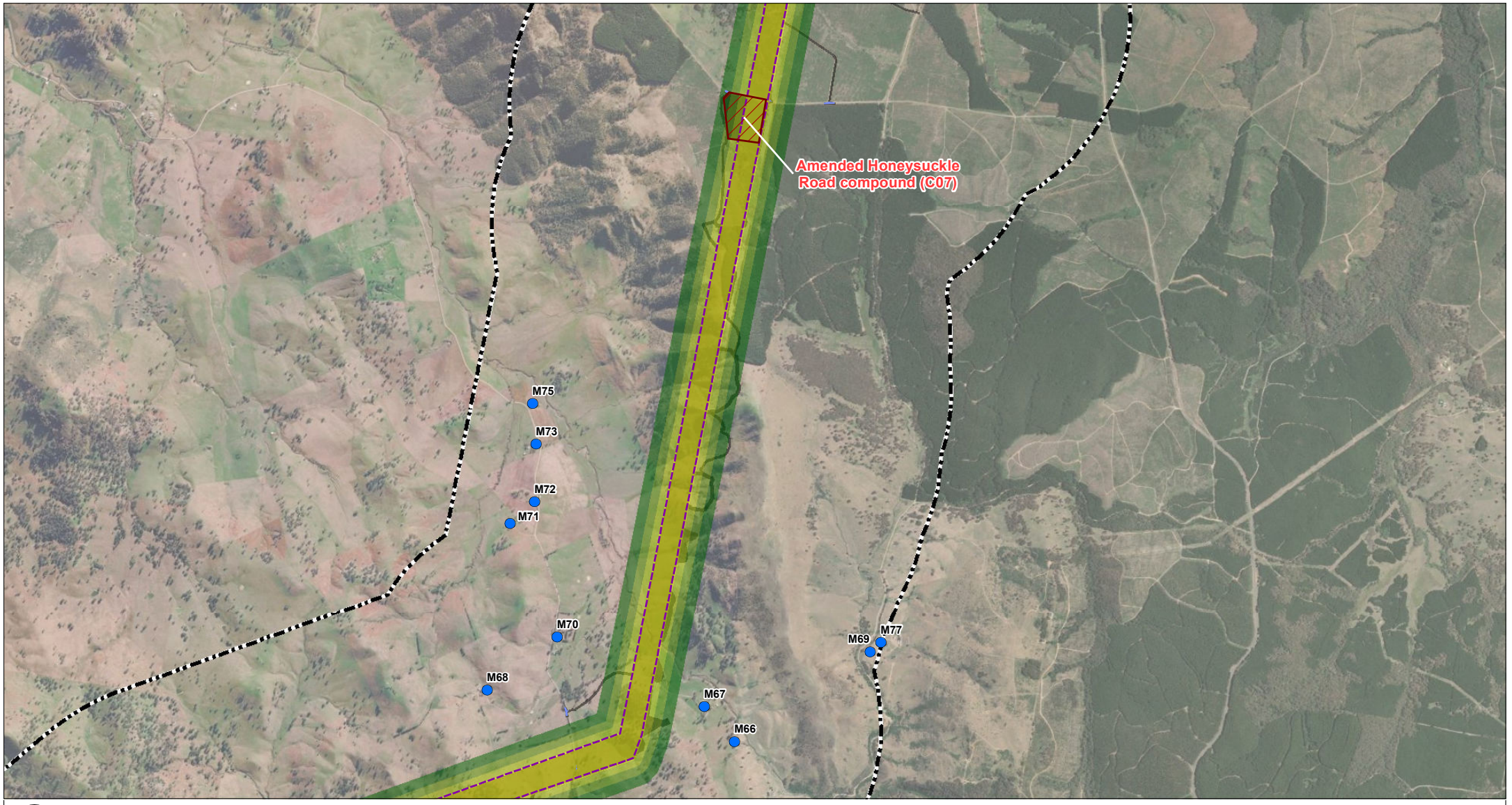

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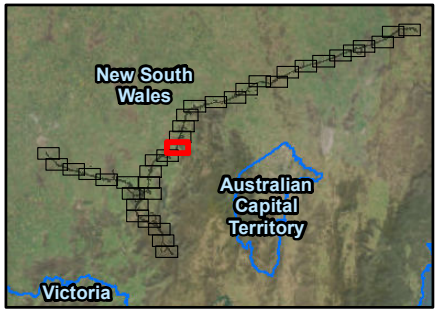

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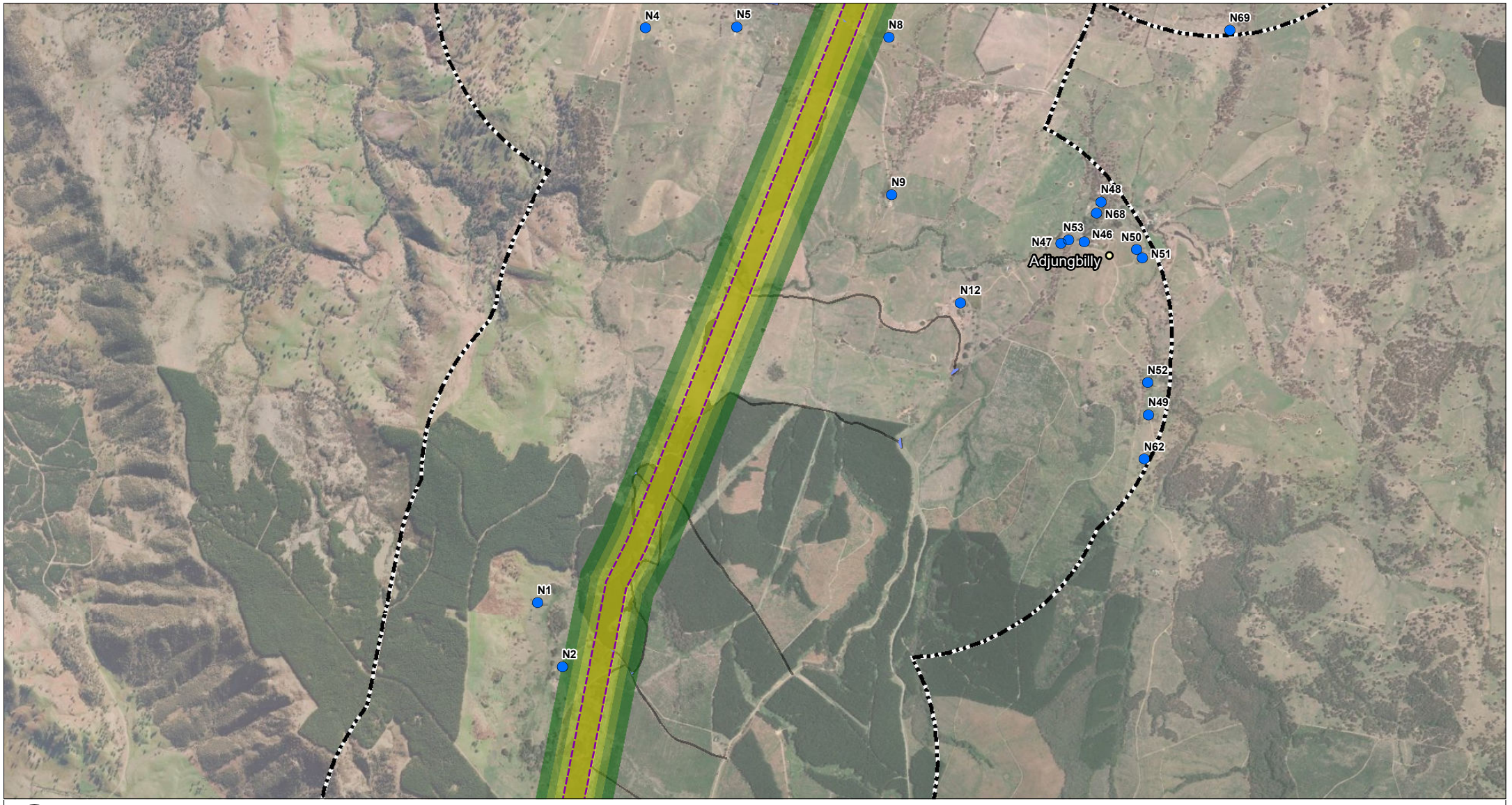

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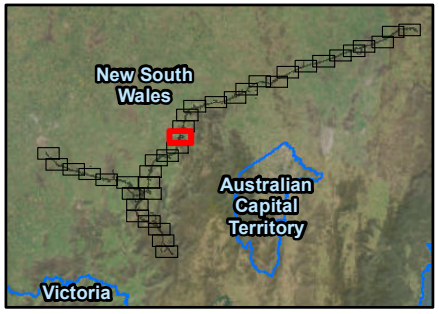
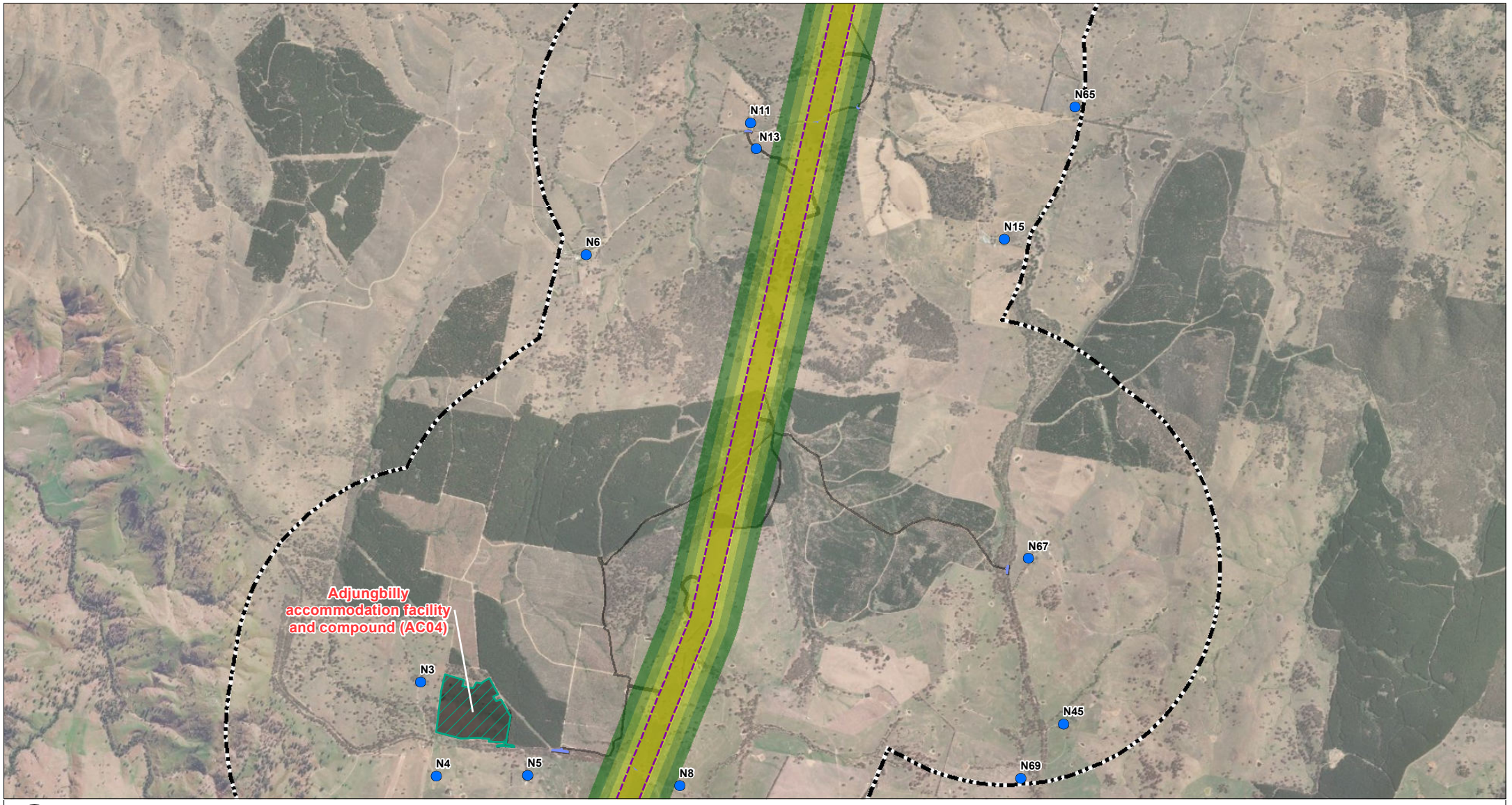


HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

DRONE NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.3



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

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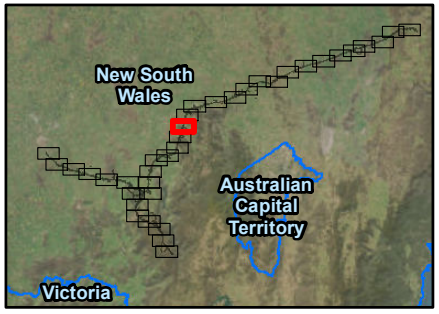

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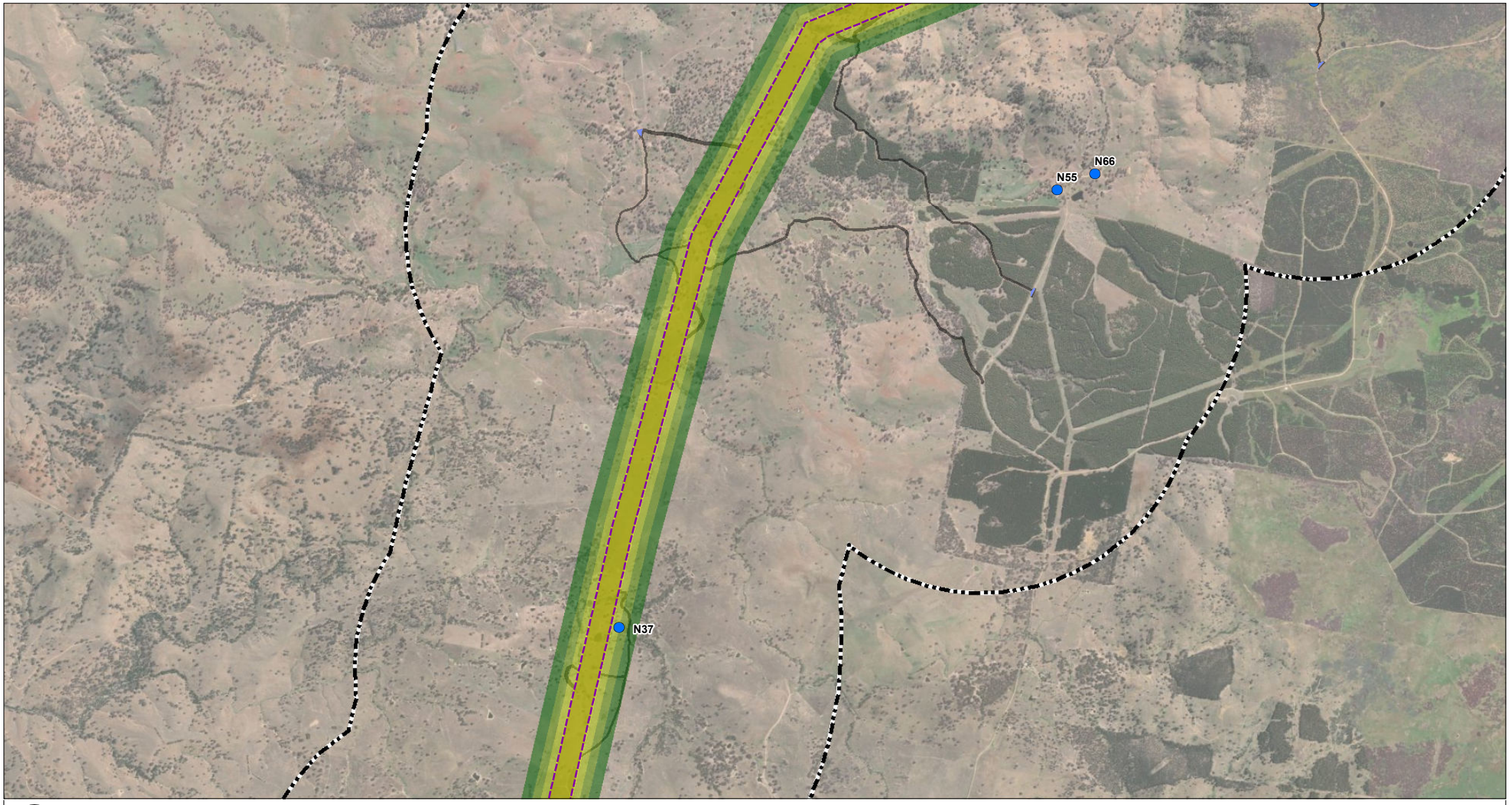

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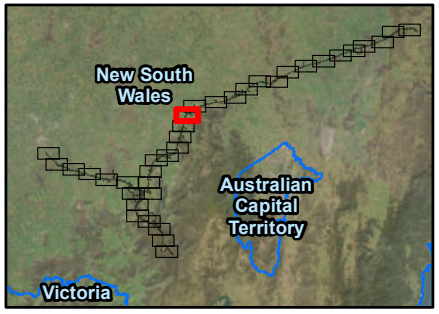

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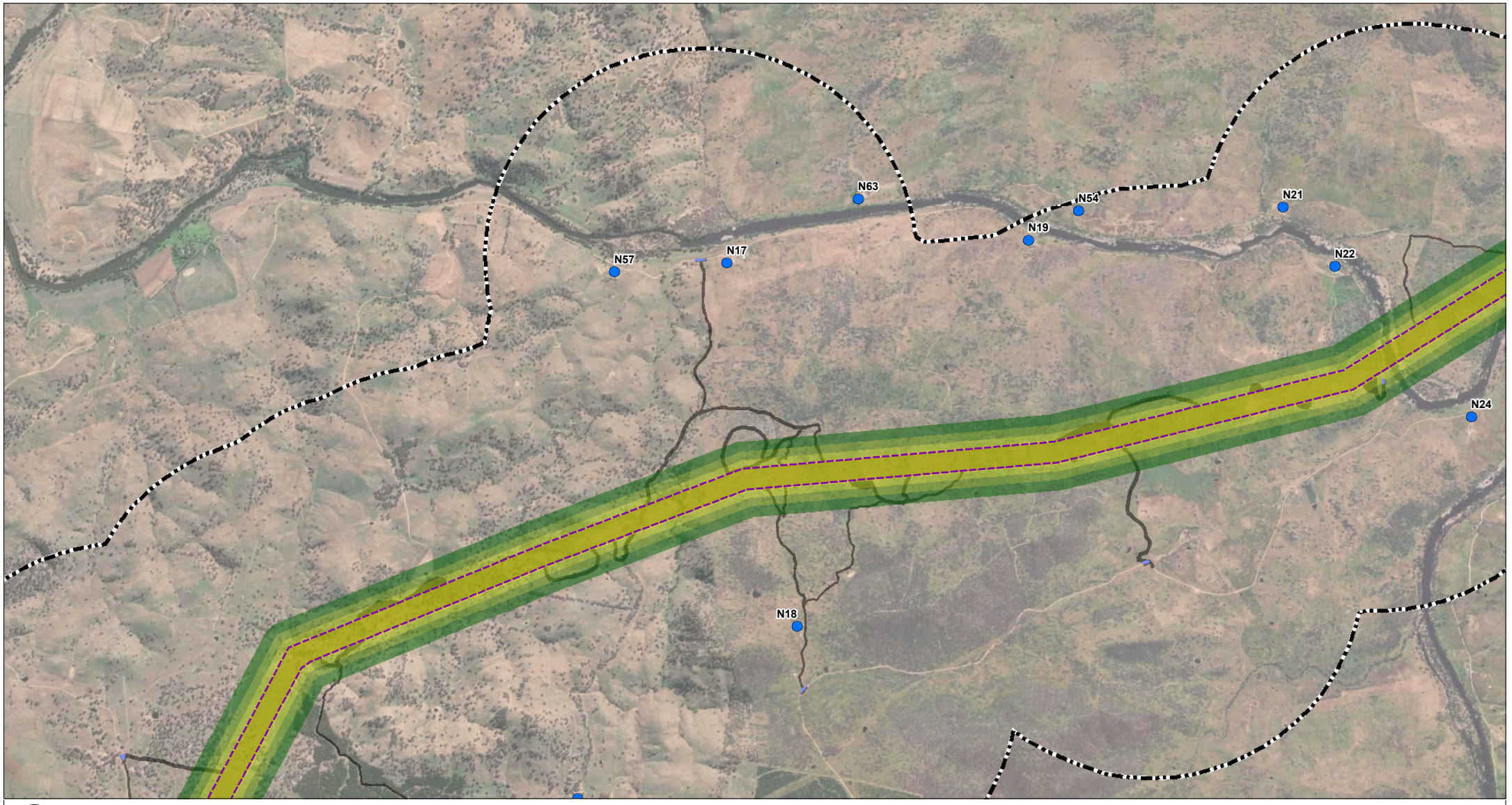

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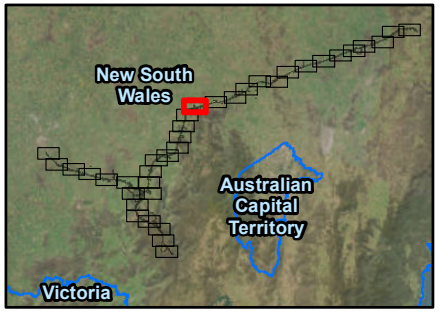

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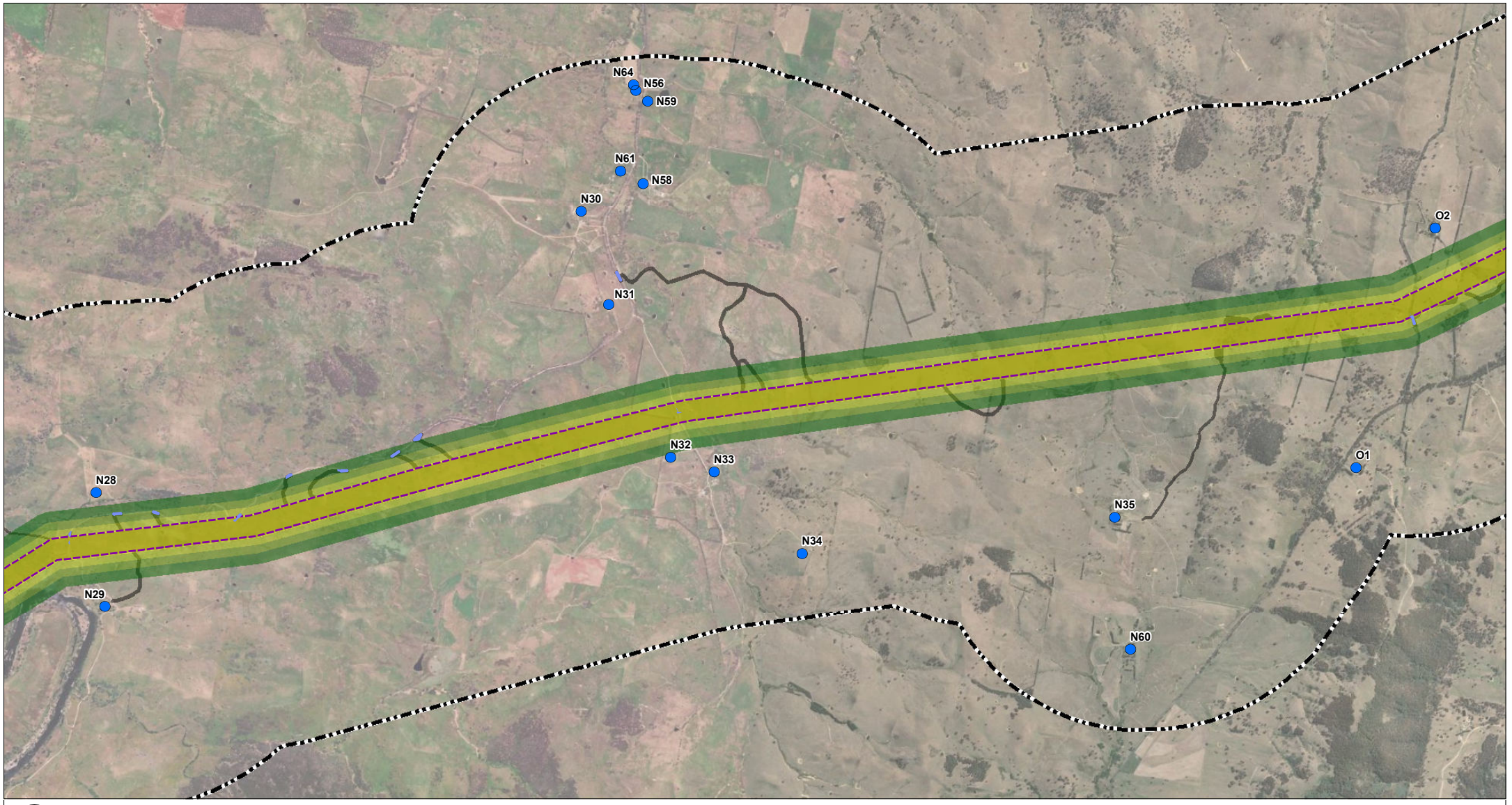

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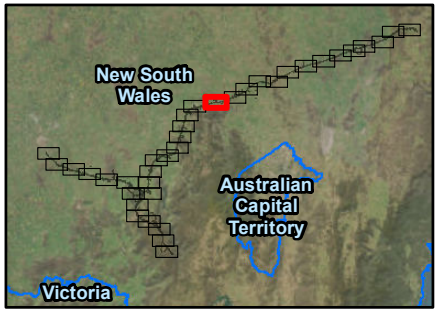

