Transgrid

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Victoria to New South Wales Interconnector West (VNI West) (NSW)

Technical paper 4 – Agricultural Impact Assessment

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Transgrid

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Project overview

Transgrid and Transmission Company Victoria (TCV) are jointly developing a new electrical connection between NSW and Victoria called the Victoria to NSW Interconnector West project (VNI West). Transgrid is responsible for seeking the required planning approval and delivering the NSW component of VNI West (referred to as 'the project' or 'VNI West (NSW)') in the Riverina Region of NSW.

The project would provide the NSW 500 kV double circuit overhead transmission line component of the connection between the NSW/Victorian border near Murrabit and the future Dinawan substation (currently being constructed as part of the EnergyConnect (NSW – Eastern section) project). The project would also include replacement of around nine kilometres of an existing overhead single circuit 330 kV transmission line (Line 51) with a double circuit 330 kV transmission line generally between Ivydale Road (south of the existing Wagga substation) and the future Gugaa 500 kV substation, Livingstone Gully Road(which is subject to separate planning approval under the HumeLink project (SSI-36656827)). The project would also include an expansion of the future Dinawan substation and connection works at both the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road.

This technical paper assesses the potential impacts to agriculture from the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS) for the project.

The impacts have been assessed in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Housing and Infrastructure (DPHI), and against the relevant legislation and guidelines as they apply to agriculture.

Legislative and policy context

Impacts to agriculture from construction and operation of the project have been assessed in accordance with the relevant legislation and guidelines as they apply to agriculture, including:

- The land and soil capability assessment scheme (OEH 2012)
- Infrastructure proposals on rural land (DPI 2013)
- Interim protocol for site verification and mapping of biophysical strategic agricultural land (OEH 2013)
- Regional Strategic Weed Management Plans 2023-2027 (Riverina LLS 2022 and Murray LLS 2022
- Regional Strategic Pest Animal Management Plans 2024-2028 (Riverina LLS 2024 and Murray LLS 2024).
- *Biosecurity Act 2015* (NSW)
- State Environmental Planning Policy (Primary Production) 2021.

Methodology

The assessment of the project's potential impacts on agriculture included the following key steps:

- reviewing the legislative and policy context for the agricultural impact assessment
- conducting landholder interviews across a range of agricultural enterprises
- analysing and describing the existing environment using publicly available data and feedback from engagement for the project with relevant stakeholders, landholders and community members
- assessing impacts on agriculture (including biosecurity impacts) during both construction and operation of the project
- providing recommended mitigation and management measures to avoid and minimise potential impacts.

Existing environment

General

Most of the project is located across the Murray River Council, Edward River Council and Murrumbidgee Council. The Wagga Wagga City Council hosts around nine kilometres of a replacement transmission line between Gregadoo and the proposed Gugaa 500 kV substation (the network augmentation works component). The study area mainly consists of alluvial plains with elevations between approximately 70 and 115 mAHD.

Annual rainfall ranges from approximately 335 to 400 millimetres across the study area between Dinawan and the Victorian border. The average annual rainfall at Wagga Wagga is 573 millimetres.

Average monthly maximum temperatures reach around 31^{o}C to 33^{o}C in summer months, but are approximately 1.3^{o}C cooler in Wagga Wagga. Average monthly minimum temperatures fall to approximately 2.8^{o}C to 3.6^{o}C in the coldest month (July).

The study area in the NSW/Victorian border to the future Dinawan substation component is dominated by moderate fertility vertosols. Land and soil capability (LSC) classes 4 (moderate capability) and 5 (moderate-low capability) are the dominant land types.

The study area for the network augmentation works component is characterised by moderately low fertile kandosols, natric kurosols and sodosols, and also consists mostly of LSC classes 4 and 5.

Land use and agricultural productivity

Agricultural land uses are predominant with livestock enterprises on native vegetation comprising most of the study area in the NSW/Victorian border to the future Dinawan substation component. There is some irrigated cropping in the vicinity of the study area between Dinawan and the Carrathool Road. Between Moulamein and the Victorian border there is a high proportion of cropping, irrigated cropping and grazing of modified pastures.