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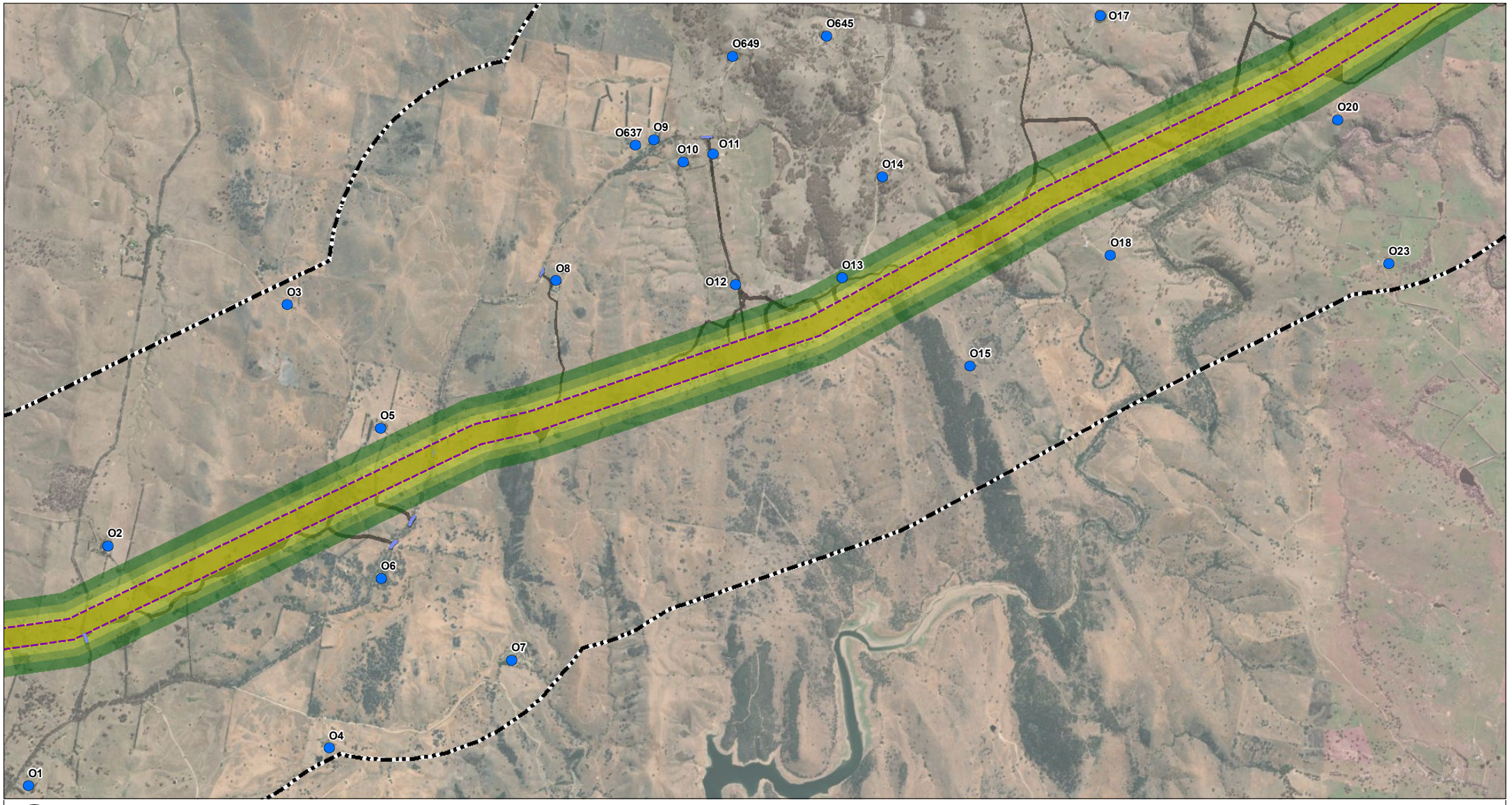

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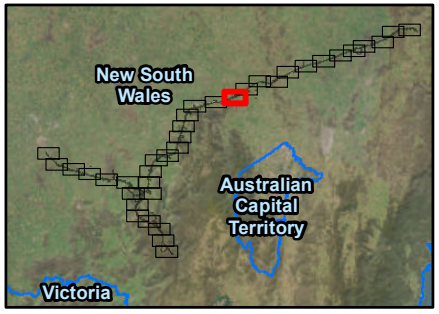

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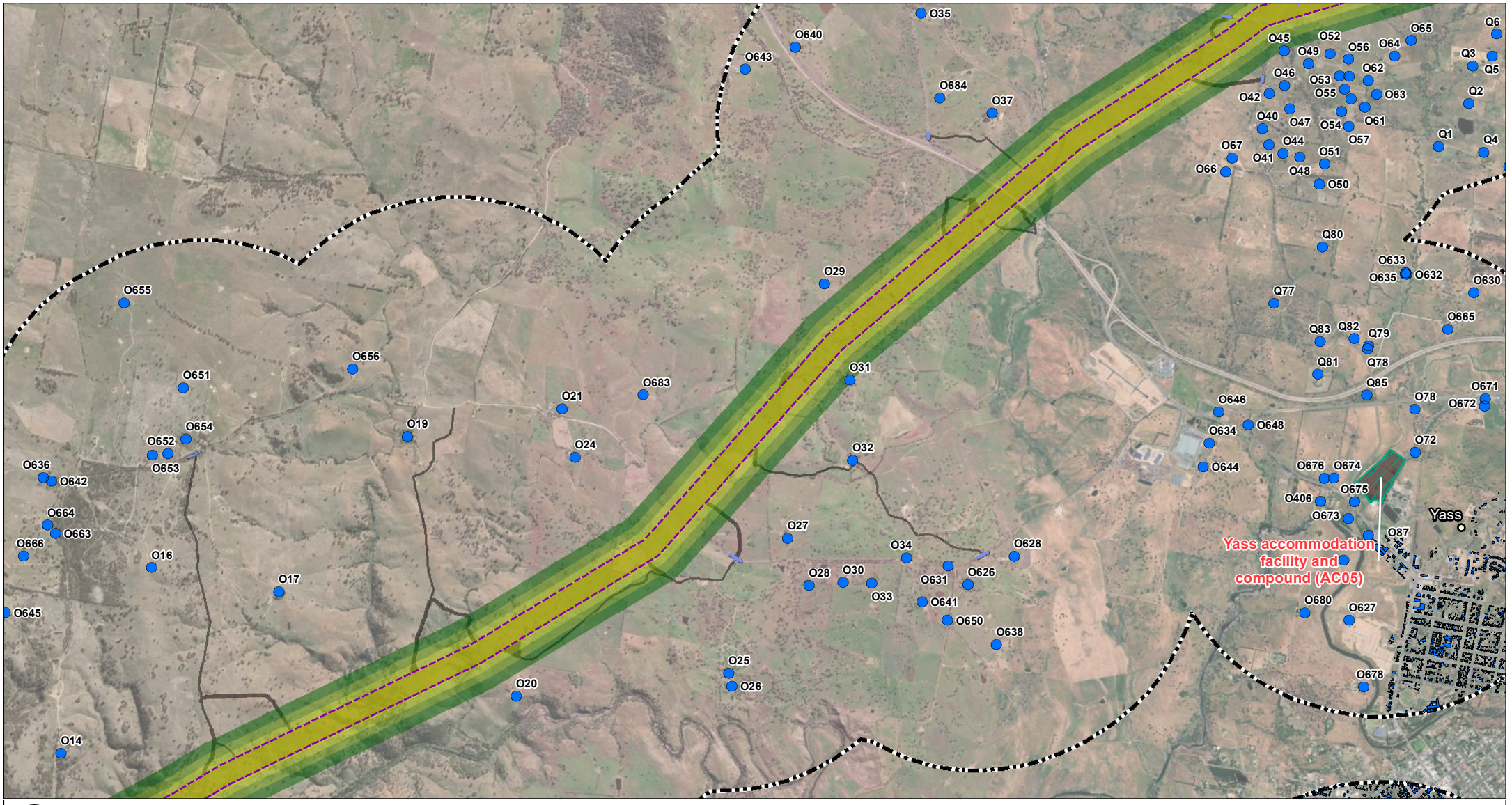

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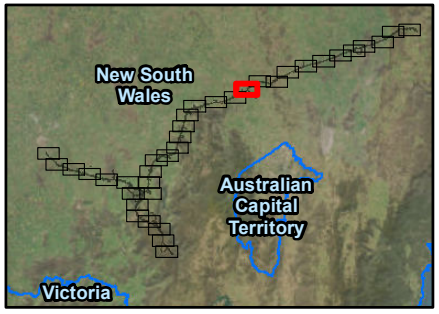

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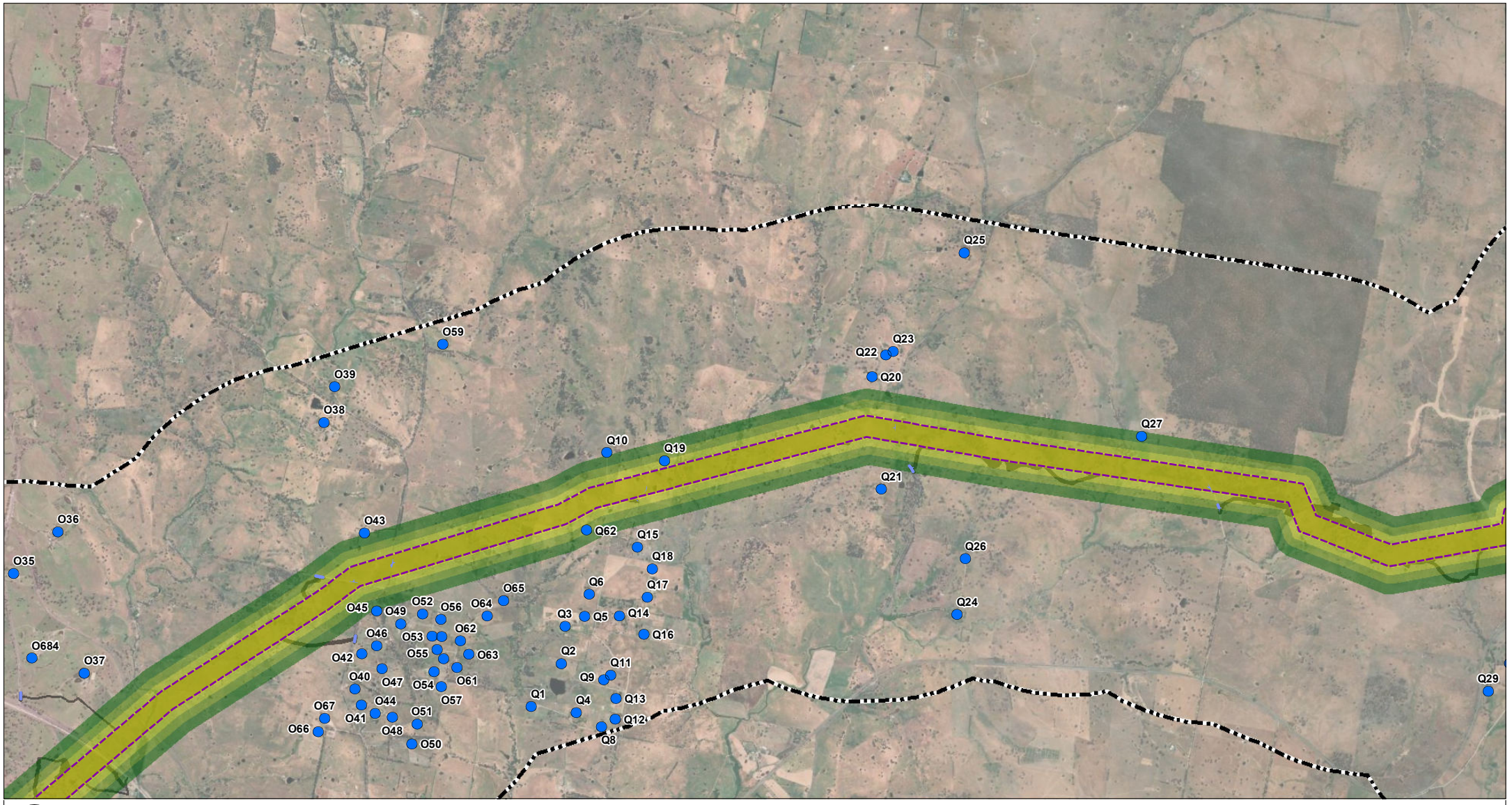

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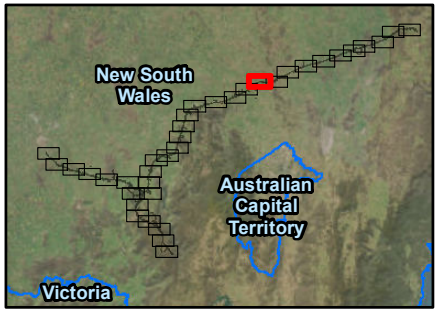

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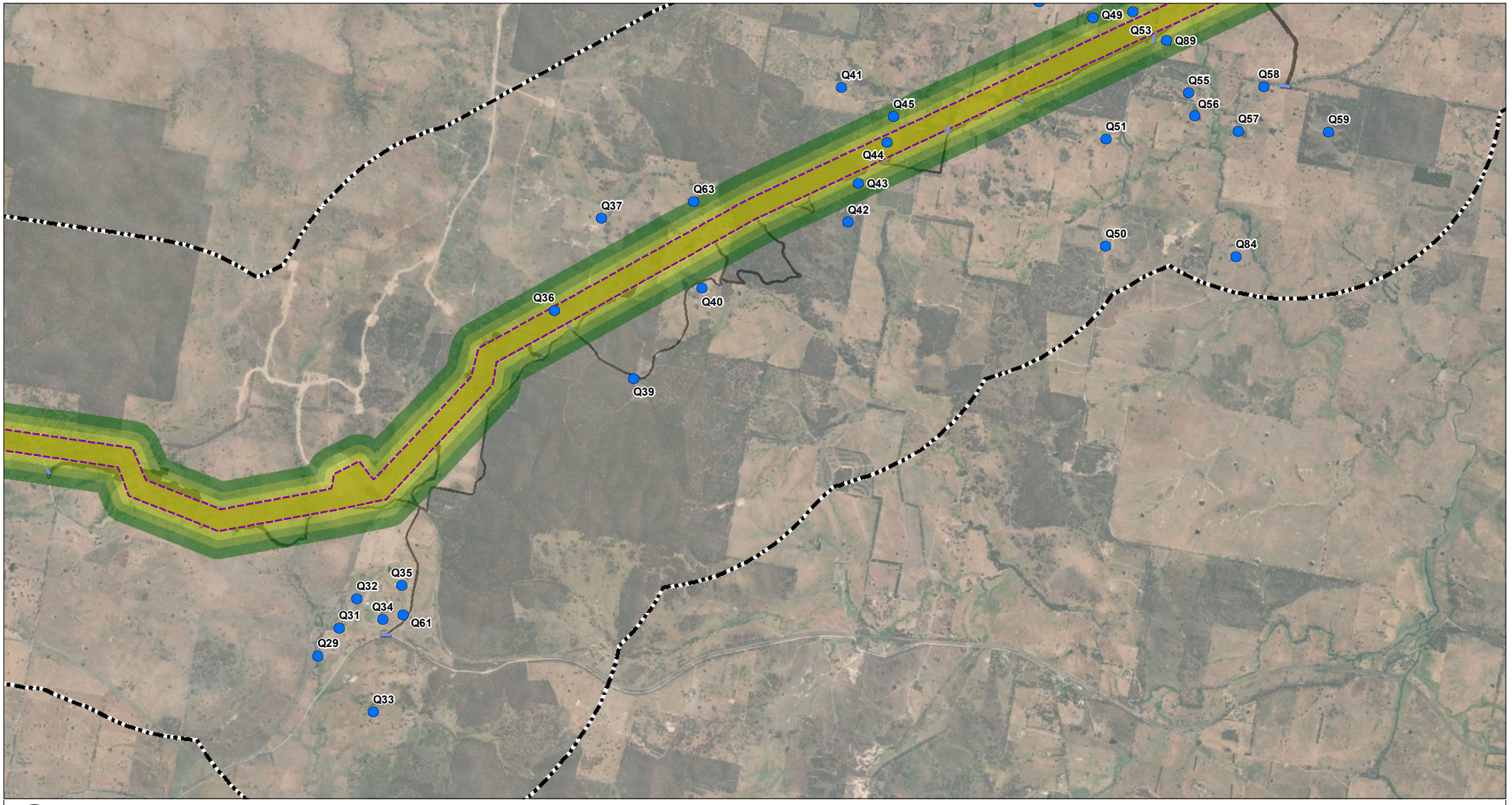

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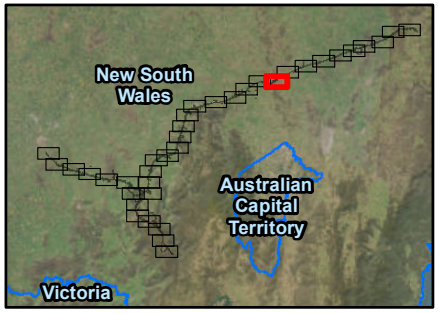

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

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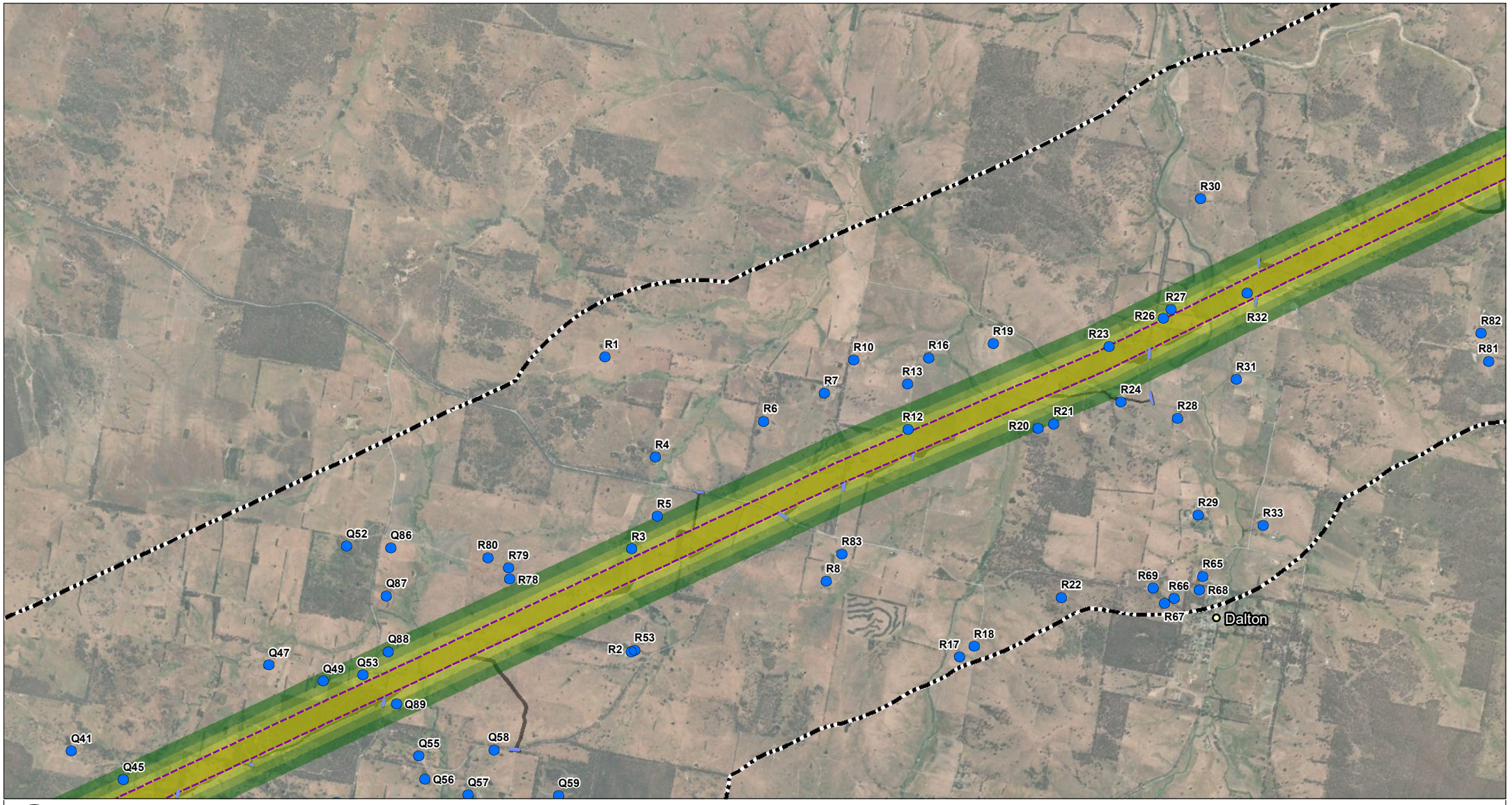

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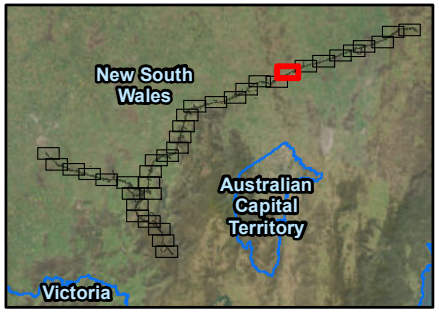

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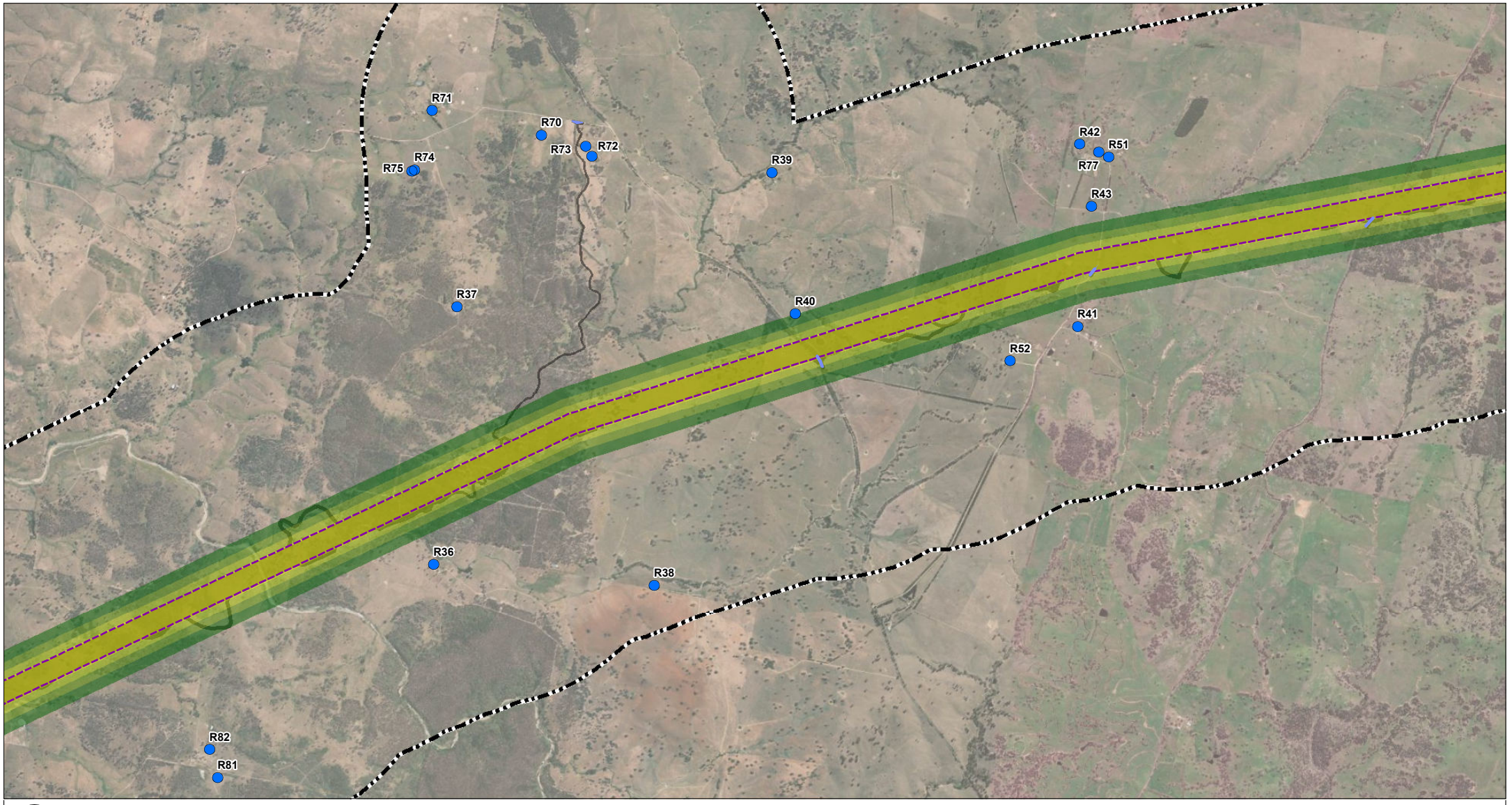

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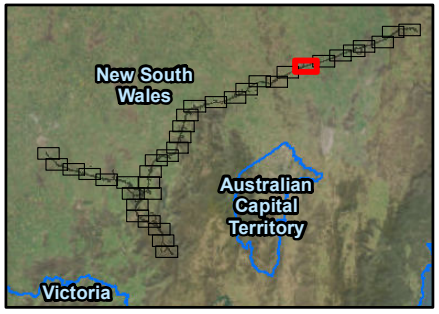

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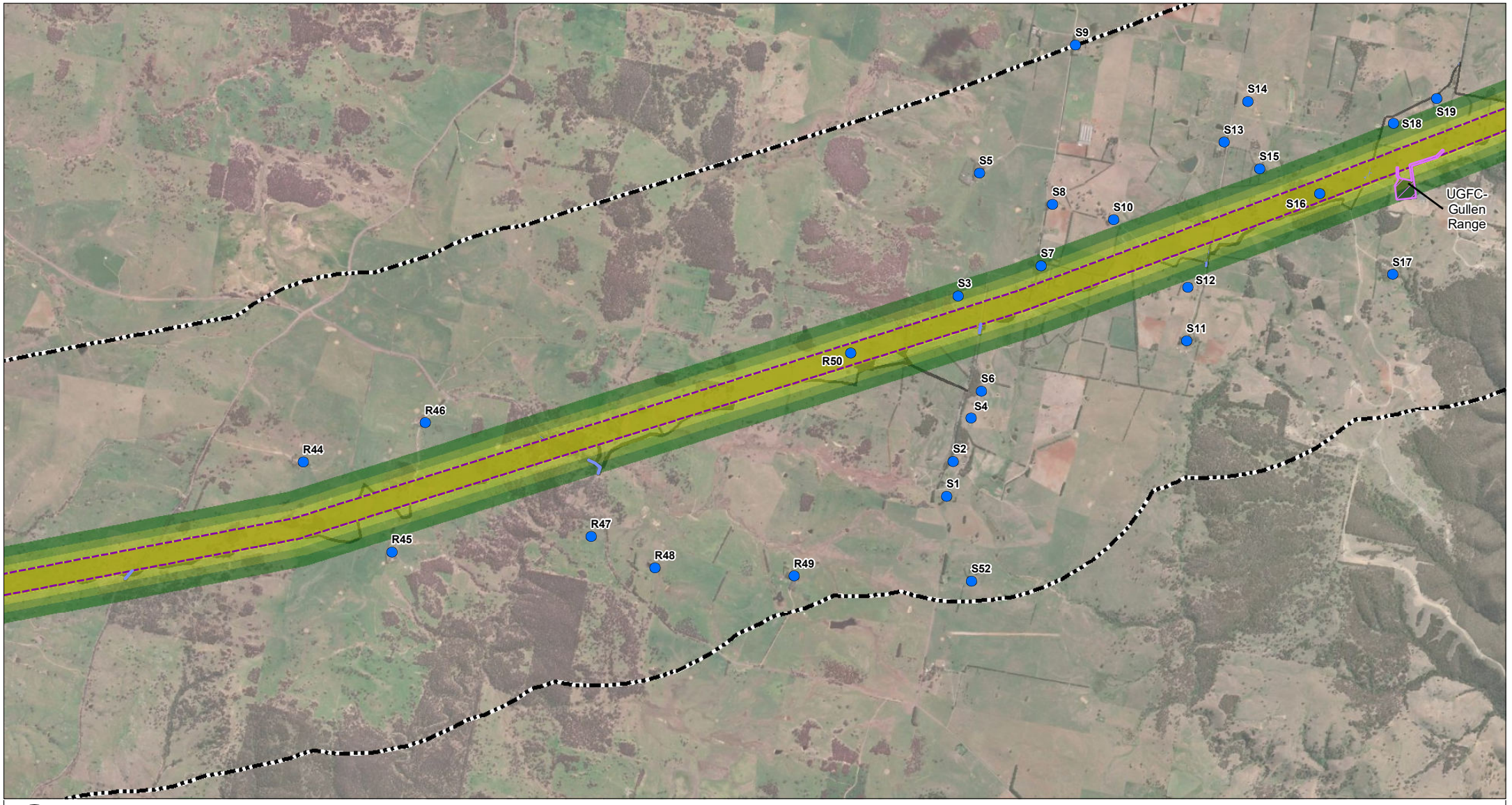

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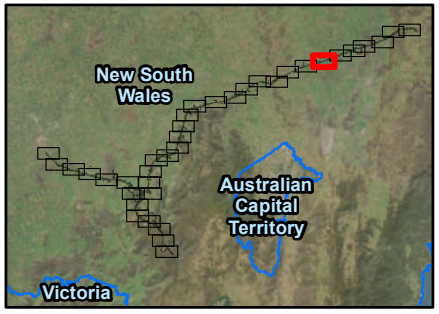

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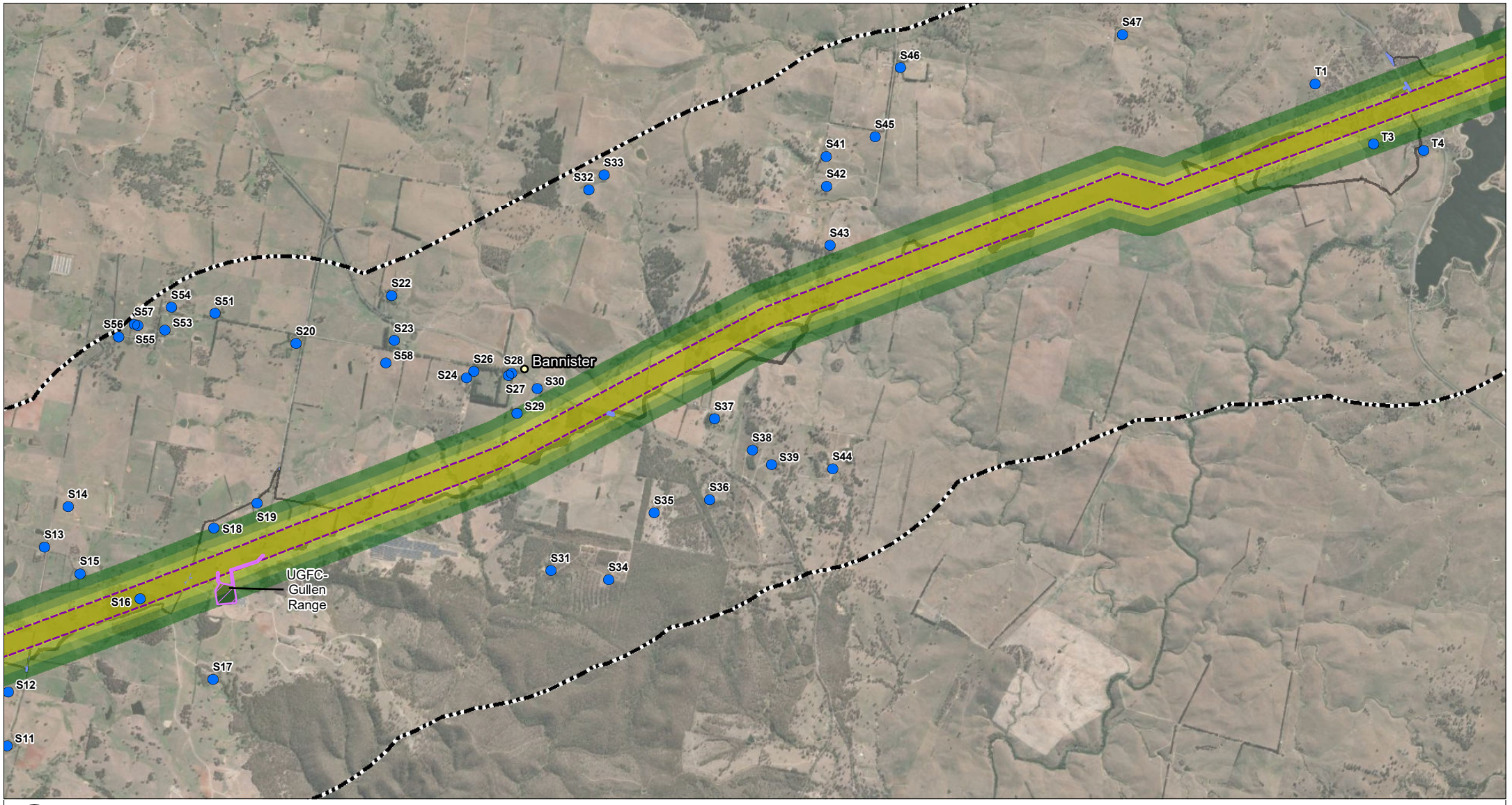

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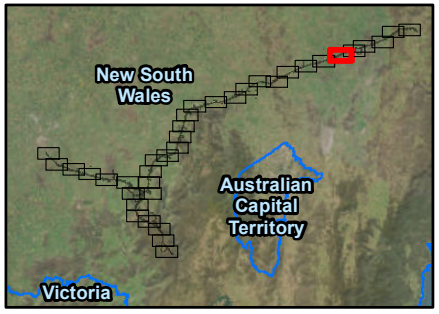

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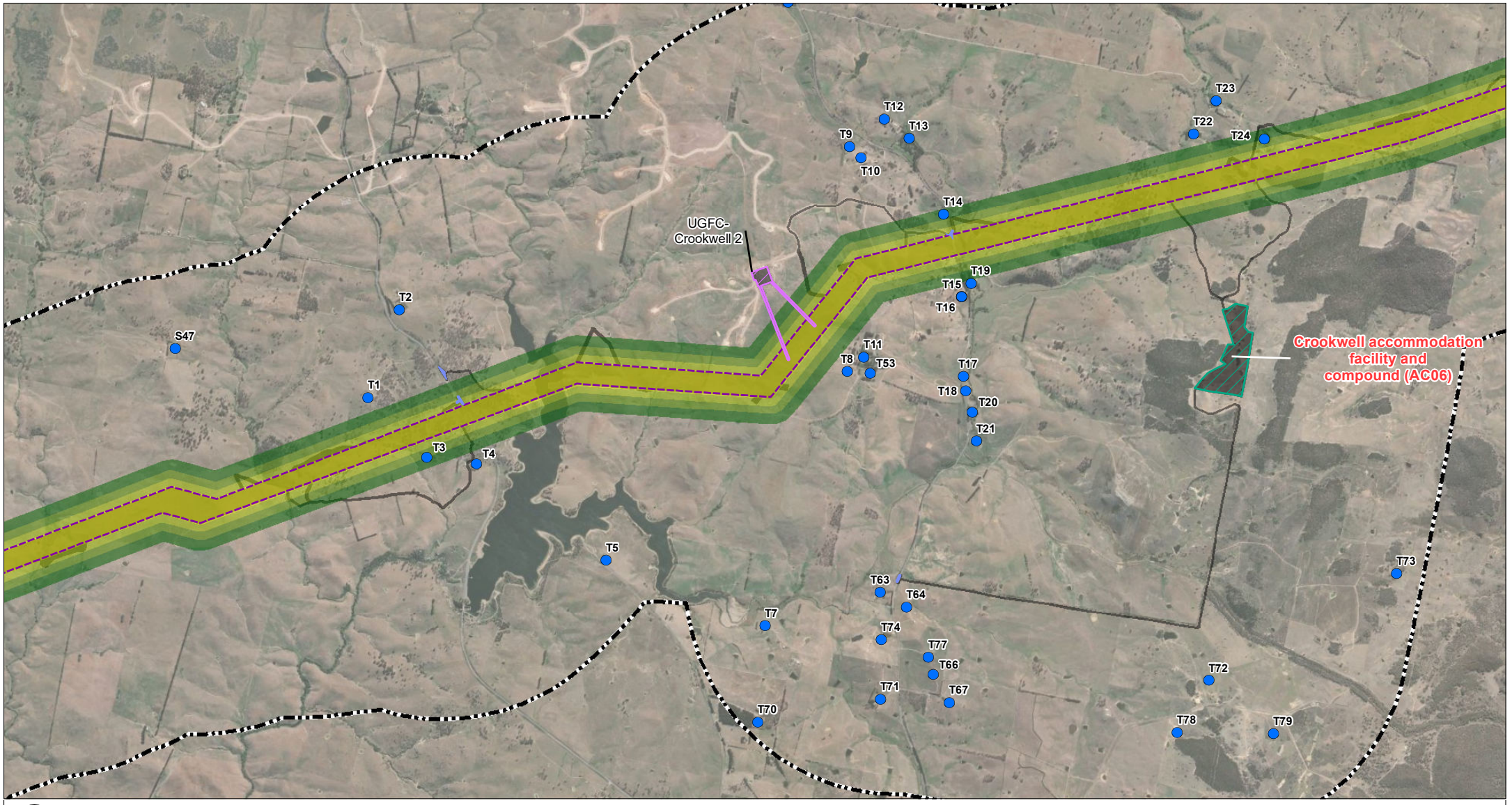

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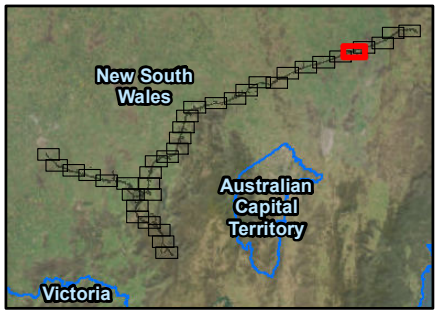

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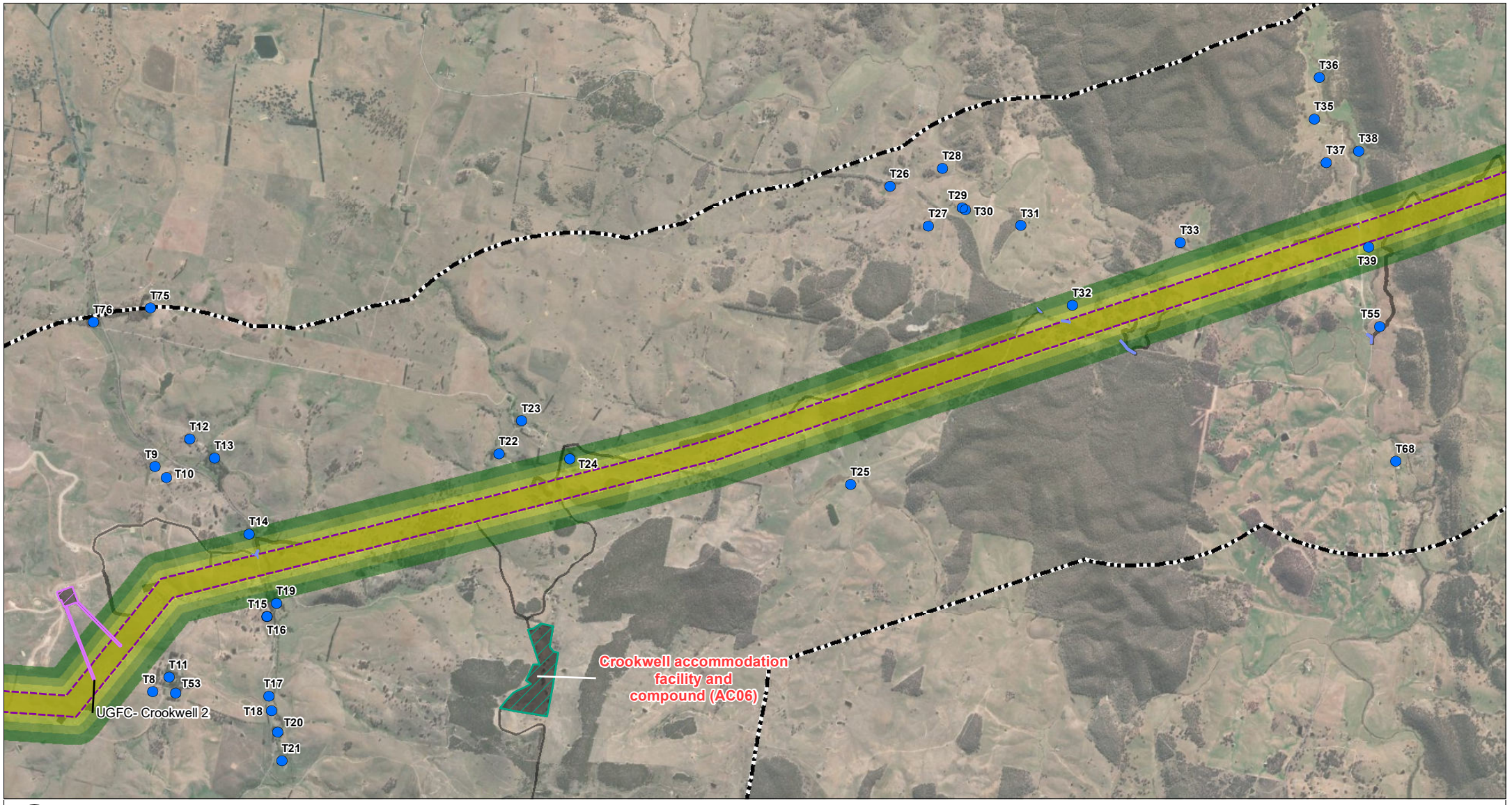

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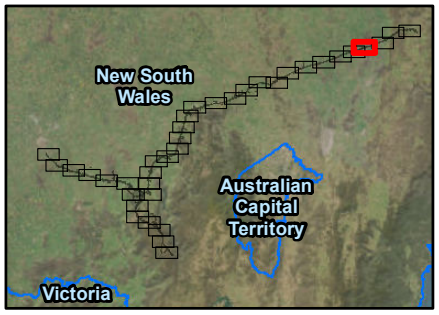

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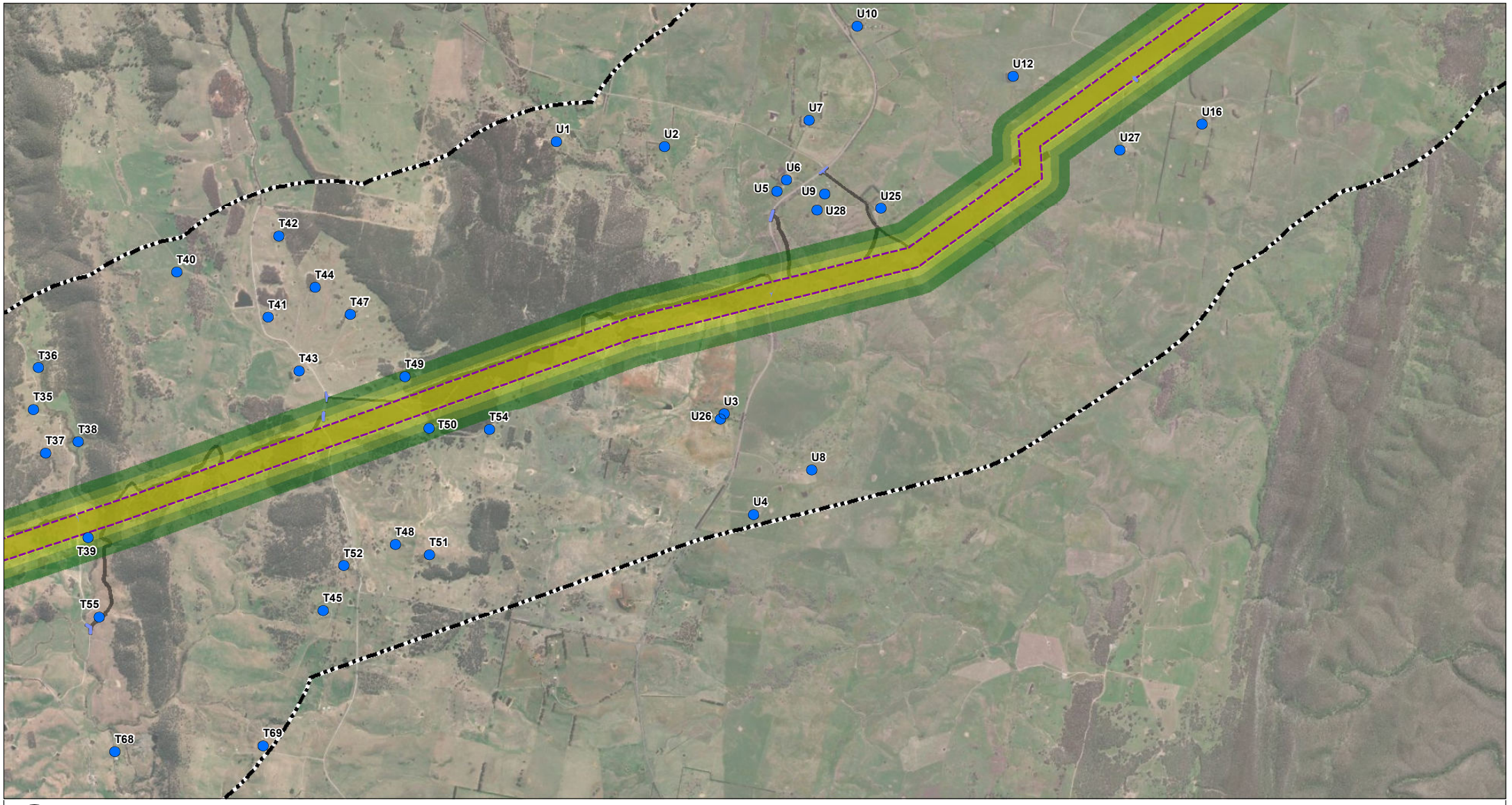

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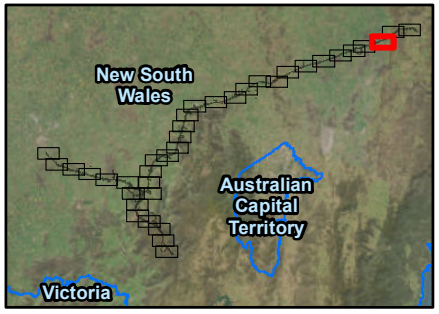
- Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
- 65 - 70 dBA
- 70 - 75 dBA
- 75 - 80 dBA

Project Components

- Substation
- Amended project footprint
- Construction compound
- Combined worker accomodation facility and construction compound
- Telecommunications connection
- Project corridor
- Intersections

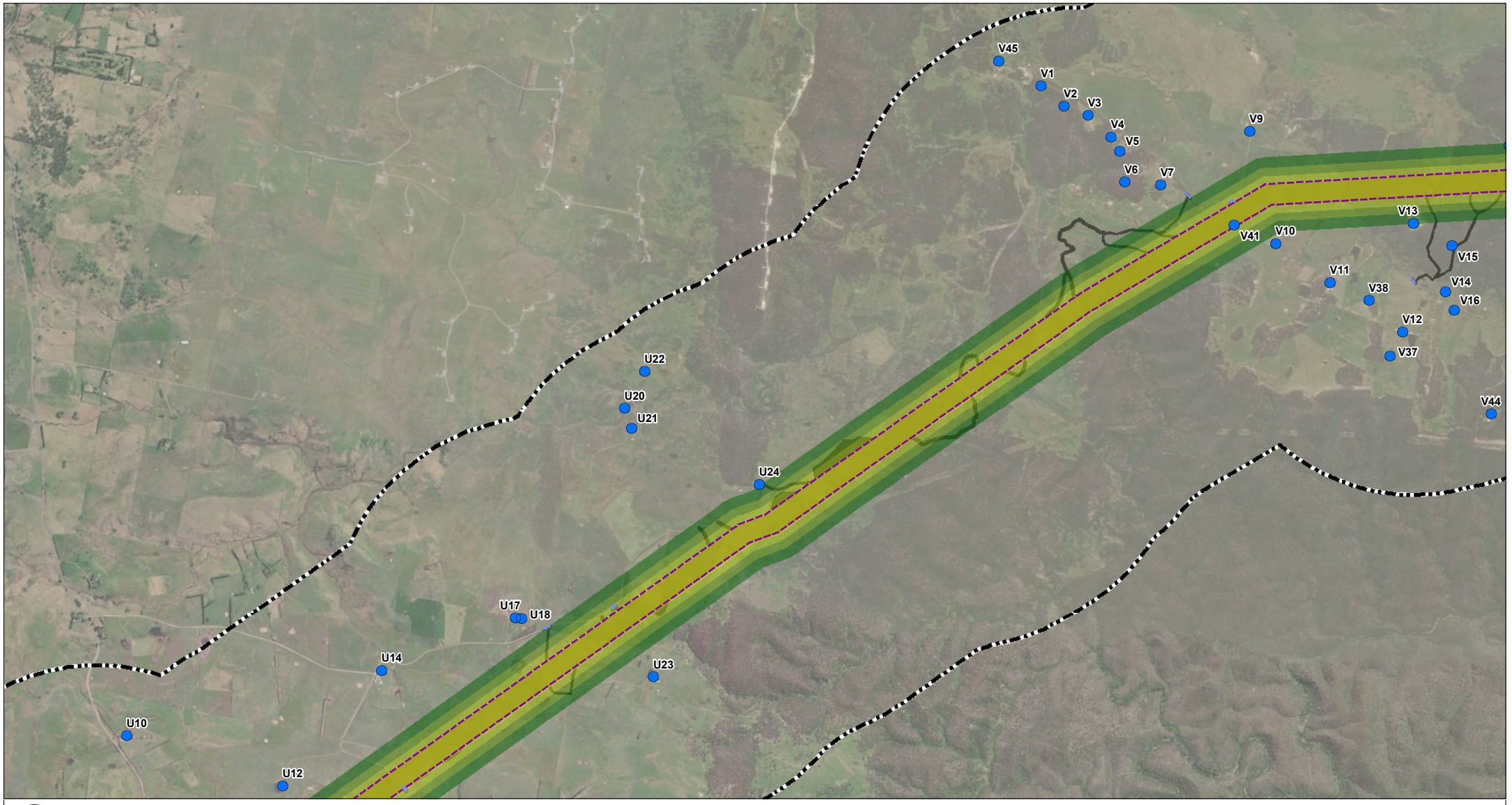


HUMELINK NOISE AND VIBRATION IMPACT ASSESSMENT

DRONE NOISE FROM CORRIDOR WORK AT 170FT

ATTACHMENT I.3

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_I3_Drone noise from corridor work at 170ft.mxd



0 300 600 1,200 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	06-Mar-2024
Drawn by:	JG

SLR

- Population centre
- Receiver
- Existing substation fence line
- Amended study area

LAmax Aircraft Noise

- 60 - 65 dBA
- 65 - 70 dBA
- 70 - 75 dBA
- 75 - 80 dBA

Project Components

- Substation
- Amended project footprint
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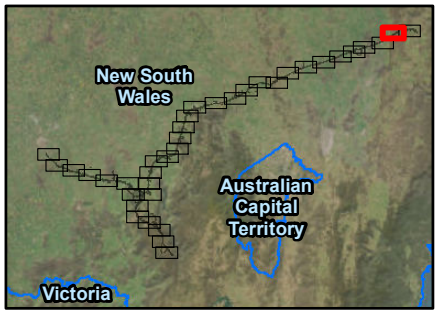