Land use in the network augmentation works component is dominated by grazing of modified pastures and cropping.

The average gross value of agricultural production was $489 per hectare in 2020-21 across the main local government areas (LGAs) of Murray River, Edward River and Murrumbidgee and $813 per hectare in Wagga Wagga. The gross value of agricultural production varies from approximately $26,711 per hectare for irrigated horticulture production and $1,074 per hectare for broadacre cropping to $216 per hectare for grazing production.

Assessment of impacts

The project would impact upon agriculture during construction and operation. In most cases the impacts would be greater during construction due to the extent and intensity of proposed activities across a larger impact area. However, impacts during construction would be temporary, while operational impacts would be permanent.

Loss of agricultural land use

The potential loss of agricultural land use would be greatest during construction and considerably smaller during operation. These impacts would be limited by the relatively small area that would be affected by the project compared to the total agricultural area of the local government areas in which the project is located (being Murray River, Edward River, Murrumbidgee and Wagga Wagga). The potential loss of agricultural land use during operation would be minimised through the continuation of grazing and cropping enterprises across most of the project footprint, and by implementing the proposed mitigation measures.

Based on the conservative assumption that the project footprint would be restricted from agricultural use for two years during construction, reduced gross agricultural income is estimated at $1.354 million.

Reduced gross agricultural income due to the loss of land use during the operation period is estimated at approximately $230,000 per annum (rounded). The lower operational impact than the construction impact the reflects the continuation of grazing and cropping enterprises across most of the project footprint during operation.

These assessments only address financial effect on gross agricultural income due to the loss of land use. The financial effects of other agricultural impacts (such as livestock disturbance, biosecurity risks and impacts on aerial agriculture) have not been quantified.

Biosecurity

The potential spread of weeds by vehicles, machinery, personnel and movement of soil and water is the highest biosecurity risk arising from the project. The introduction of plant or animal diseases due to the project is also a relevant biosecurity risk.

Biosecurity controls and individual Property Management Plans (detailed in Chapter 8 (Management and mitigation)) would be implemented to manage potential biosecurity risks. Following implementation of these mitigation measures, relatively low biosecurity risks are expected.

Other potential impacts

Other potential agricultural impacts include:

- temporarily restricted livestock and vehicle movements (mainly during construction)
- disruptions to on-ground and aerial agricultural operations
- disruptions to livestock and grazing management
- radio communication and global positioning system (GPS) interference (during operation only)
- low level risks of fire ignition and restricted firefighting activities.

However, these impacts can be largely reduced by the mitigation measures outlined in Chapter 8 (Management and mitigation), such as consultation with landholders, individual property management plans and a Biosecurity management plan. Although there could be a risk of significant impacts on agriculture at a local level after mitigation, overall, impacts are expected to be relatively small and have a minor effect on productivity at a regional scale. Some of these impacts have been considered in more detail in other technical reports including *Technical paper 12 – Bushfire impact assessment* and *Technical paper 14 – Aviation impact assessment*.

Recommended management and mitigation

The mitigation measures for both construction and operation of the project are provided in Chapter 8 (Management and mitigation) of this assessment. Key mitigation measures include consultation with landholders to minimise impacts through optimal positioning of project elements, individual property management plans to reduce disruption to agricultural activities and a project-wide Biosecurity management plan to reduce biosecurity risks. These measures would reduce potential agricultural impacts throughout detailed design, construction and operation.