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

DRONE NOISE FROM CORRIDOR WORK AT 170FT

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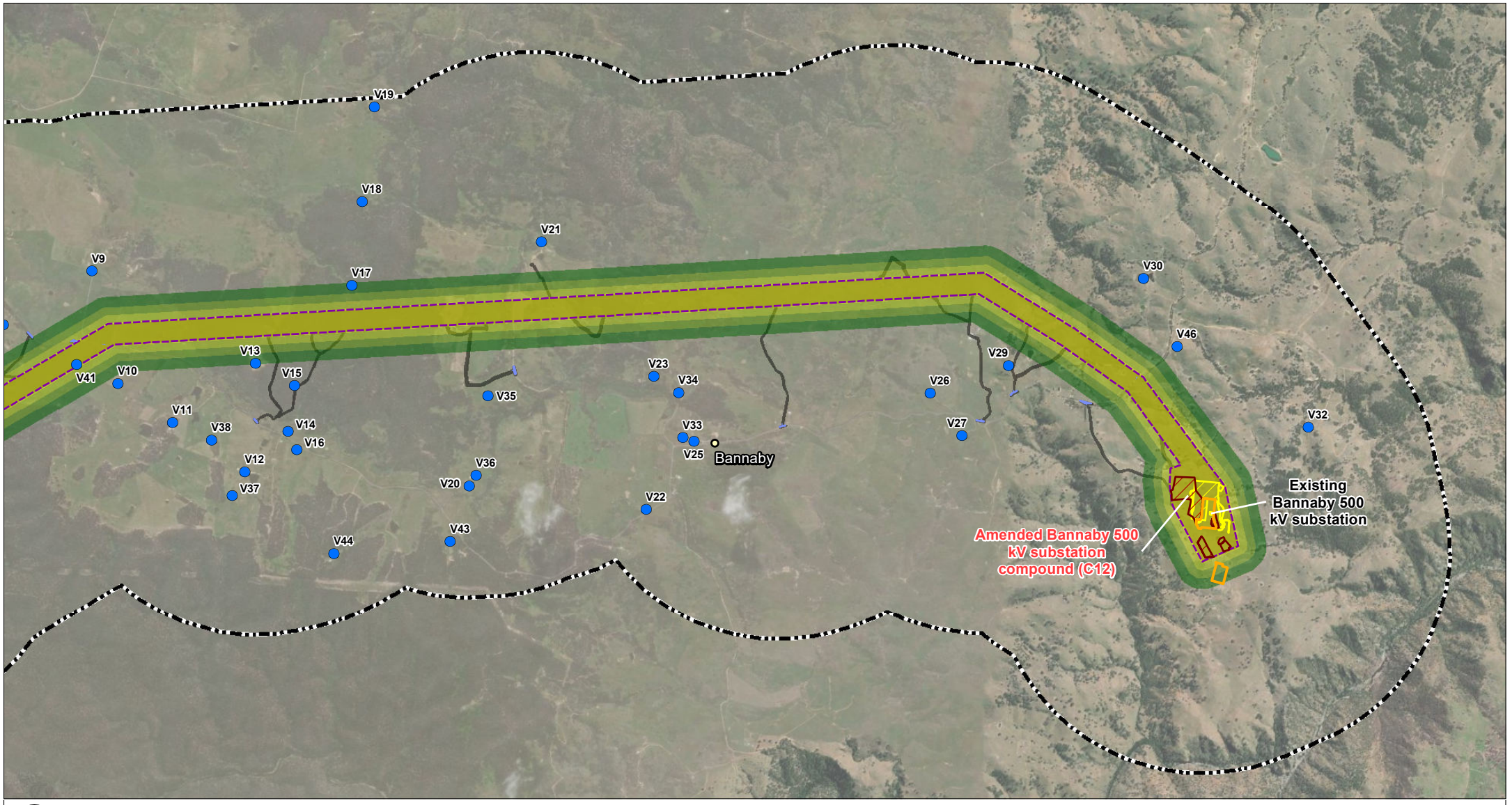

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Project Number:	610.30622
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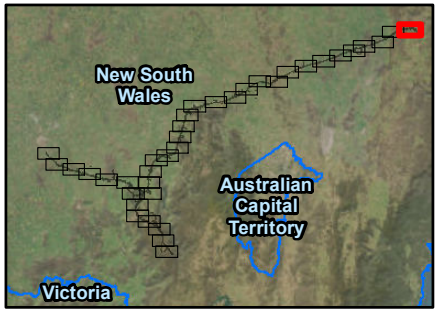

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

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Attachment J Operational noise impact mapping

HumeLink
Technical Report 9
Noise and Vibration Impact Assessment Addendum

0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	08-Mar-2024
Drawn by:	JG

- Potentially impacted receivers
- Typical fair weather transmission line noise impact zone
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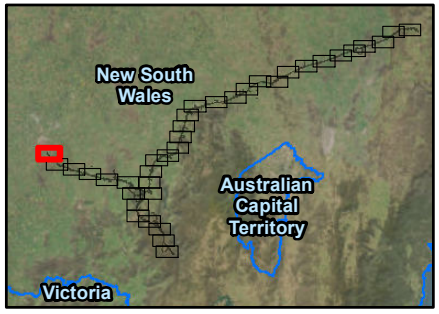
- Population centre
- Amended study area

Project components

- Substation
- Amended project footprint

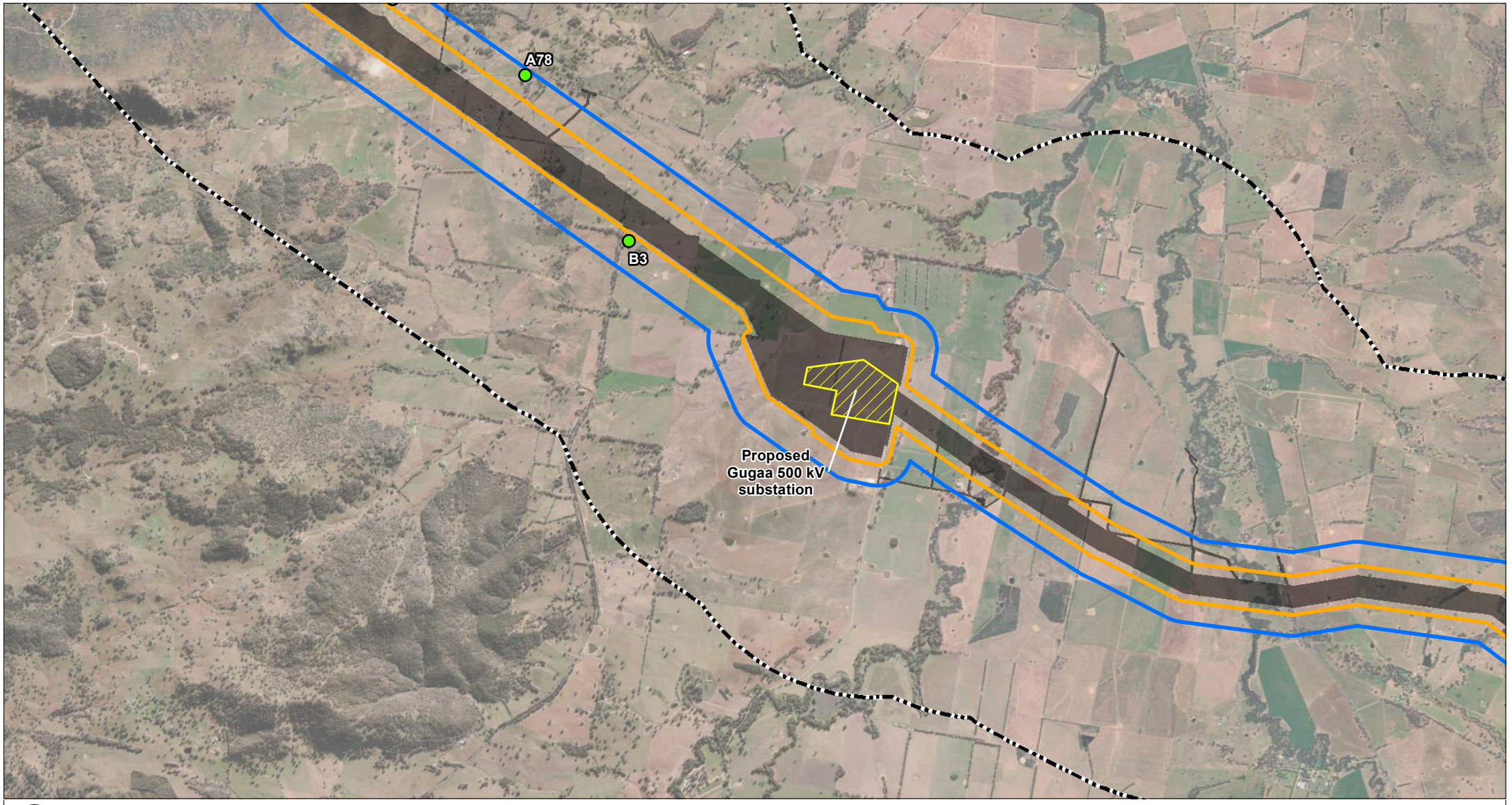


HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
Page 1 of 37

ATTACHMENT J

\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_AttachmentJ_Operation Noise.mxd



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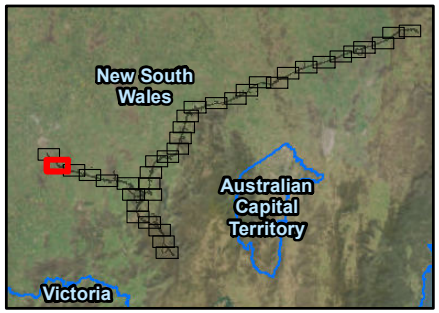

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
Page 2 of 37

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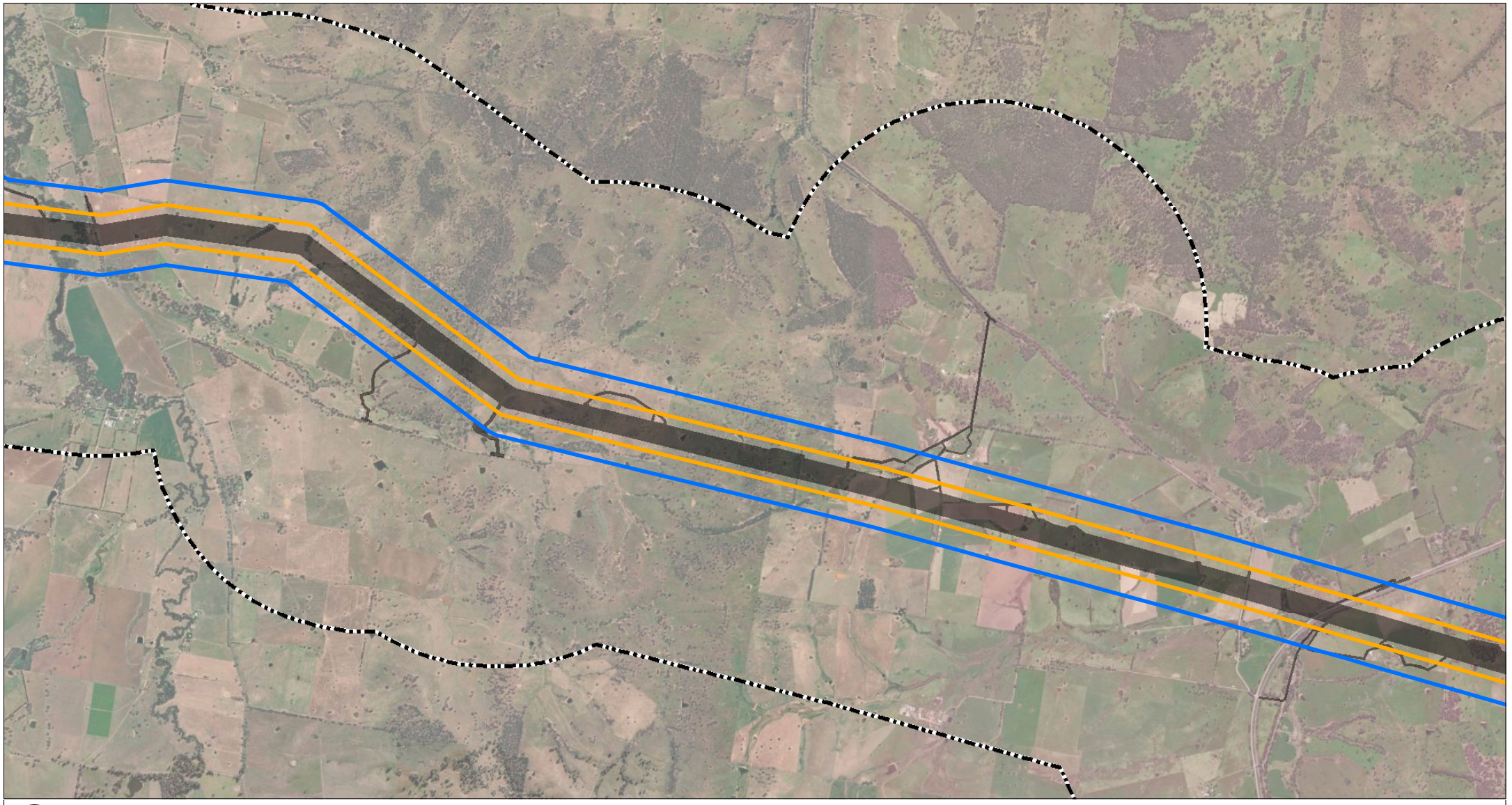

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SLR

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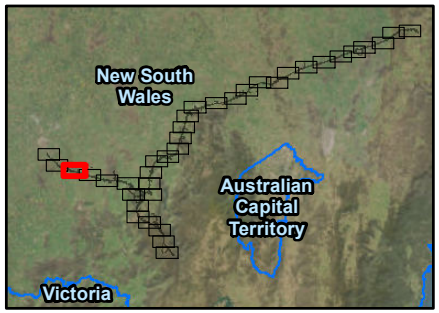

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
Page 3 of 37

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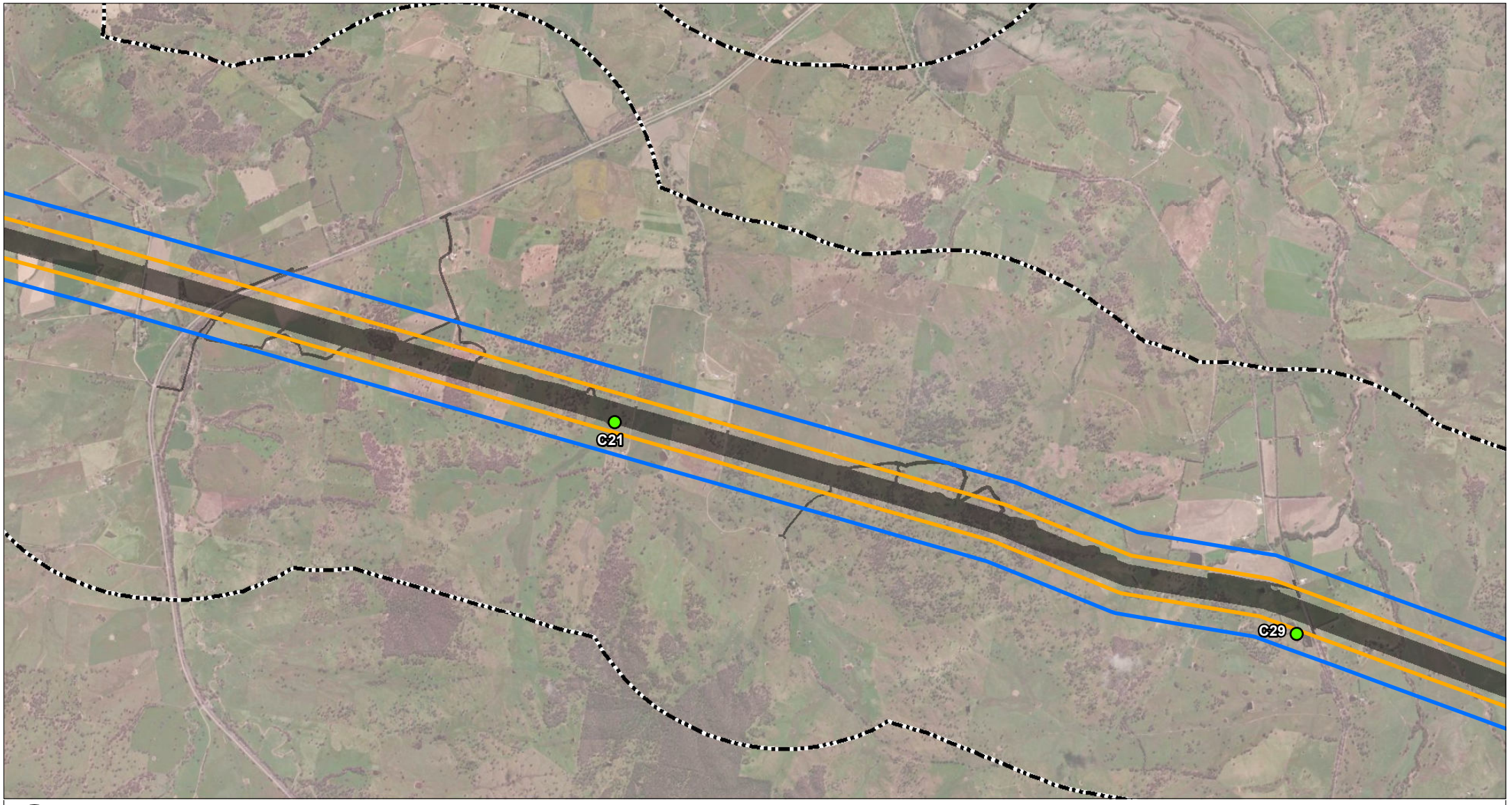

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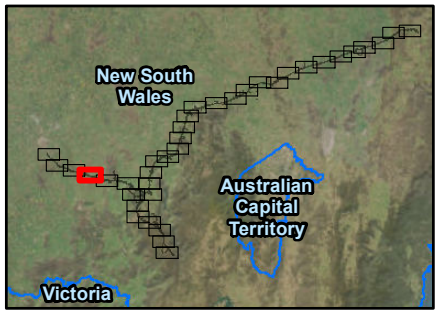

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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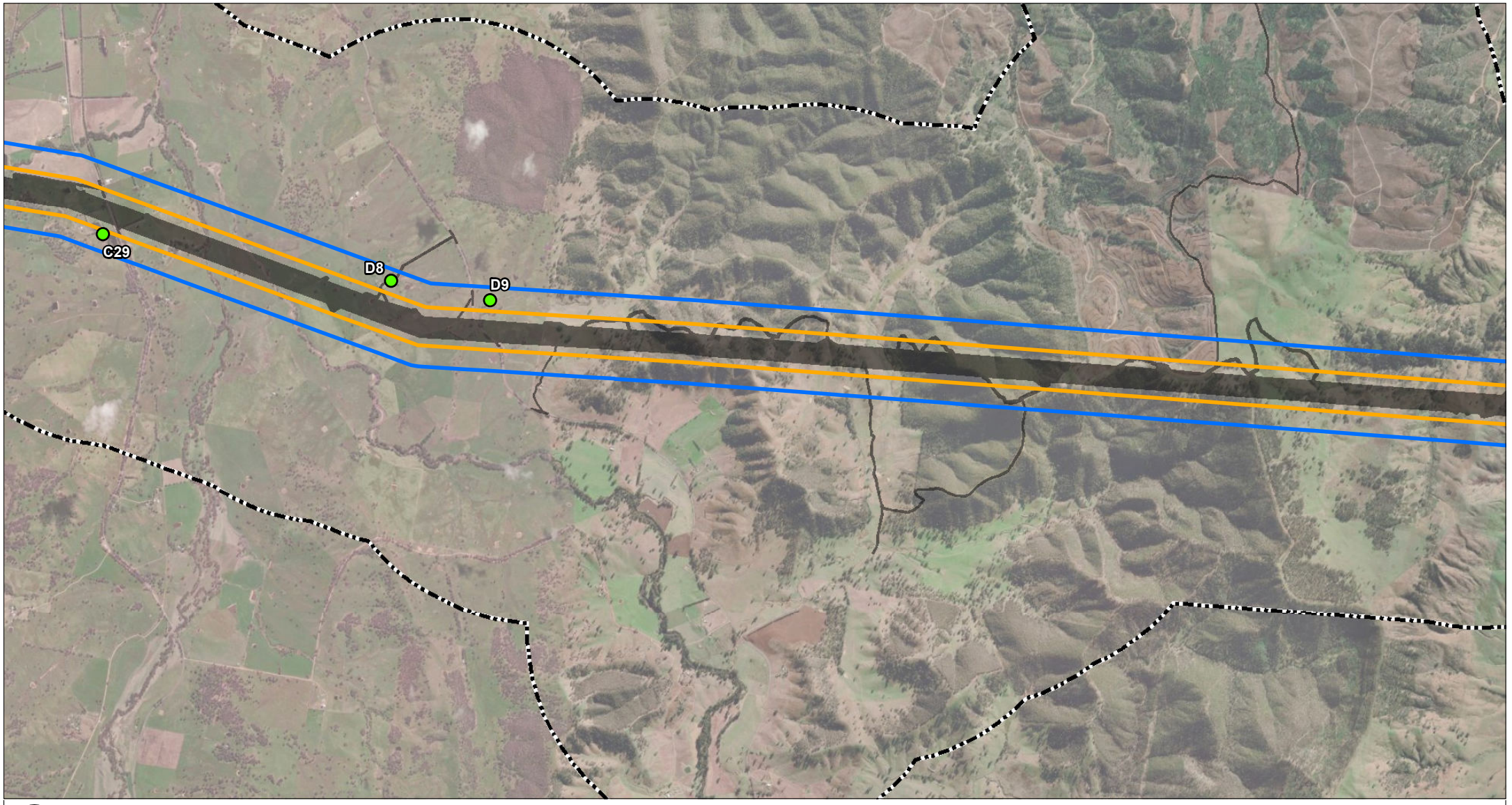

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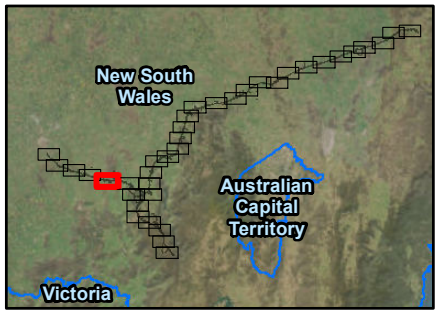

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
Page 5 of 37

ATTACHMENT J

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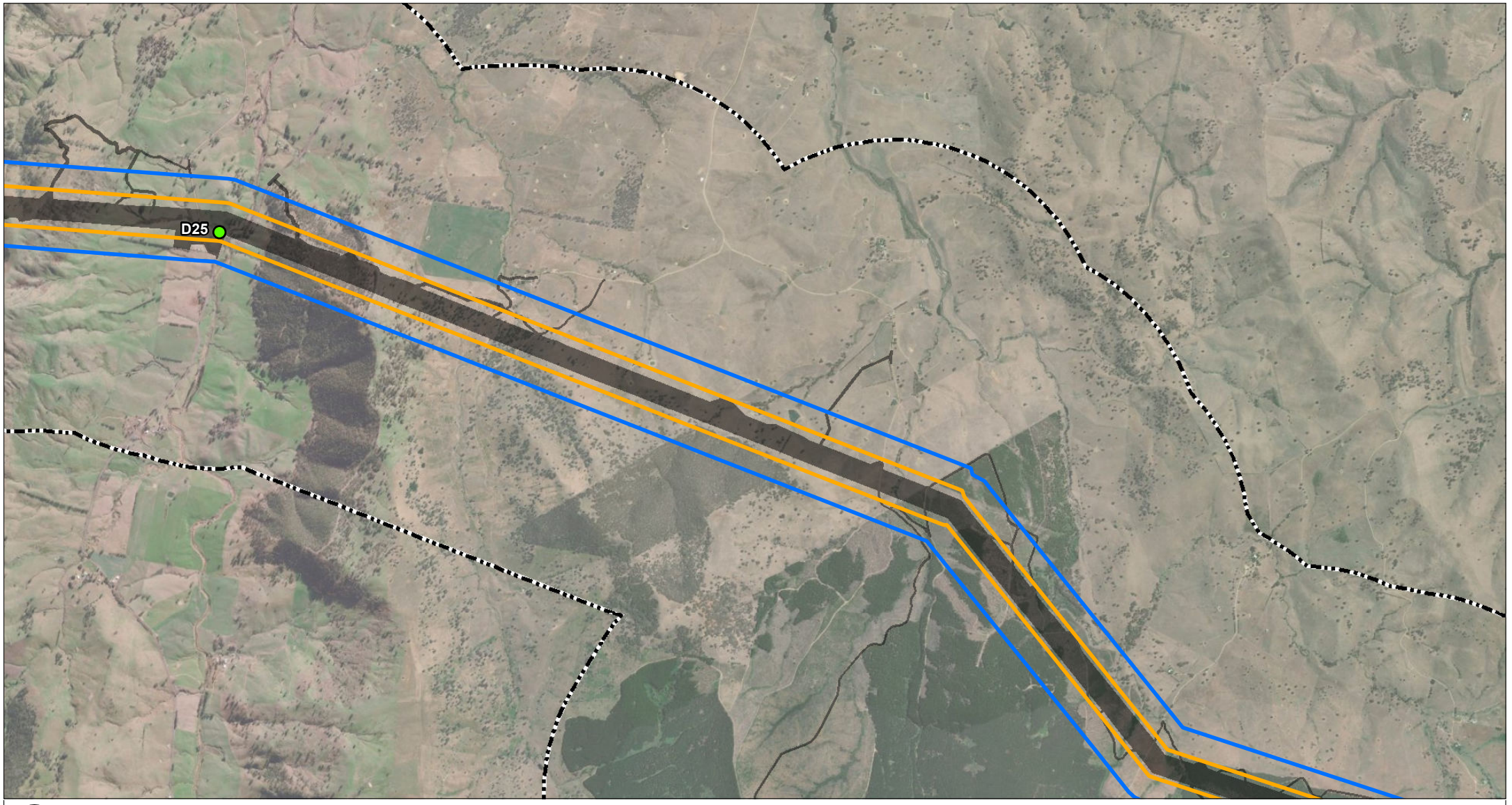

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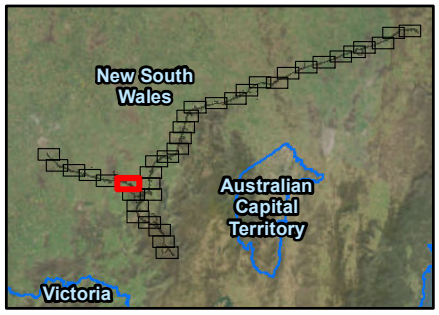

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts

ATTACHMENT J

0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
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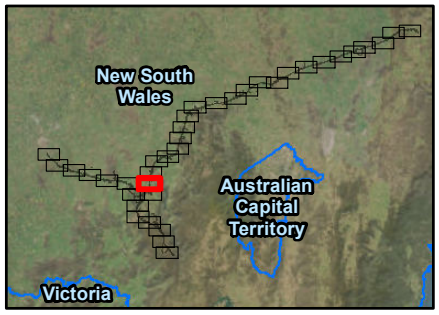

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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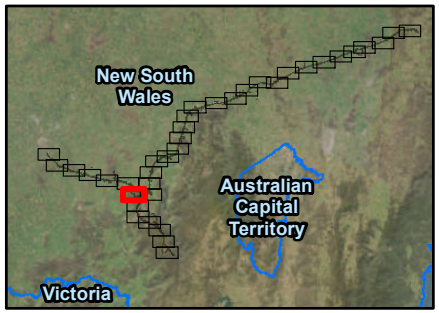

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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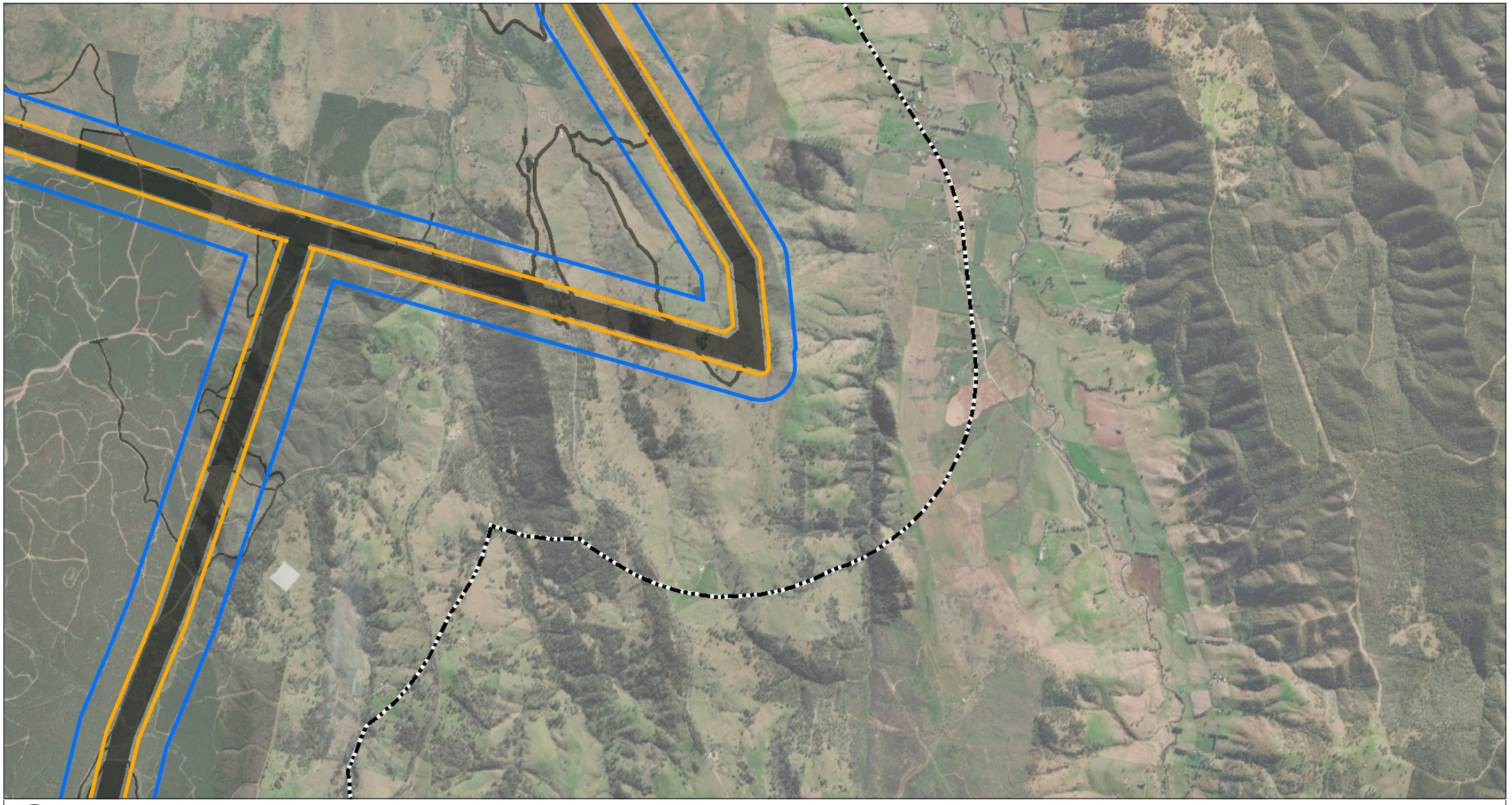

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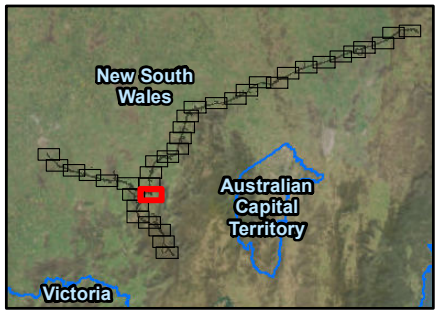

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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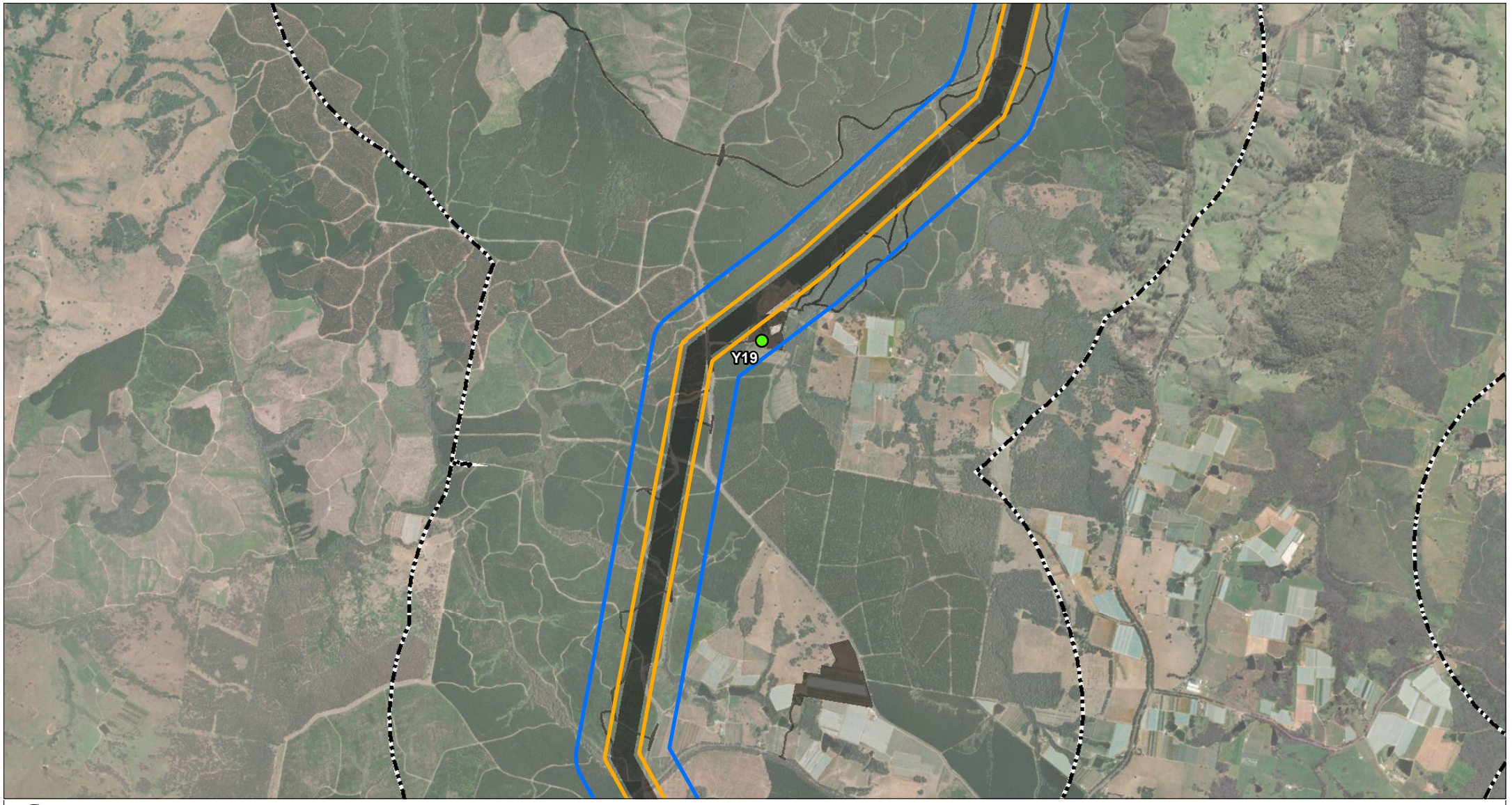

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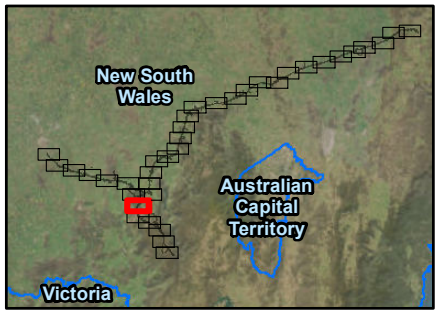

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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Potentially impacted receivers

Typical fair weather transmission line noise impact zone

Worst-case L50 (light rain or mist) transmission line noise impact zone

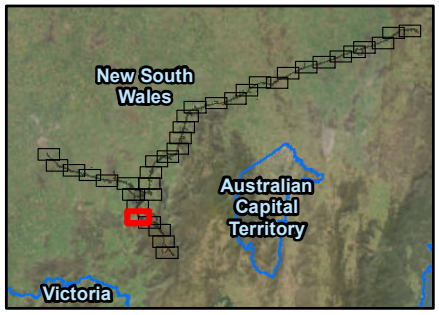
Population centre

Amended study area

Project components

Substation

Amended project footprint



HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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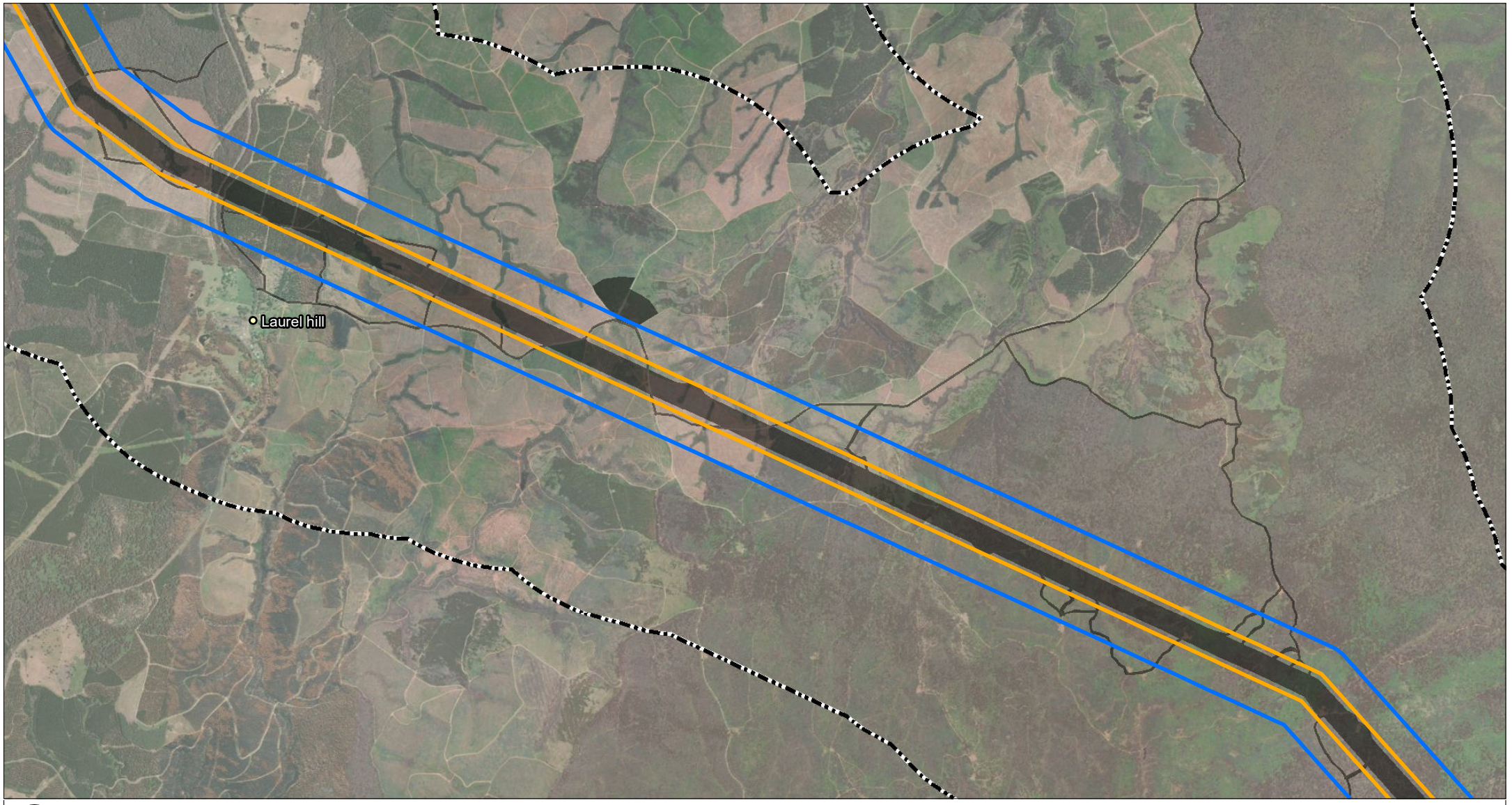

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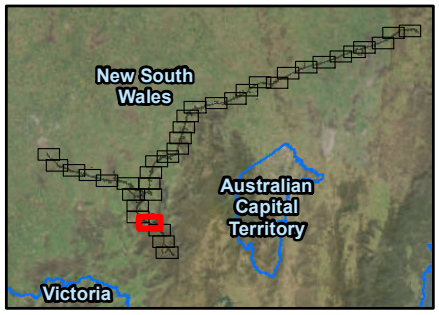

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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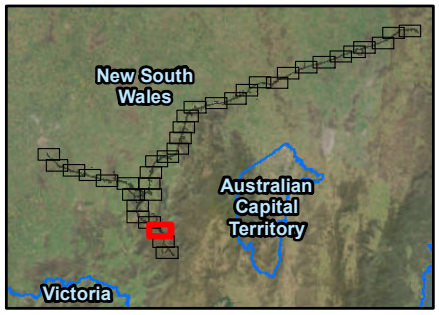

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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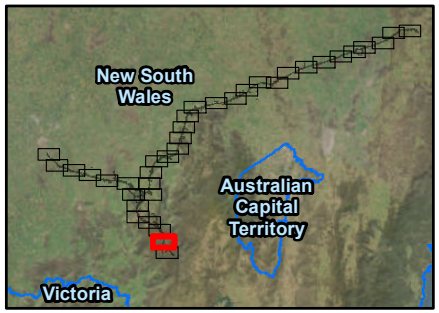

HUMELINK
NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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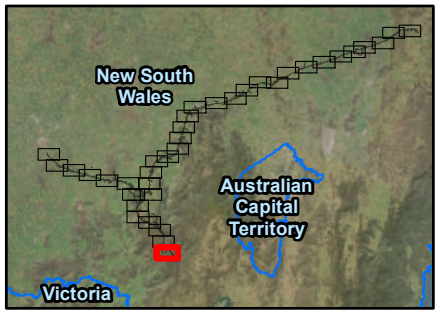

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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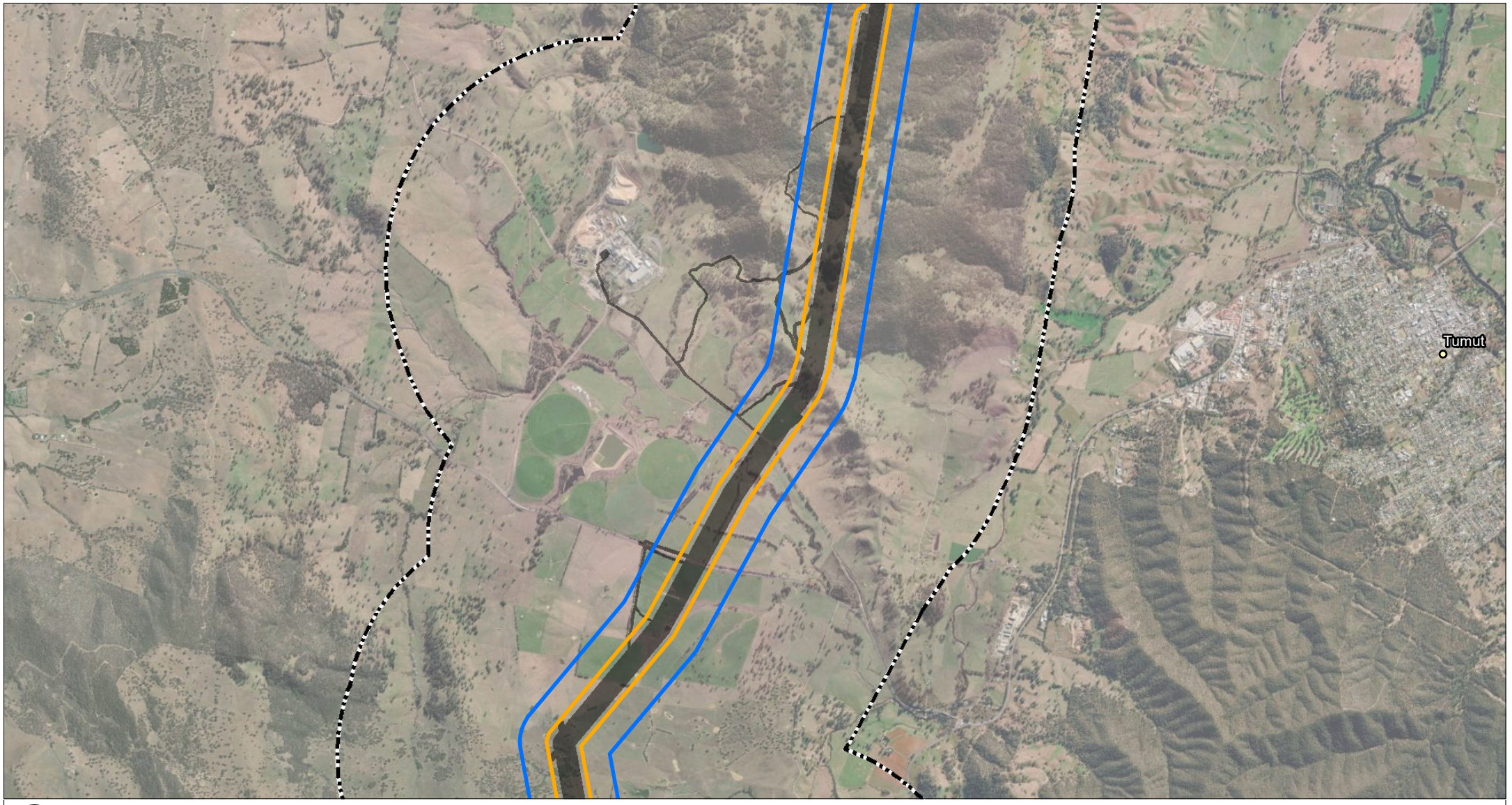


0 250 500 1,000 Metres

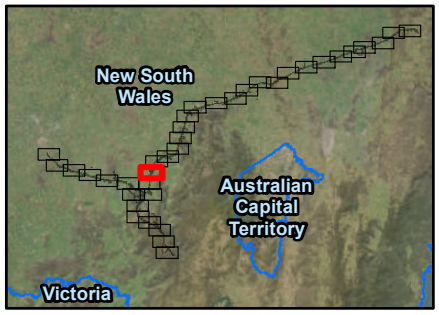
Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	08-Mar-2024
Drawn by:	JG

SLR

- Potentially impacted receivers
- Typical fair weather transmission line noise impact zone
- Worst-case L50 (light rain or mist) transmission line noise impact zone
- Population centre
- Amended study area

Project components

- Substation
- Amended project footprint



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Night-time Cumulative Transmission Line Operational Noise Impacts
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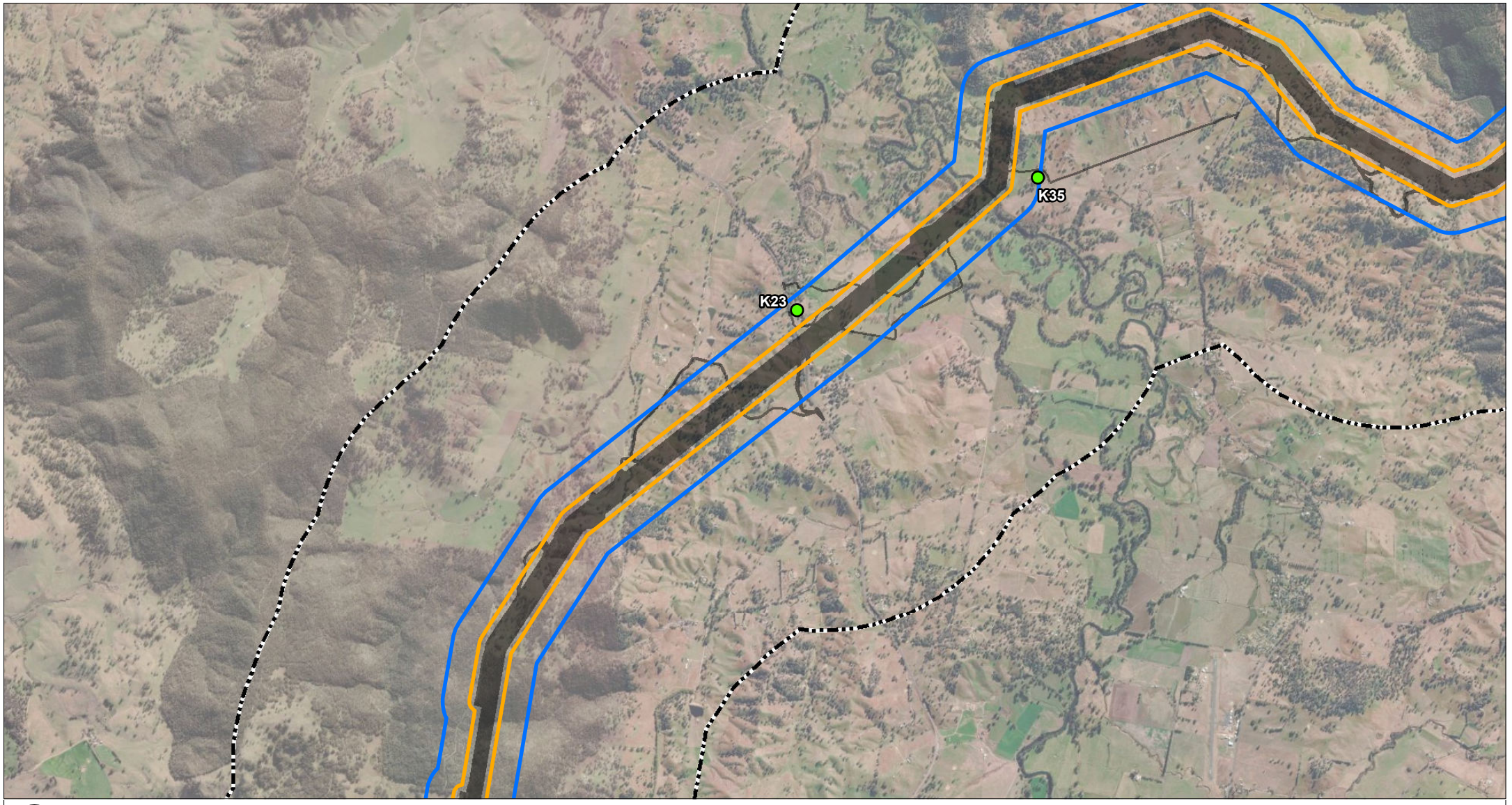

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Project Number:	610.30622
Date:	08-Mar-2024
Drawn by:	JG