Abbreviations

Term	Definition
ABS	Australian Bureau of Statistics
ALC	Agricultural Land Classification system (see Hulme et al 2002)
AEZ	access exclusion zone
APZ	asset protection zone
BoM	Bureau of Meteorology
BSAL	biophysical strategic agricultural land (refer section 4.4.2)
chromosols	Moderate fertility soils with a distinct texture contrast between the A horizons and the B horizons, but the latter is neither strongly acidic nor sodic.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTF	Controlled traffic farming. CTF is a farming system built on permanent confined wheel tracks where the crop zone and traffic lanes are separated.
DPHI	Department of Planning, Housing and Infrastructure (now DPHI)
DPE	(former) NSW Department of Planning and Environment (now DPHI)
DPI	(NSW) Department of Primary Industries
DPIE	(former) Department of Planning, Industry and Environment (now DPHI)
EIS	Environmental Impact Statement
GPS	global positioning system
HV	high voltage
km	kilometres
kV	kilovolt
LGA	local government area
LLS	Local Land Services
LSC	Land and Soil Capability
mAHD	metres above the Australian Height Datum
m	metres

Term	Definition
mm	millimetres
NARCliM	NSW and Australian Regional Climate Modelling
NEM	National Electricity Market
NRM	National Resource Management
NSW	New South Wales
OEH	former (NSW) Office of Environment and Heritage
OJD	ovine Johne's disease
REZ	renewable energy zone
SEARs	Secretary's Environmental Assessment Requirements issued in response to an SSI application
SSAL	State significant agricultural land (refer section 4.4.3)
TCV	Transmission Company Victoria
TSR	travelling stock reserve
VNI West	Victoria to New South Wales Interconnector West
VNI West (NSW)	NSW component of the Victoria to New South Wales Interconnector West

Glossary of terms

Term	Definition
access tracks	Temporary and permanent access tracks along and to the transmission line easements and associated transmission line infrastructure.
agricultural business	Businesses on the ABS Business Register were in scope for the 2020-21 Agricultural Census if: • they undertook agricultural activity, and • the estimated value of their agricultural operations was $40,000 or greater
agricultural construction disturbance footprint	The part of the project footprint that would be unavailable to agricultural activities during construction.
agricultural operation disturbance footprint	The part of the project footprint that would be unavailable to agricultural activities during operation.
arable land	land capable of growing crops
biosecurity matter	Under the *Biosecurity Act 2015* (NSW), 'biosecurity matter' means: (a) any living thing, other than a human, or (b) any part of an animal, plant or living thing, other than a human, or (c) a product of a living thing, other than a human, or (d) a disease, or (e) a prion, or (f) a contaminant, or (g) a disease agent that can cause disease in a living thing (other than a human) or that can cause disease in a human via transmission from a non-human host to a human, or (h) anything declared by the regulations to be biosecurity matter.
brake and winch site	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.
chromosols	Moderate fertility soils with a distinct texture contrast between the A horizons and the B horizons, but the latter is neither strongly acidic nor sodic.
Commonwealth	Reference to the Commonwealth of Australia such as 'Commonwealth land' or 'Commonwealth legislation'.

Term	Definition
construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities. It can also comprise concrete batching plant, crushing, grinding and screening plant, testing laboratory and wastewater treatment plant.
cumulative impact	Cumulative impacts refer to the interactions between the project and other approved or yet-to-start projects, or with reasonably foreseeable future development in the area that is likely to be affected by the project. Cumulative impacts can indicate that the combination of effects, either positive or negative, created by multiple projects or developments, may be greater than that of the impact of one project or proposed development.
ferrosols	Deep, well-structured and friable soils that have formed on basalt. They are high in free iron oxide and clay and are generally strongly acid.
detailed design	When referred to in EIS, some elements of the final project infrastructure location may continue to be refined as part of the finalisation of the design. This term represents the next phase of project development following project approval and will further develop the design and construction methodology of the project considering: • the performance outcomes identified in the EIS • mitigation measures identified the EIS (see pre-construction) • any conditions of approval.
impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Impacted LGAs	The local government areas of Murray River, Edward River, Murrumbidgee and Wagga Wagga in which the study area is located.
interconnector	An electricity interconnector is a connection that allows power to flow in both directions between regions in the National Electricity Market (NEM), providing access to a larger number of electricity generators and greater ability to meet varying demand where and when it is needed most.
kurosols	Moderately fertile with a distinct texture contrast between the topsoil (A horizons) and a strongly acid subsoil (B horizons) with higher clay content. have.
land capability	the ability of land to support agricultural activities on a sustainable and productive basis, as defined by the LSC scheme.
natric kurosols	Kurosols with sodic topsoils.

Term	Definition
network augmentation works component	The portion of the project footprint encompassing the replacement of a section of existing single circuit 330 kV transmission line with a double circuit 330 kV line between Ivydale Road in Gregadoo and Transgrid's proposed Gugaa 500 kV substation, and associated infrastructure.
NSW/Victorian border to Dinawan substation component	The portion of the project footprint encompassing the proposed new 500 kV double-circuit overhead transmission line between the NSW/Victoria border and the future Dinawan 330 kV substation, and associated infrastructure.
Primary Production SEPP	State Environmental Planning Policy (Primary Production) 2021
(the) project	Victoria to New South Wales Interconnector West (NSW)
(the) project footprint	Refers to the generally 200 m wide corridor area that may be directly impacted by the project including all proposed infrastructure elements (including the proposed transmission line corridor, substation site works and other ancillary works) as well as locations for proposed construction elements such as temporary worker accommodation facilities, construction compounds, access tracks and site access points, laydown and staging areas, concrete batching plants, brake and winch sites and site offices.
(the) proponent	Transgrid
rudosols	Soils with low inherent fertility and a sandy, weakly developed profile.
sodosols	Similar soils to kurosols but have a sodic sub soil which is not strongly acidic.
stock units	In this assessment, one sheep or goat is equated to one stock unit and cattle are equated to ten stock units each.
study area	The study area for the assessment of impacts is based on the project footprint with a 1.5 km buffer.
substation	A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
switching station	A facility used to connect two or more distinct transmission lines of the same designated voltage.
temporary worker accommodation facilities	Areas that would be constructed and operated during construction to house the construction workers.
tenosols	Soils with low inherent fertility and a sandy, weakly developed profile.

Term	Definition
Transgrid (or 'the proponent')	The manager and operator of the high voltage electricity transmission network in NSW and the Australian Capital Territory with connections to Victoria and Queensland. Transgrid manages the network that is the backbone of the NEM, which enables energy trading between Australia's three largest states along the east coast.
transmission line alignment	The location of the transmission line structures along the middle of the transmission line easement.
transmission line corridor	A generally 200 metre wide corridor along the length of the transmission line within which the transmission line, structures and easement would be located (sub set of the project footprint).
transmission line easement	The area surrounding and including the transmission lines that allows access, construction and maintenance work to take place. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets The easements for the new 500 kV transmission line between the NSW/Victorian border and the future Dinawan substation would typically be 70 m wide. However, transposition locations would require wider easements up to 110 m wide. The replacement of the 330 kV transmission line between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road would occur within the existing 60 m wide easement.
transmission line structure	A free standing steel tower structure to support the transmission line cables. Structures can consist of two types of supporting steel lattice structures being: a suspension structure and strain structure (also known as tension structure).
vertosols	Soils with clay texture throughout the profile, display strong cracking when dry, and shrink and swell considerably during wetting and drying phases.
VNI West	An interconnector of about 480 km between the power grids of NSW and Victoria. Specifically, VNI West would connect the EnergyConnect (NSW – Eastern section) project (at the future Dinawan substation in NSW) with the Western Renewables Link proposal (at Bulgana in Victoria) via a new substation near Kerang (in Victoria).

Term	Definition
VNI West (NSW) or ('the project)	The NSW component of VNI West includes: • a new 500 kV transmission line connection between the NSW/Victorian border and Transgrid's Dinawan substation (currently under construction as part of the EnergyConnect (NSW – Eastern section) project) • replacement of a section of existing single circuit 330 kV transmission line to a double circuit 330 kV line generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road (subject to separate planning approval as part of the HumeLink project) • expansion of the future Dinawan 330 kV substation to include a new 500 kV switchyard and two new 330 kV bays • connection and transmission line diversion works at both the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road to connect the new transmission line infrastructure • ancillary activities to support construction and operation of the project.
(the) western LGAs	The three local government areas (LGAs) of Murray River, Edward River and Murrumbidgee on which the NSW/Victorian border to Dinawan substation component of the project is located.