Potentially impacted receivers

Typical fair weather transmission line noise impact zone

Worst-case L50 (light rain or mist) transmission line noise impact zone

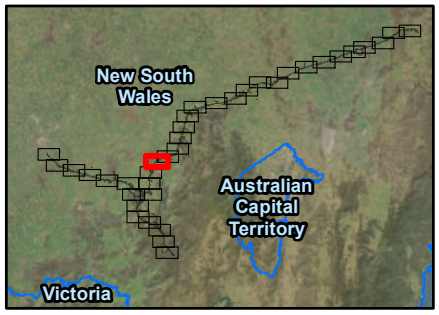
Population centre

Amended study area

Project components

Substation

Amended project footprint



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Night-time Cumulative Transmission Line Operational Noise Impacts
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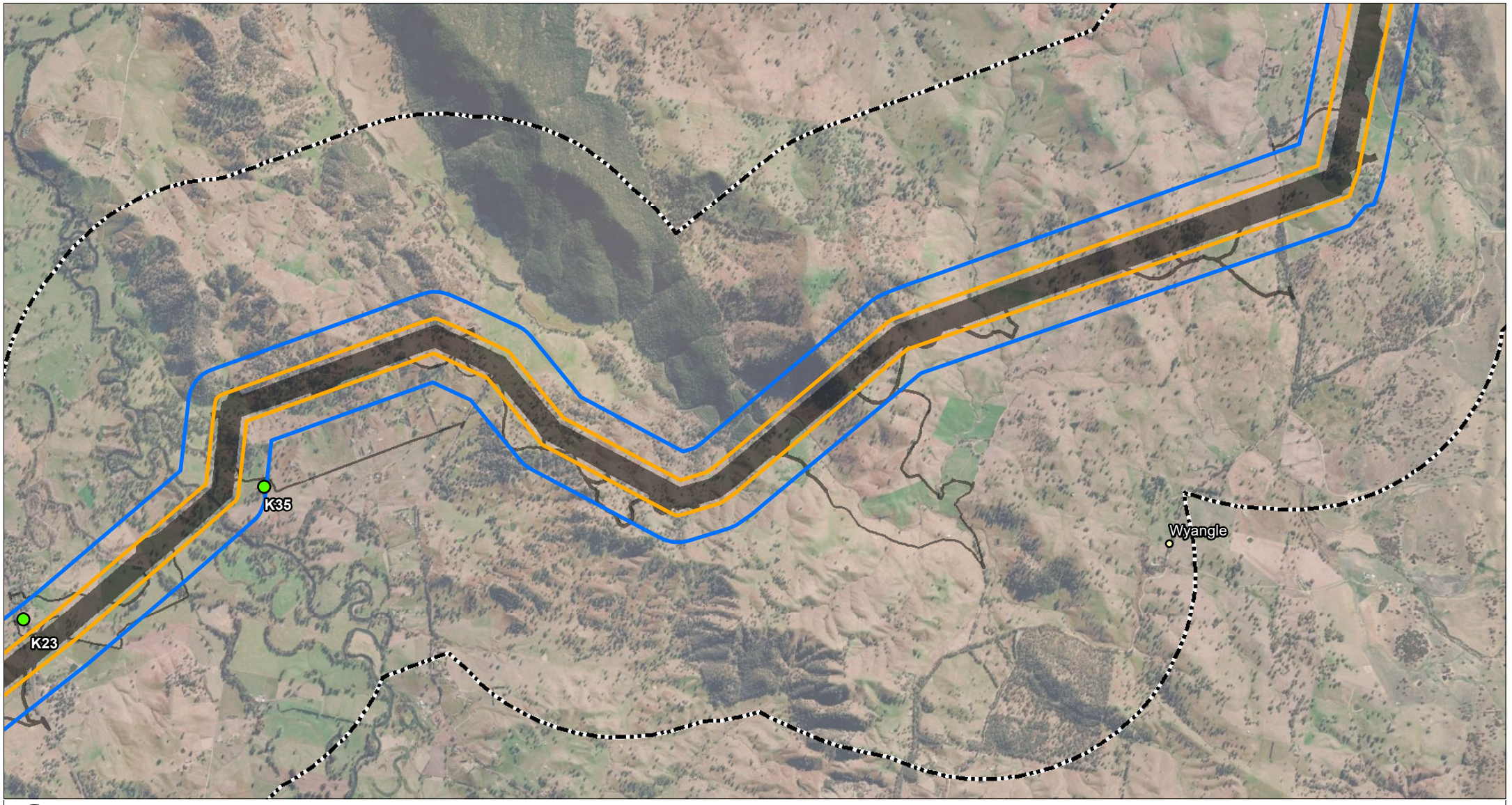

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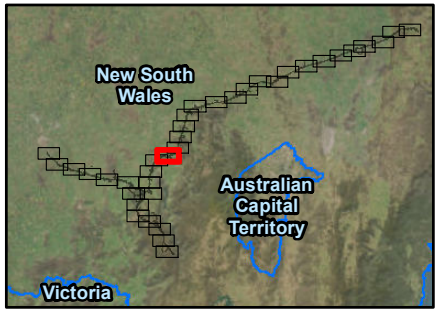

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts

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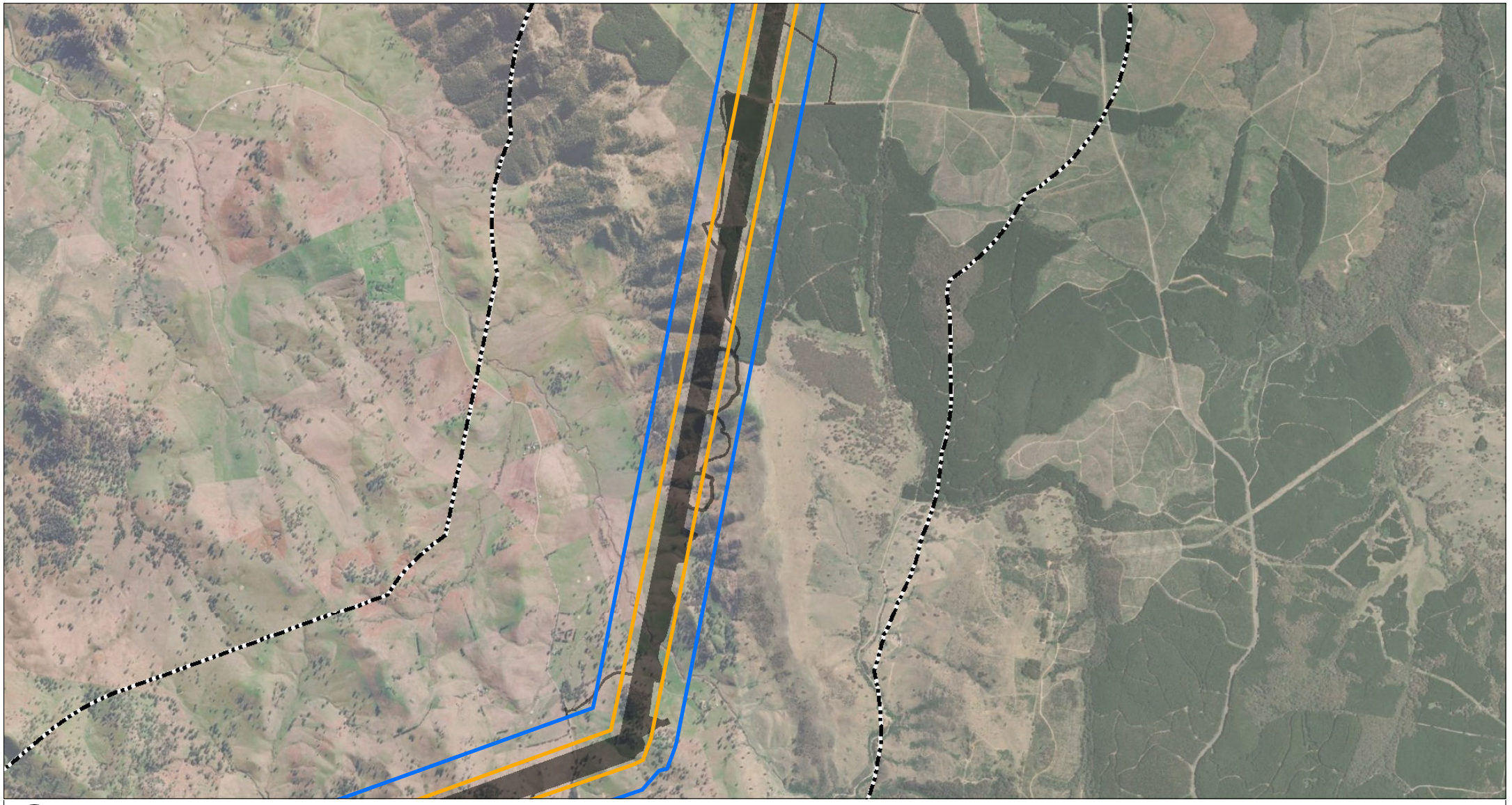

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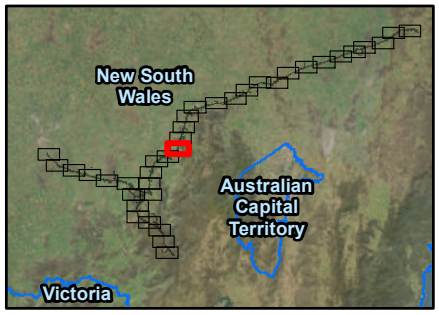

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Night-time Cumulative Transmission Line Operational Noise Impacts

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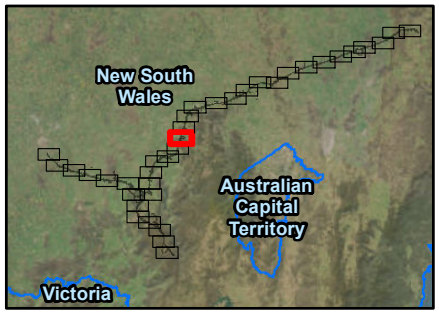

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts

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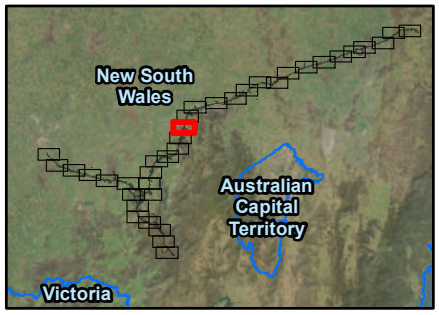

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Night-time Cumulative Transmission Line Operational Noise Impacts
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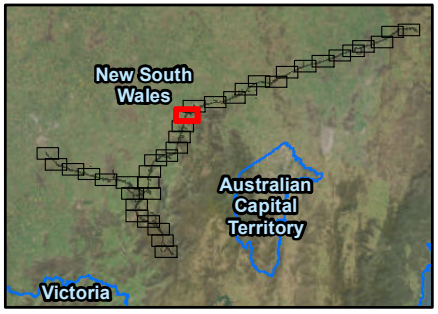

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Night-time Cumulative Transmission Line Operational Noise Impacts
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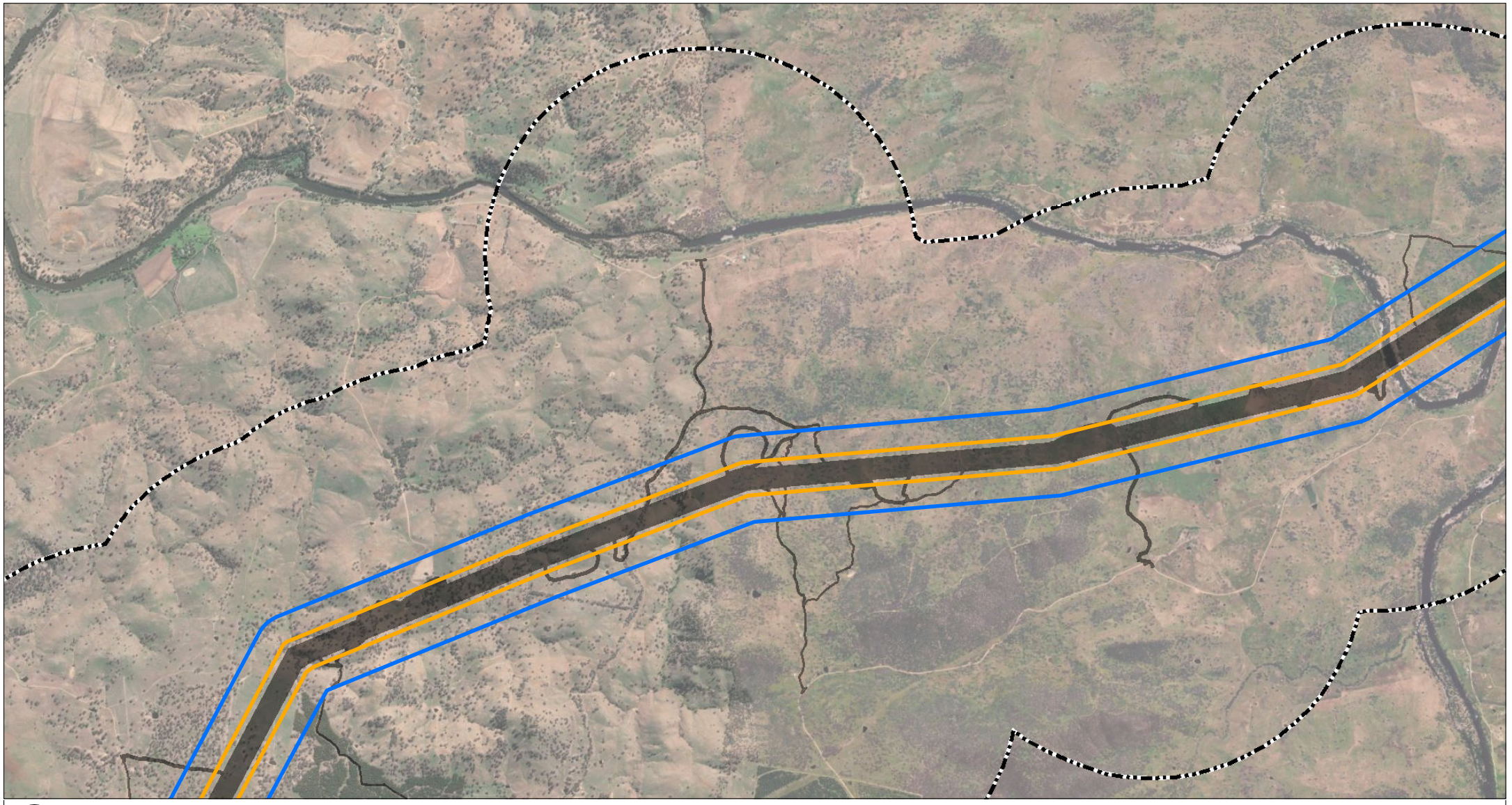

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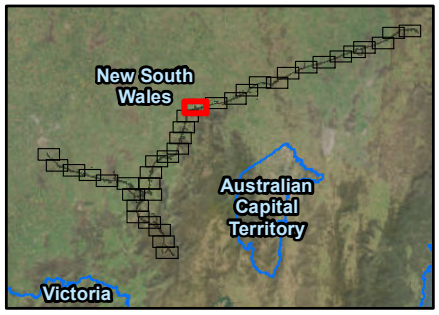

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Night-time Cumulative Transmission Line Operational Noise Impacts
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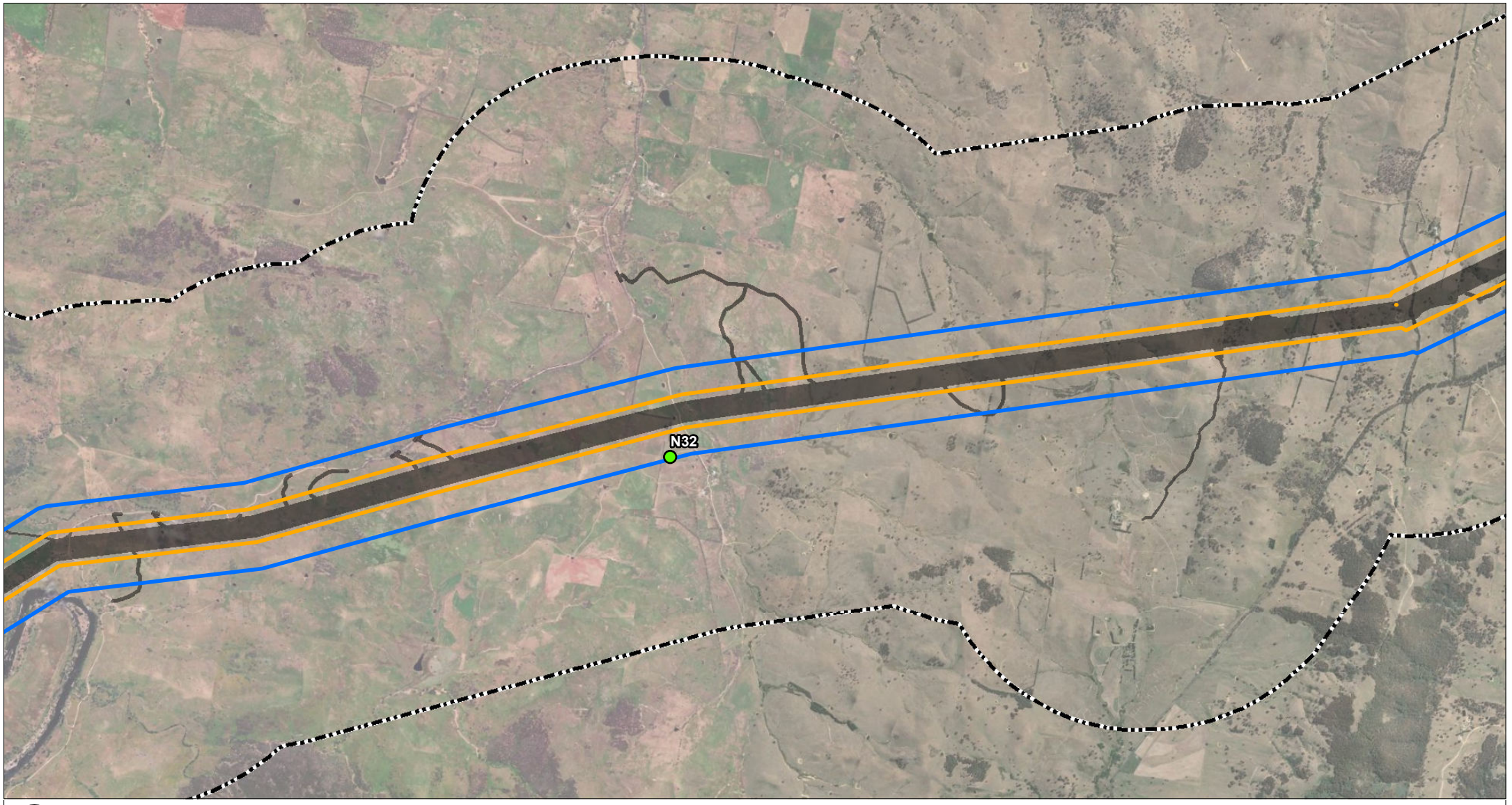

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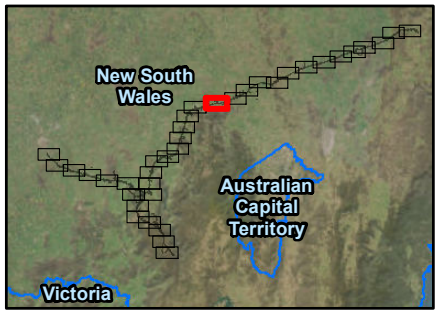

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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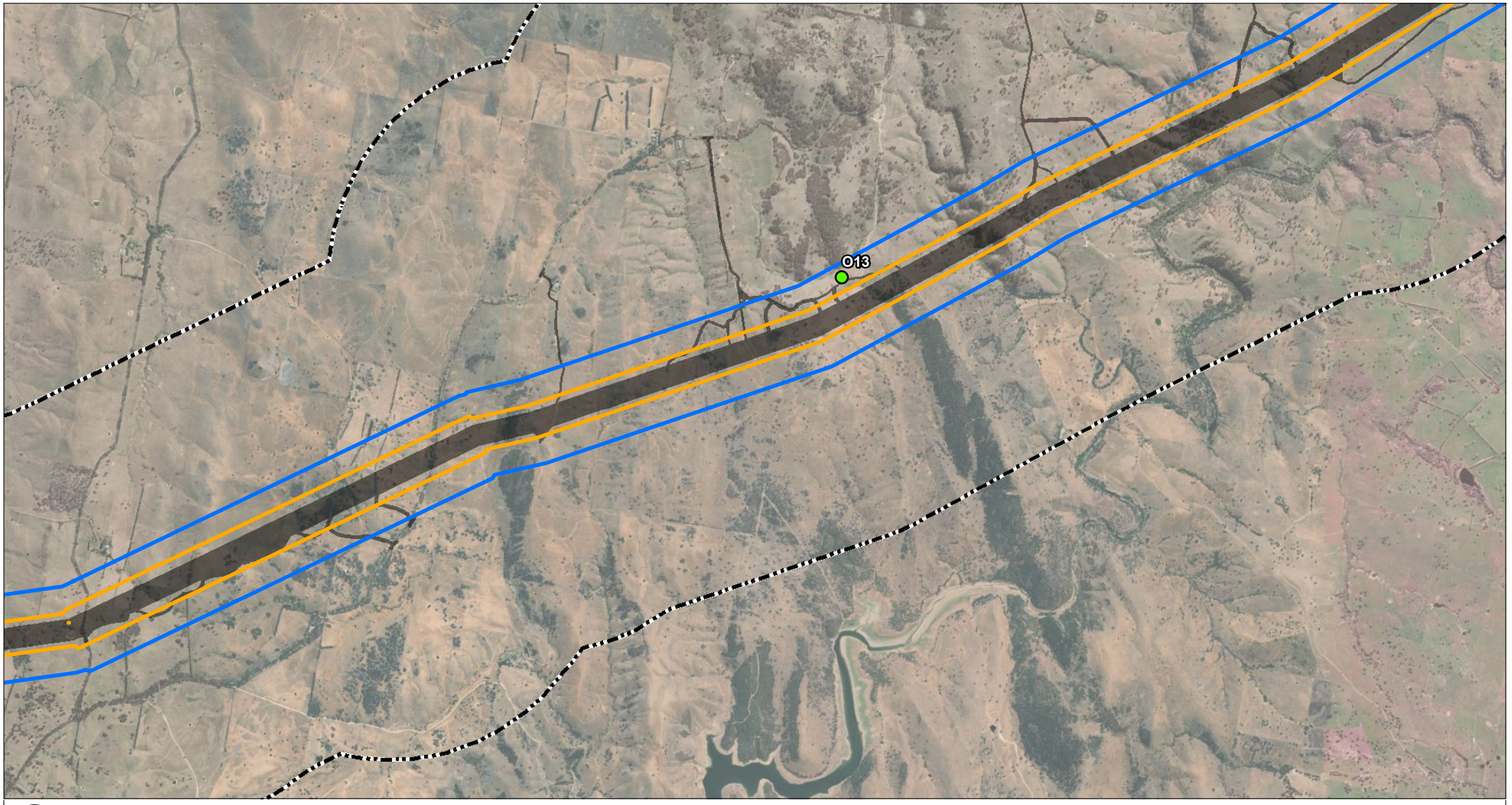

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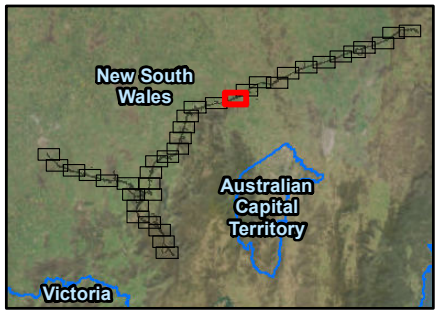

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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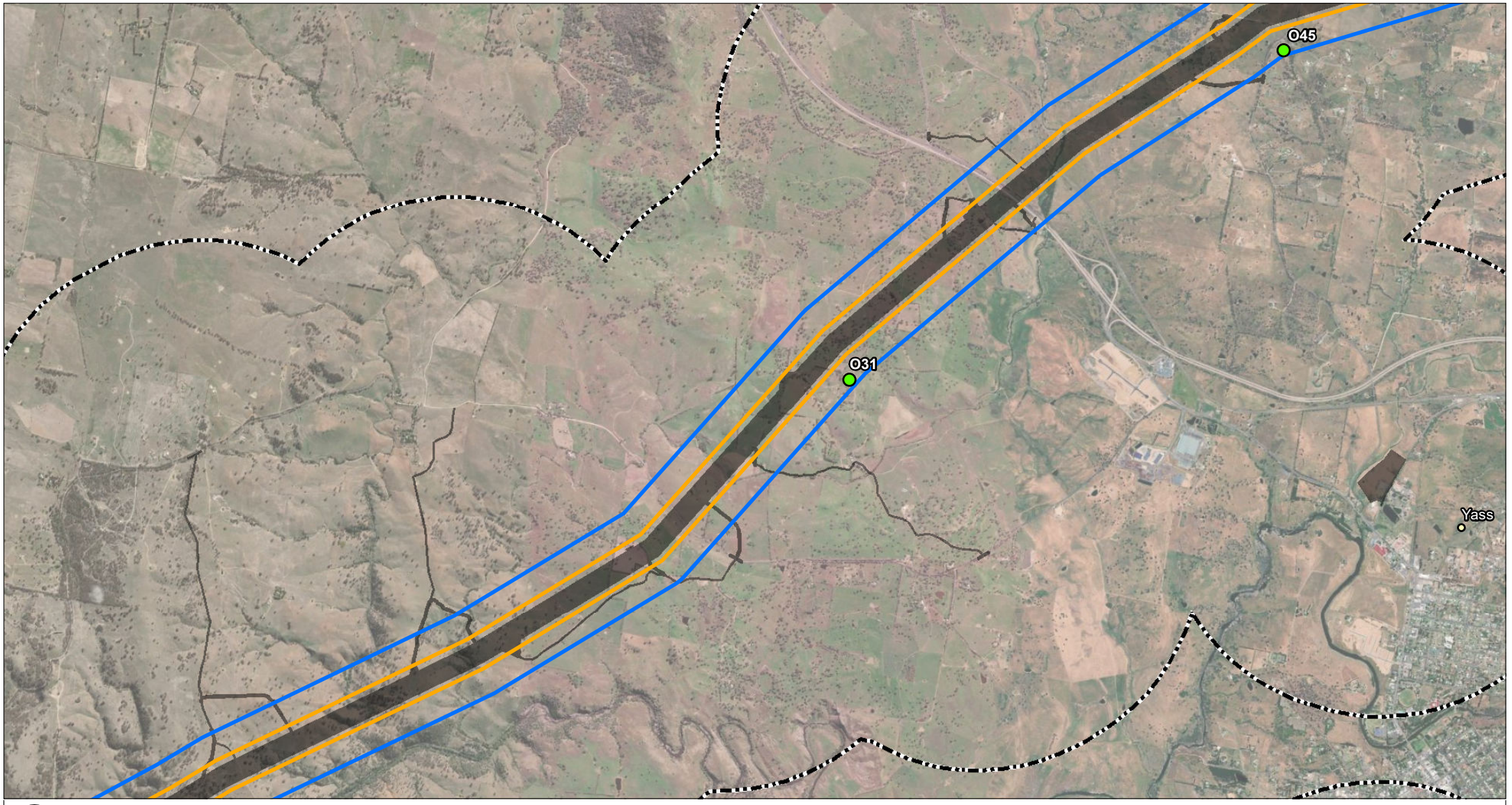

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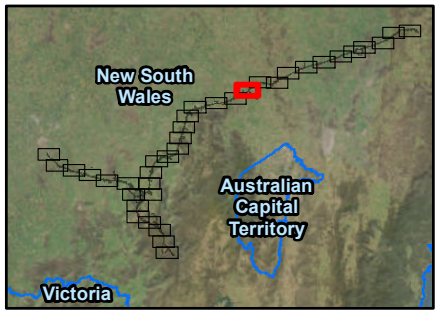

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Night-time Cumulative Transmission Line Operational Noise Impacts
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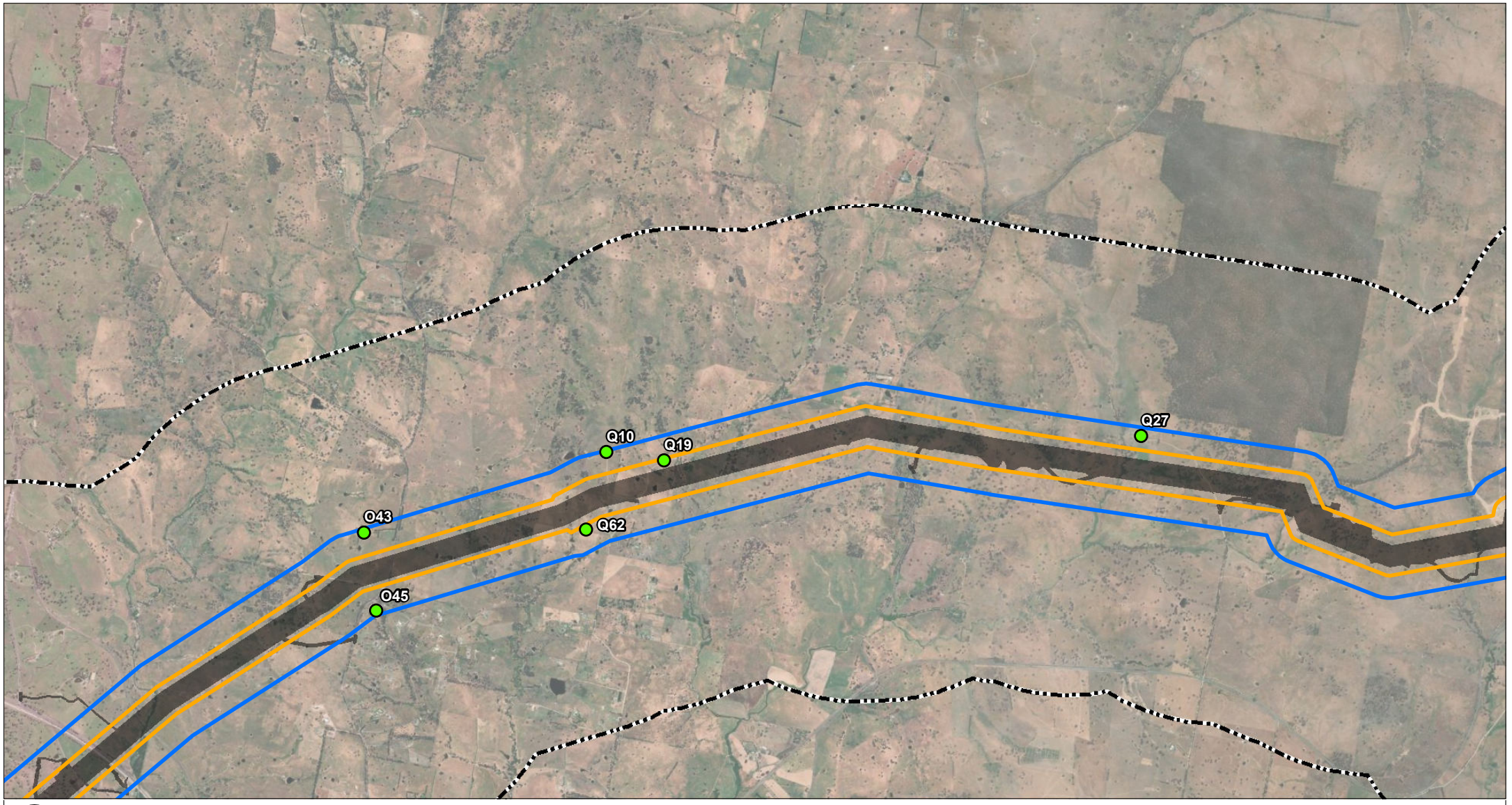

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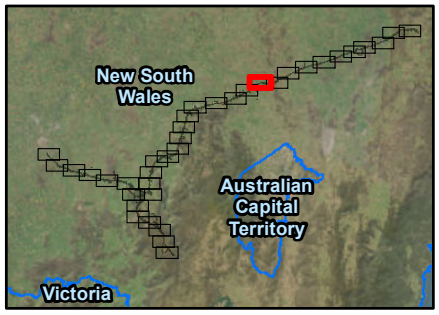

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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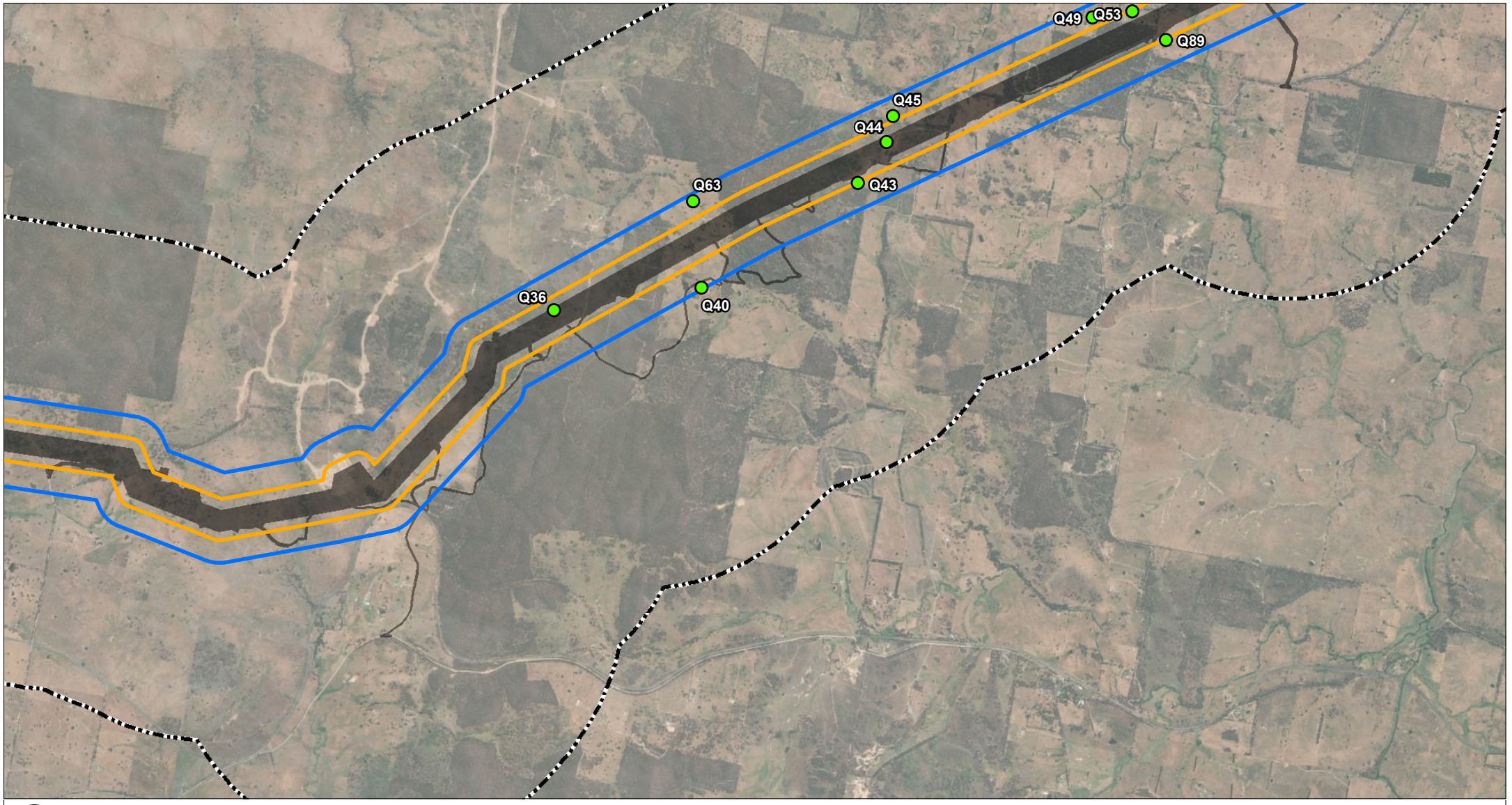

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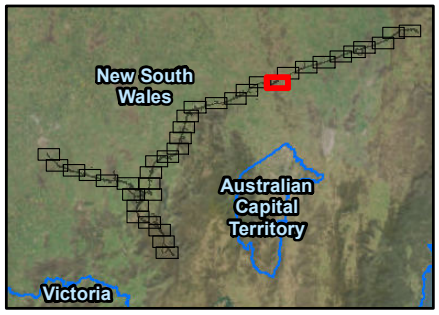

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NOISE AND VIBRATION IMPACT ASSESSMENT

Night-time Cumulative Transmission Line Operational Noise Impacts
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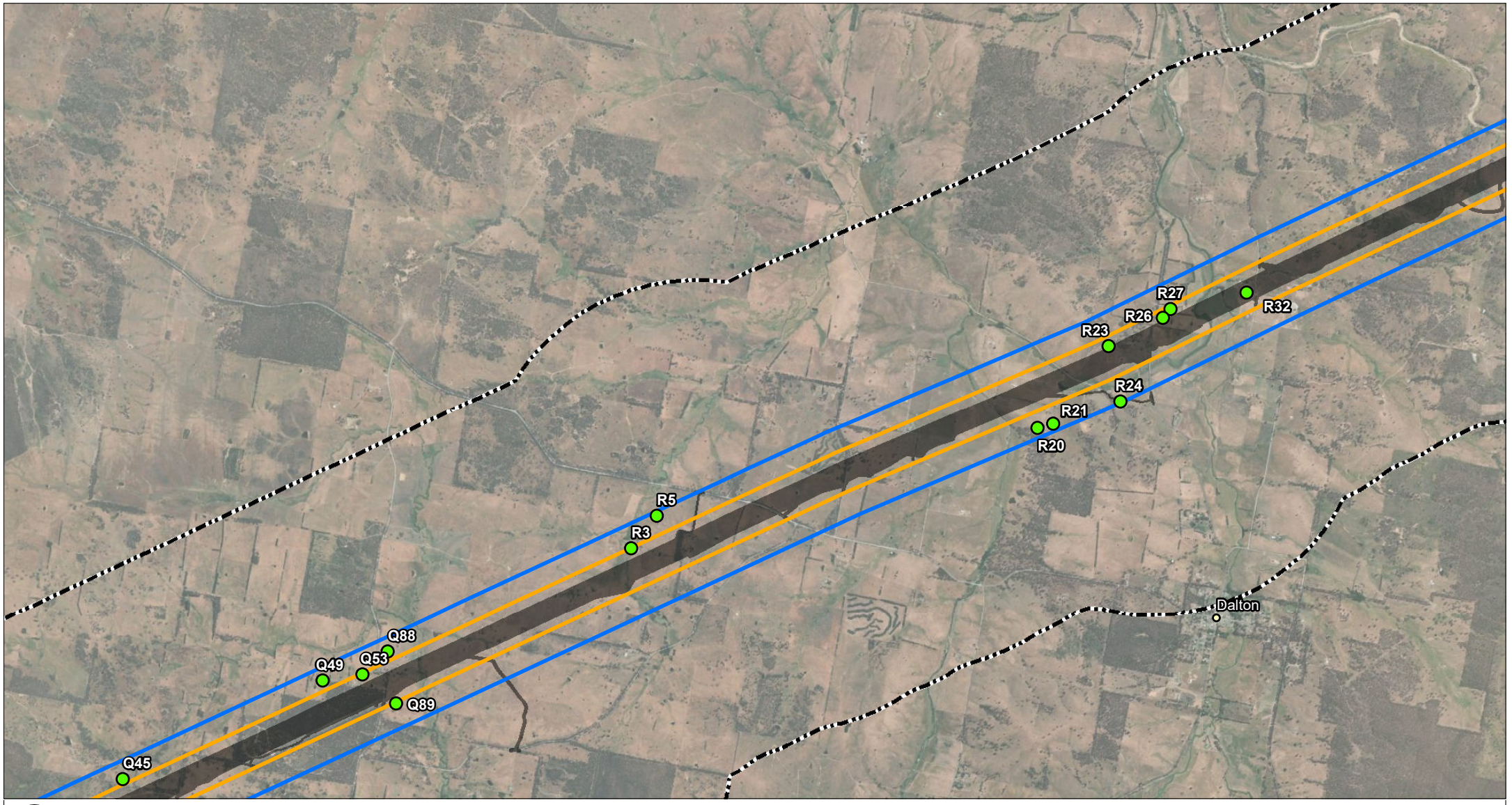

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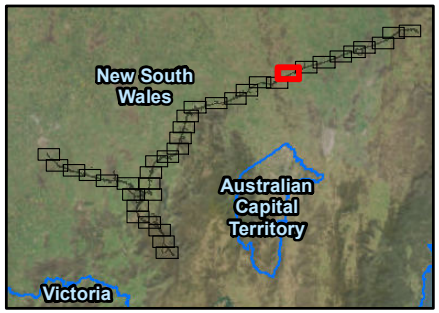

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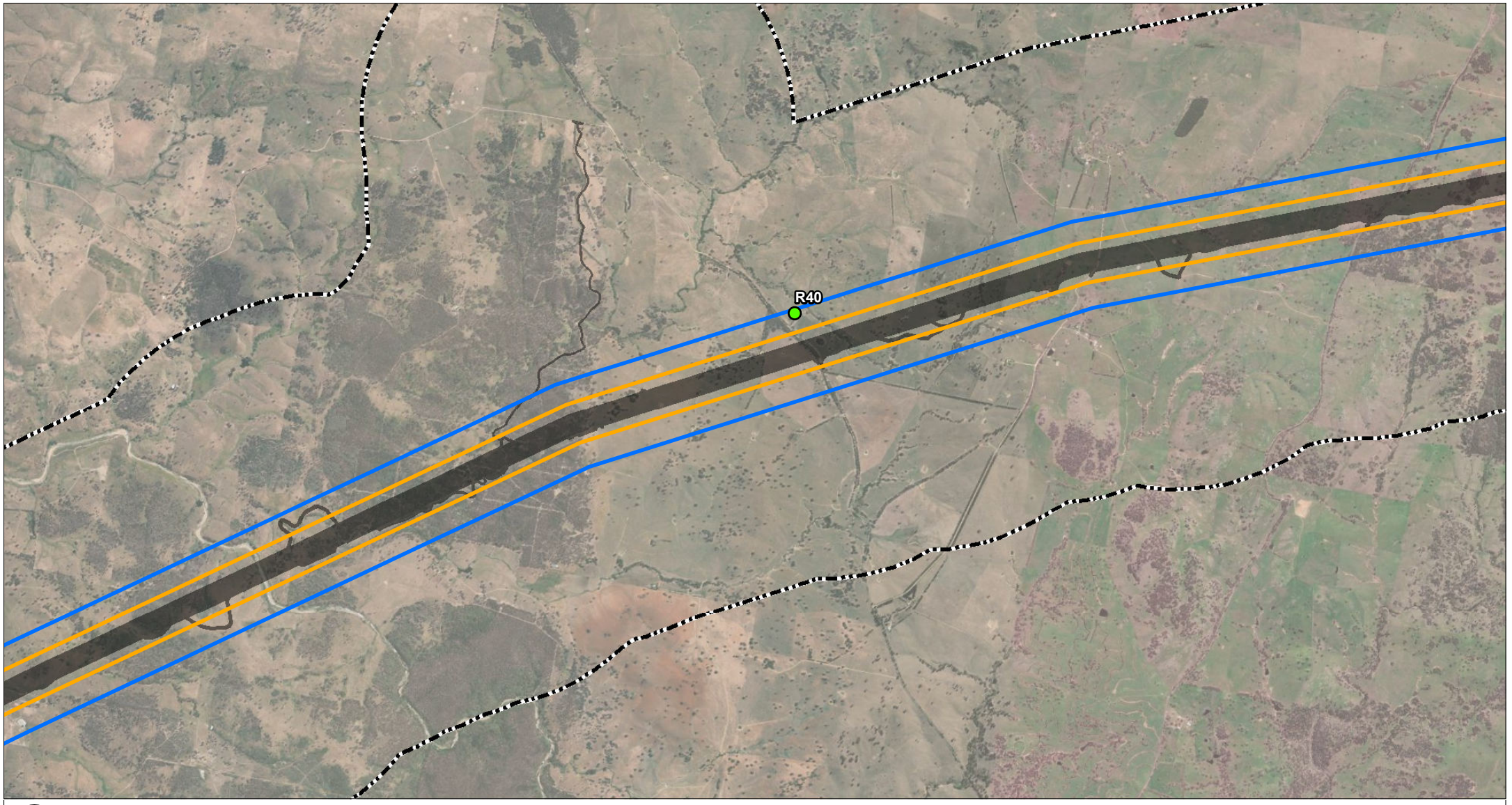

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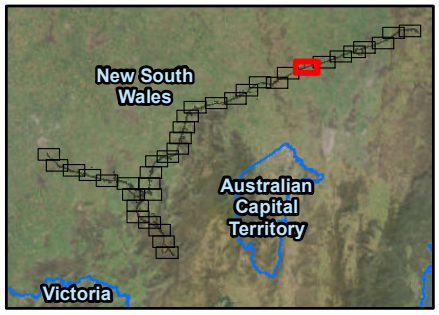

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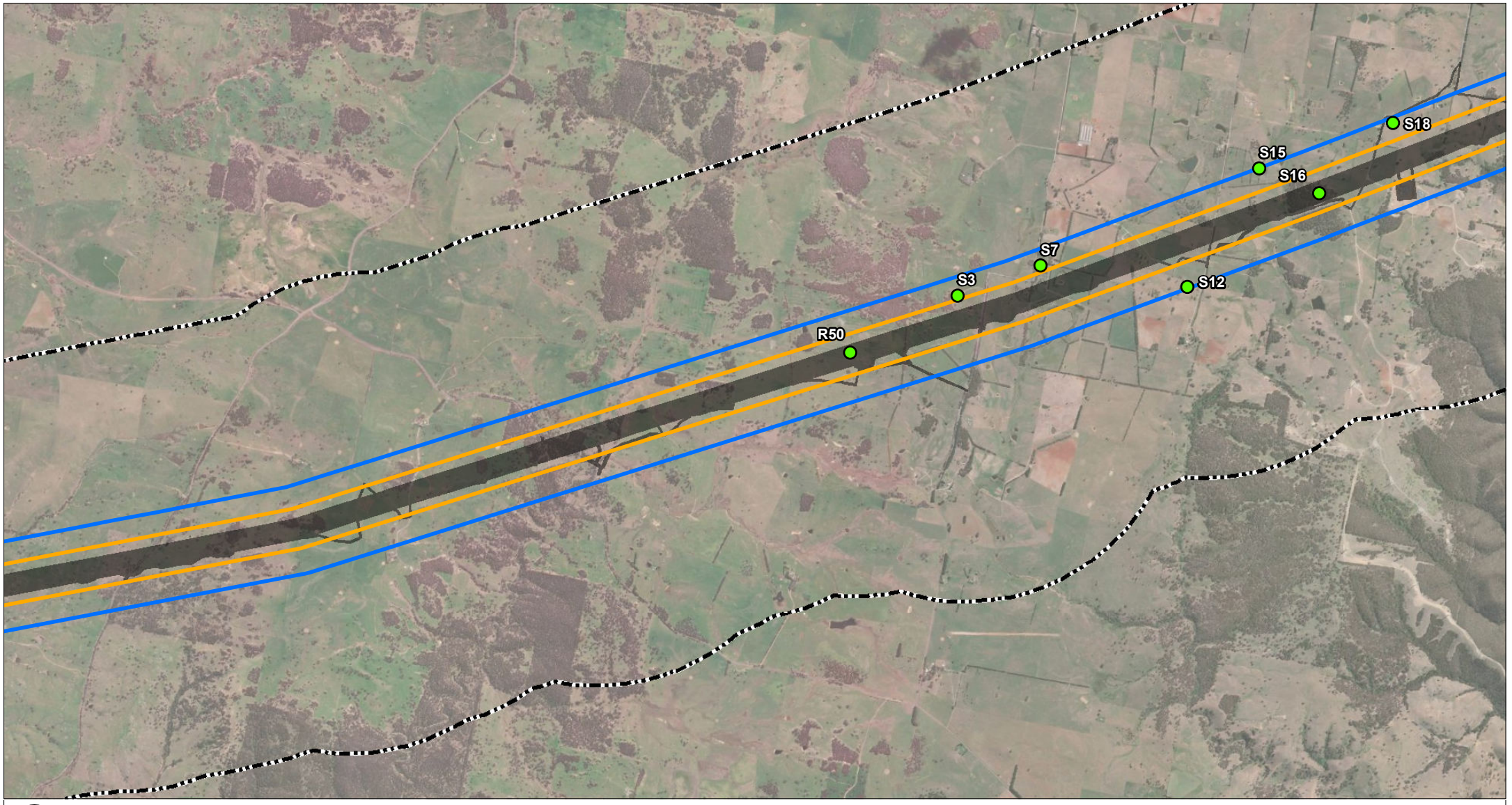

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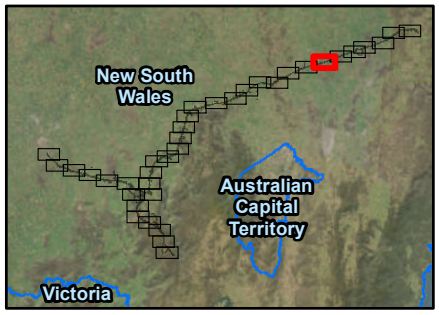

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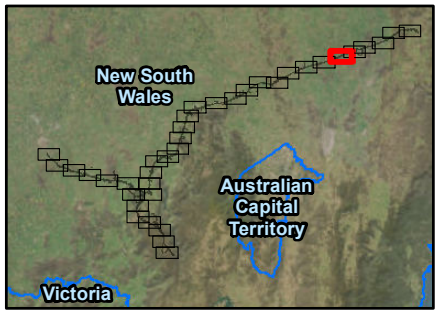

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Night-time Cumulative Transmission Line Operational Noise Impacts
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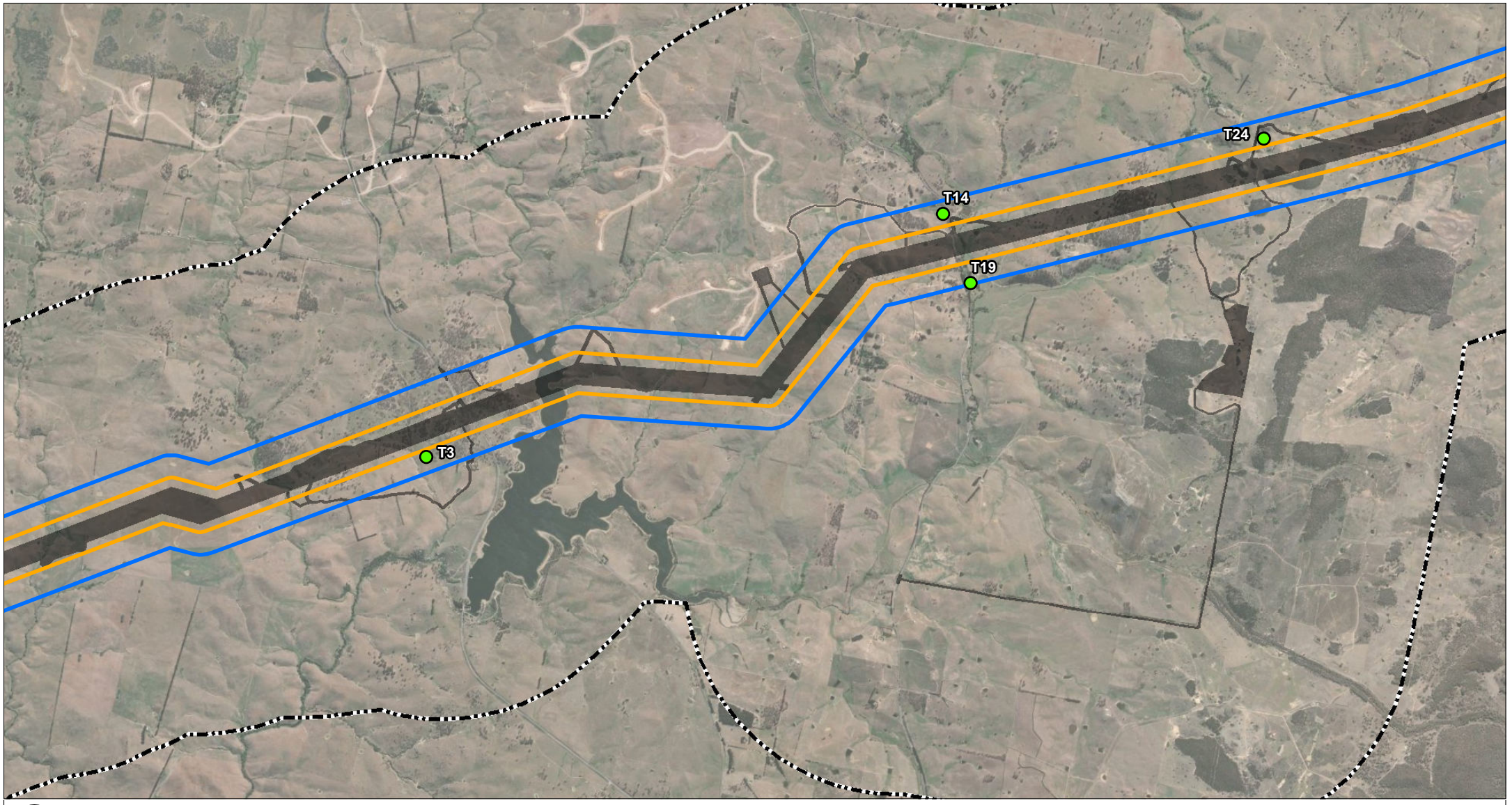
\\au.slr.local\corporate\Projects-SLR\610-SrvSYD\610-SYD\610.30622.00000 HumeLink EIS AV AQ\06 SLR Data\01 CADGIS\GIS\AV\61030622 AV Noise Impact_AttachmentJ_Operation Noise.mxd