1 Introduction

This chapter provides an overview and background to the NSW component of the Victoria to NSW Interconnector West (VNI West) project, including a summary of the project and the purpose and structure of this technical paper.

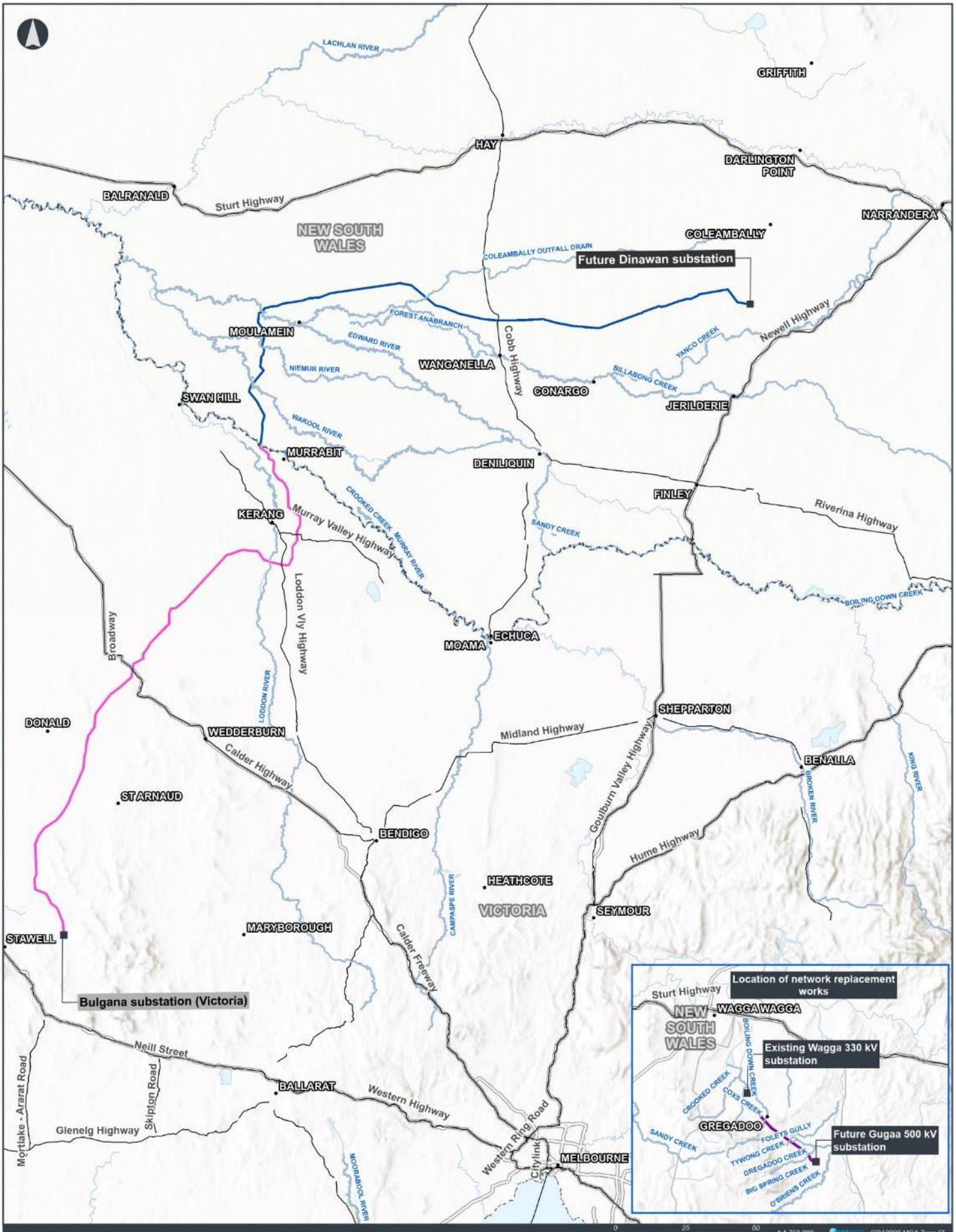
1.1 Project context and overview

Transgrid and Transmission Company Victoria (TCV) are jointly developing a new electrical connection between NSW and Victoria called the Victoria to NSW Interconnector West project (VNI West). VNI West would form a second transmission link between NSW and Victoria to harness clean, low-cost electricity from Renewable Energy Zones (REZ) in both states and improve the reliability and security of electricity supply. VNI West is a priority project for the Australian Energy Market Operator (AEMO), and the Commonwealth and NSW and Victorian governments.