0 250 500 1,000 Metres

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	610.30622
Date:	08-Mar-2024
Drawn by:	JG

SLR

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- Substation
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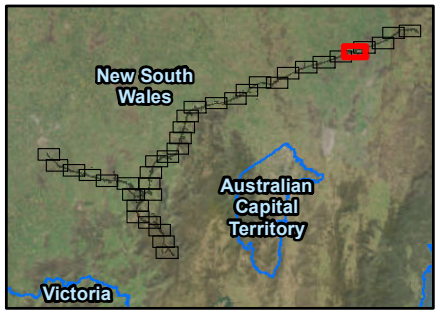

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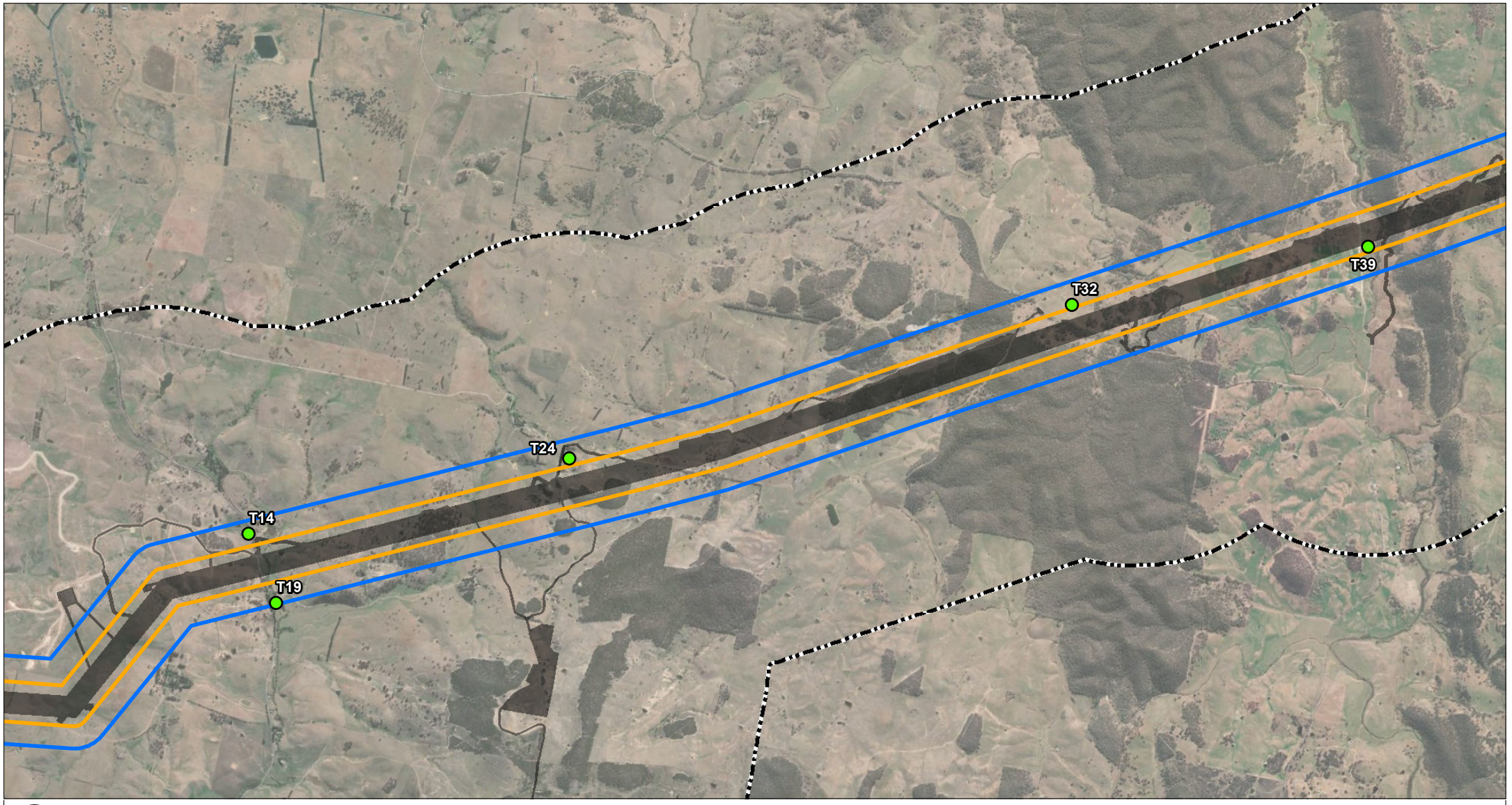

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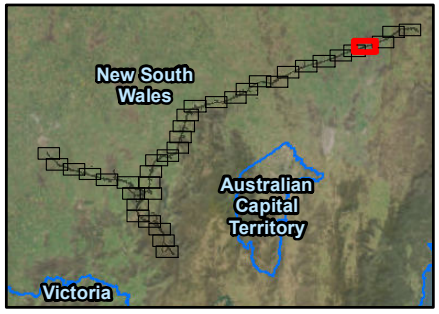

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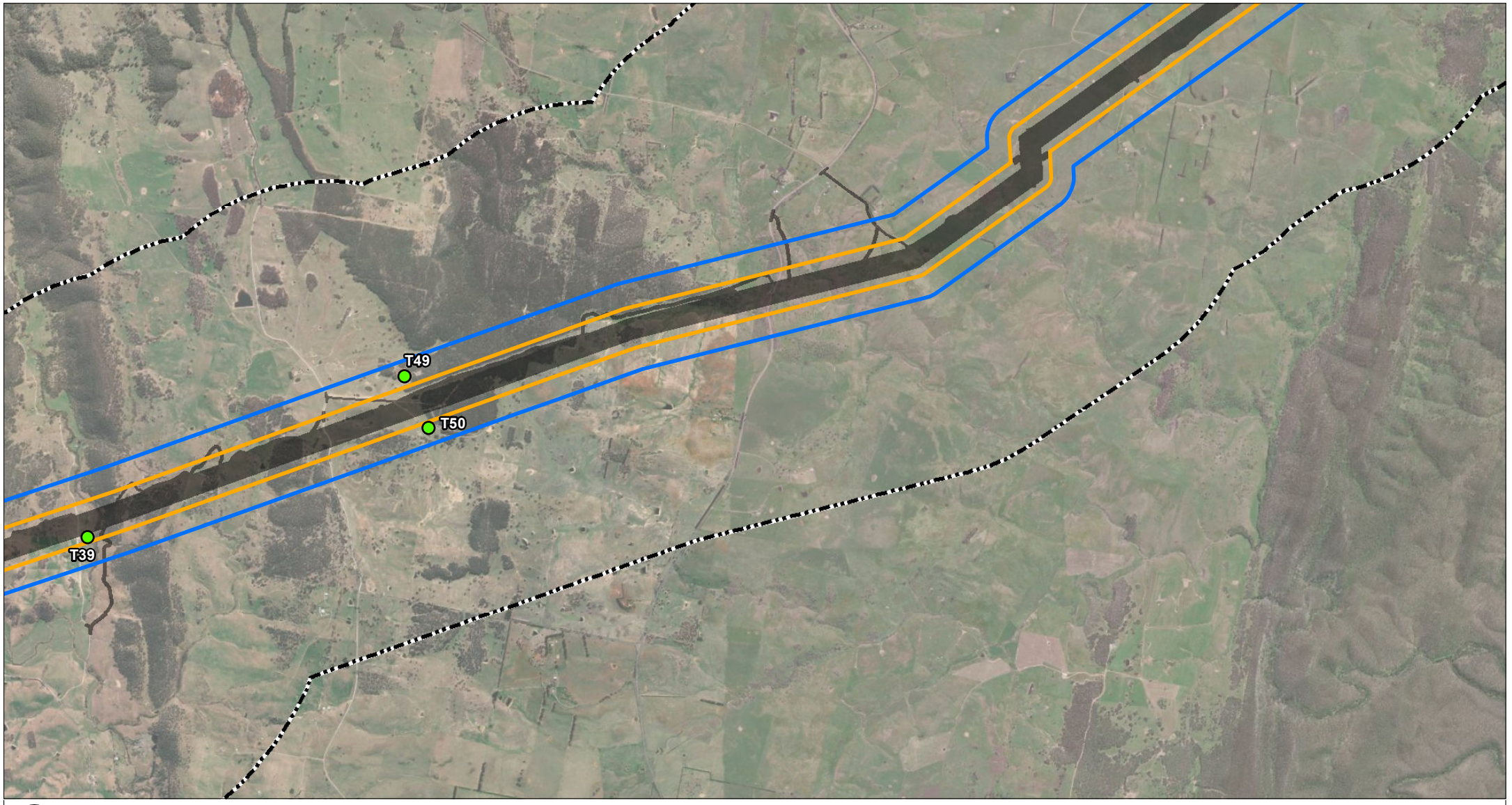

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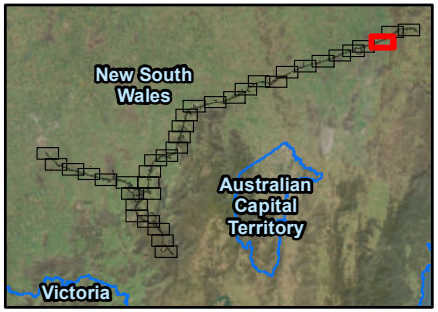

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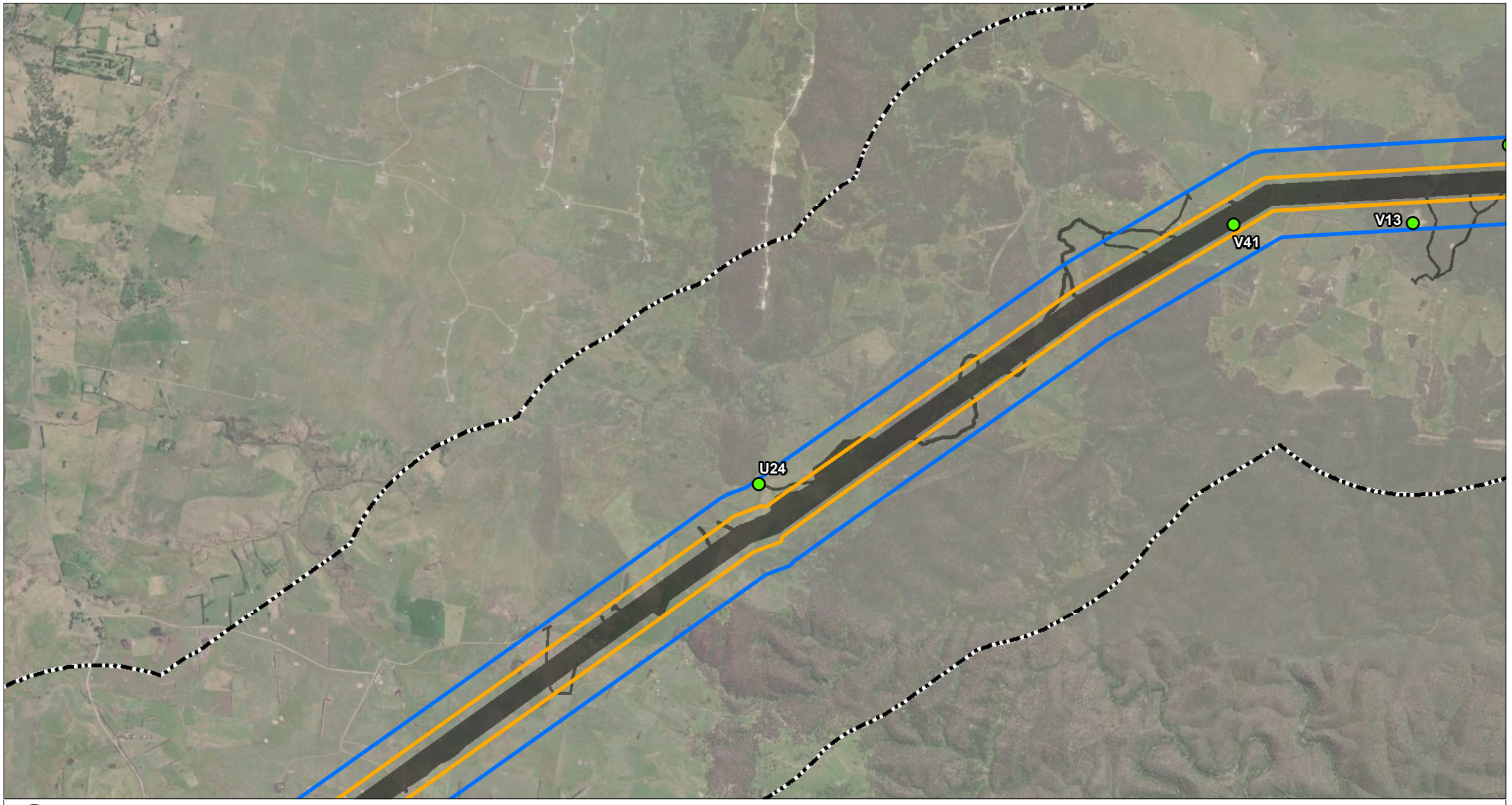

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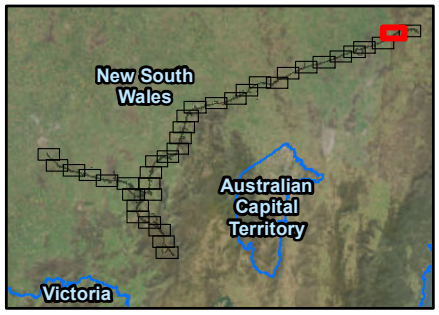

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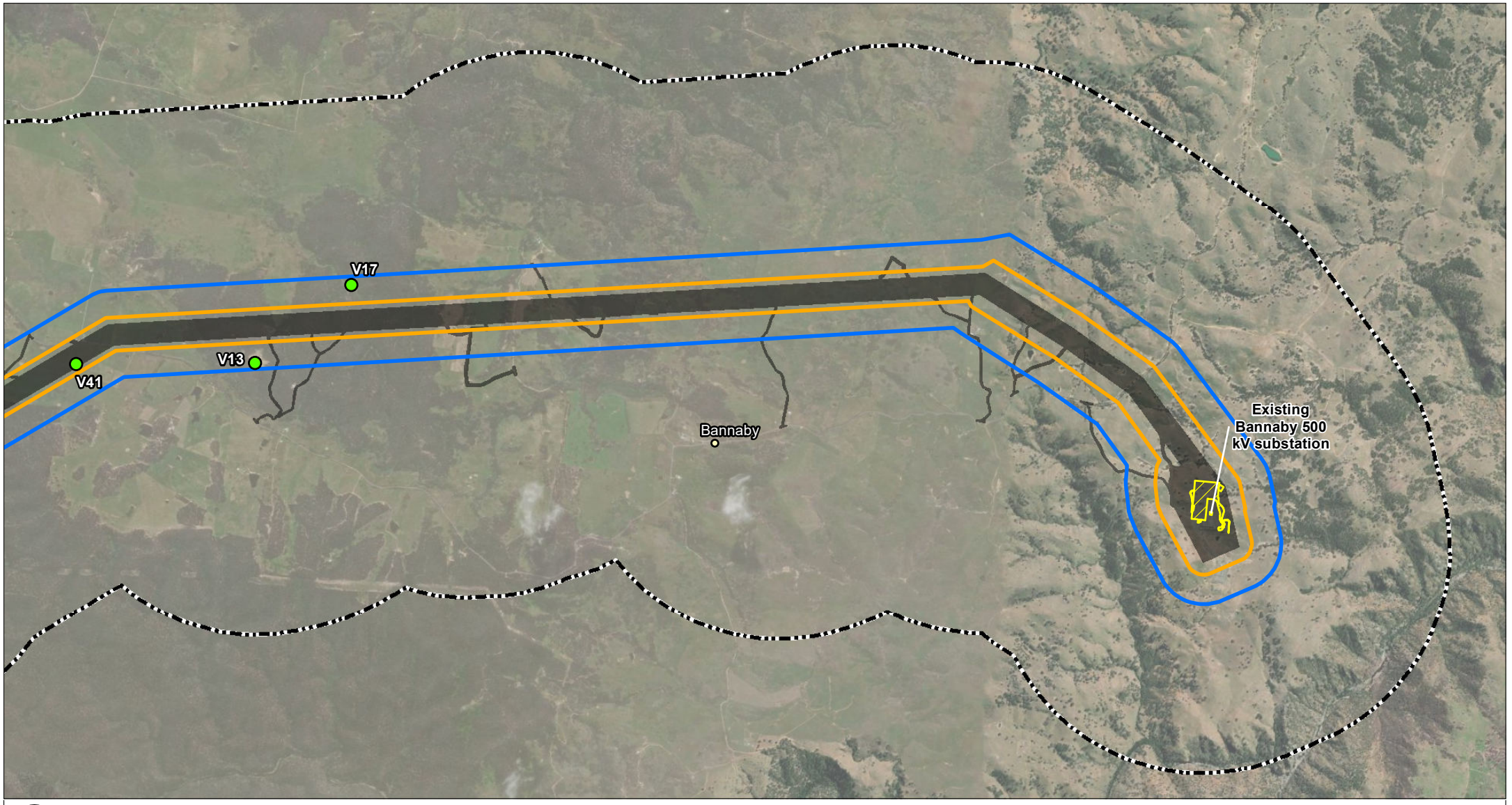

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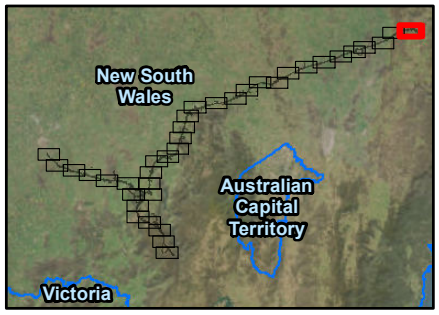

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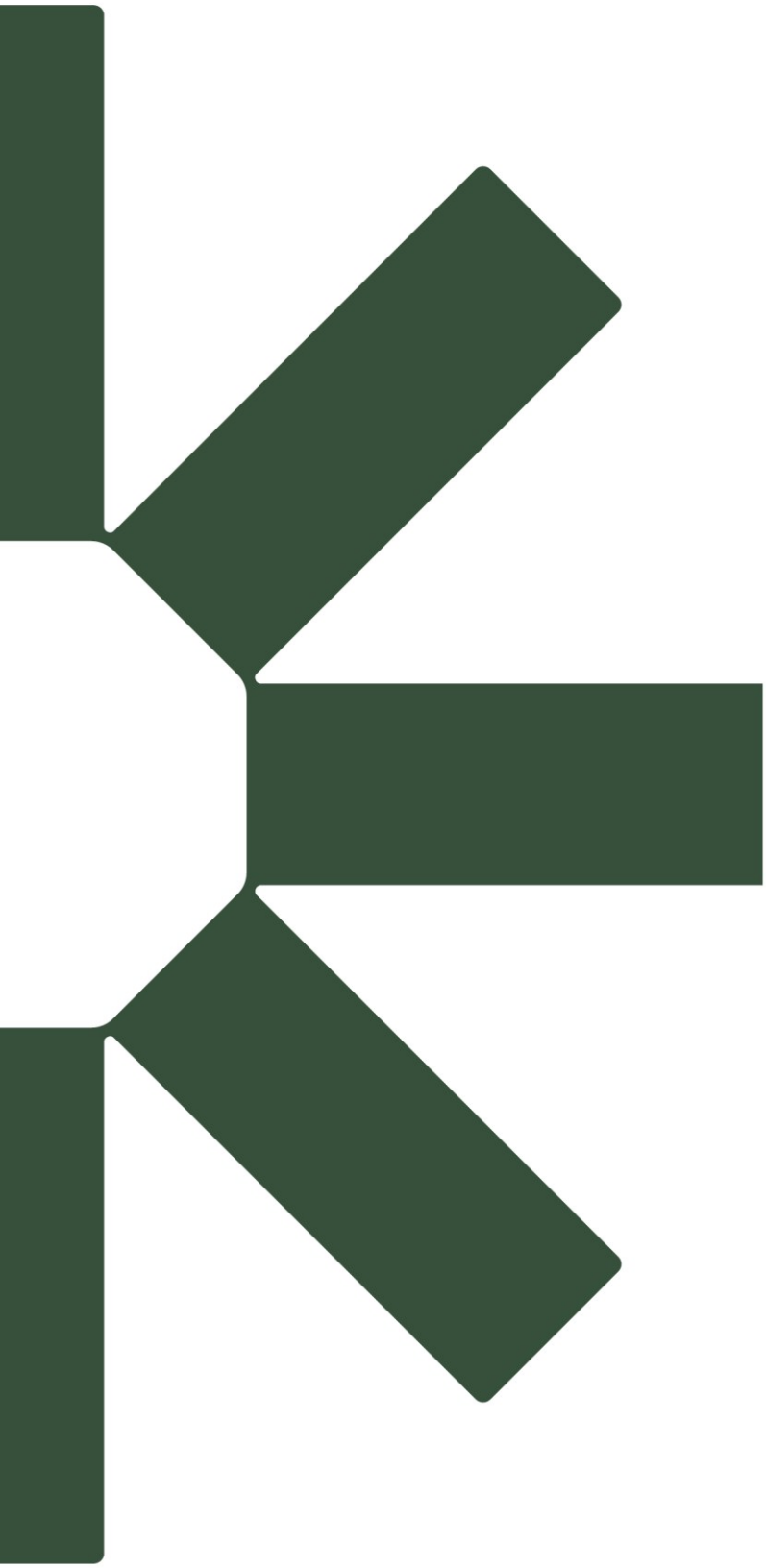
Significance of potential operation transmission line noise impacts

Receiver ID	Potential transmission line operational noise impact significance[1]			
	Amended project only		Cumulative (amended project and existing)	
	Fair weather	L50 (light rain or mist)	Fair weather	L50 (light rain or mist)
A120	-	-	-	Negligible
A29	-	Moderate	-	Moderate
A33	-	-	-	Negligible
A38	-	Moderate	-	Significant
A40	-	Significant	-	Significant
A41	Negligible	Significant	Negligible	Significant
A51	-	Minor	-	Significant
A60	-	Negligible	-	Negligible
A66	-	-	-	Negligible
A67	-	Negligible	-	Minor
A69	-	-	-	Negligible
A73	-	Minor	-	Significant
A78	-	Negligible	-	Negligible
B3	-	Significant	-	Significant
C21	Significant	Significant	Significant	Significant
C29	-	Significant	-	Significant
D25	Moderate	Significant	Significant	Significant
D8	-	Minor	-	Significant
D9	-	Minor	-	Significant
F2	-	Significant	-	Significant
F8	-	Negligible	-	Negligible
H16	-	Negligible	-	Negligible
H19	-	Negligible	-	Negligible
K23	-	Moderate	-	Moderate
K35	-	Negligible	-	Negligible
N2	-	Negligible	-	Moderate
N32	-	Negligible	-	Negligible
N37	-	Significant	-	Significant
N8	-	Negligible	-	Negligible
O13	-	Moderate	-	Moderate
O31	-	Negligible	-	Negligible

Receiver ID	Potential transmission line operational noise impact significance[1]			
	Amended project only		Cumulative (amended project and existing)	
	Fair weather	L50 (light rain or mist)	Fair weather	L50 (light rain or mist)
O43	-	Negligible	-	Negligible
O45	-	Negligible	-	Negligible
Q10	-	Negligible	-	Negligible
Q19	-	Significant	Significant	Significant
Q27	-	Minor	-	Significant
Q36	Significant	Significant	Significant	Significant
Q40	-	-	-	Negligible
Q43	-	Significant	-	Significant
Q44	Significant	Significant	Significant	Significant
Q45	-	Significant	-	Significant
Q49	-	Moderate	-	Significant
Q53	-	Significant	Significant	Significant
Q62	-	Significant	-	Significant
Q63	-	Negligible	-	Significant
Q88	-	Moderate	-	Significant
Q89	-	Significant	-	Significant
R20	-	Negligible	-	Minor
R21	-	Negligible	-	Negligible
R23	Significant	Significant	Significant	Significant
R24	-	-	-	Negligible
R26	Moderate	Significant	Significant	Significant
R27	Negligible	Significant	Significant	Significant
R3	-	Significant	Significant	Significant
R32	Significant	Significant	Significant	Significant
R40	-	Negligible	-	Moderate
R5	-	Negligible	-	Moderate
R50	Minor	Significant	Significant	Significant
R78	-	Negligible	-	-
S12	-	-	-	Negligible
S15	-	Negligible	-	Negligible
S16	Significant	Significant	Significant	Significant
S18	-	Negligible	-	Moderate

Receiver ID	Potential transmission line operational noise impact significance[1]			
	Amended project only		Cumulative (amended project and existing)	
	Fair weather	L50 (light rain or mist)	Fair weather	L50 (light rain or mist)
S29	-	Minor	-	Significant
S3	-	Significant	-	Significant
S7	-	Significant	-	Significant
T14	-	Minor	-	Moderate
T19	-	Negligible	-	Negligible
T24	-	Moderate	-	Significant
T3	-	Moderate	-	Significant
T32	-	Significant	-	Significant
T39	Negligible	Significant	Significant	Significant
T49	-	Moderate	-	Significant
T50	-	Moderate	-	Significant
U24	-	Negligible	-	Negligible
V13	-	Negligible	-	Negligible
V17	-	Negligible	-	Negligible
V41	Significant	Significant	Significant	Significant
Y19	-	Moderate	-	Moderate

Note 1: Potential impact significance based on the NPfI categories.



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