VNI West proposes the construction, operation and ongoing maintenance of a high voltage, 500 kilovolt (kV) double circuit overhead transmission line that would connect the high voltage electricity grids in NSW and Victoria. Specifically, VNI West would link the Western Renewables Link proposal at Bulgana in Victoria with the EnergyConnect (NSW – Eastern section) project (SSI-9172452) at the future Dinawan substation in NSW (currently in construction). The connection would be made via a new substation near Kerang in Victoria (refer to Figure 1-1).

Transgrid (the proponent) is responsible for seeking the required planning approval and delivering the NSW component of VNI West (referred to as 'the project' or 'VNI West (NSW)') in the Riverina Region of NSW and would provide the 500 kV transmission line component of the connection for the VNI West project. The project would be located between the NSW/Victorian border near Murrabit in Victoria and the future Dinawan substation (the 330 V component of which is currently being constructed as part of the EnergyConnect (NSW – Eastern section) project). The project would also include replacement of around nine kilometres of an existing single circuit 330 kV transmission line (Line 51) with a double circuit 330 kV transmission line generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road (which is subject to separate planning approval as part of the HumeLink project (SSI-36656827)). The project would also include an expansion of the future Dinawan substation and substation connection works at both the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road .

TCV, in association with the AEMO Victoria, is responsible for seeking the required planning approval and the delivery of the Victorian component of the VNI West project (VNI West (Victoria)), from the crossing point on the NSW/Victorian border to a connection with the Western Renewables Link near Bulgana, via a new proposed substation near Kerang. The Victorian component is subject to a separate planning and environmental approvals under the applicable Victorian State and Commonwealth jurisdictional requirements.



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VNI West (NSW)

Figure 1.1
Overview of VNI West

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

1.1.1 Project objectives

The primary objective of VNI West is to reduce the cost of providing secure electricity transmission between NSW and Victoria in the near term and facilitate the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy generation sources. More specifically, the project aims to:

- provide reliable and affordable electricity to customers
- improve energy security of the south western transmission network, enable greater sharing of energy between NSW and Victoria and help to unlock the potential capacity of proposed REZs in the region
- support the national transition to a lower carbon emission energy system by enabling more renewable energy generation to enter the market, supporting Australia's emissions reduction targets
- support the development of a greater mix of renewable energy in the NEM.

1.2 The project

Transgrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and* Assessment *Act 1979* (NSW) (the EP&A Act) to construct and operate the project. The project was declared as Critical State Significant Infrastructure (Critical SSI) under Section 5.13 of the EP&A Act on 19 June 2024.

The project was also declared a 'controlled action' on 4 September 2024 (EPBC Act 2024/09871) by the (Commonwealth) Department of Climate Change, Energy, the Environment and Water ((Commonwealth DCCEEW) and as such also requires a separate approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). As a result of the need for Commonwealth approval, the project will be subject to the bilateral assessment process that has been established between the Australian and NSW governments.

1.2.1 Key features of the project

The key elements of the project would be located within the project footprint and would include infrastructure such as the transmission lines and transmission line structures, the 500 kV expansion component of the future Dinawan substation and some additional ancillary features. The overall scope of the project includes the following key components:

- transmission line works comprising:
  - a new 500 kV double circuit overhead transmission line around 240 kilometres in length between the NSW/Victoria border near Murrabit, and the future Dinawan substation
  - replacement of around nine kilometres of an existing 330 kV single circuit overhead transmission line (Line 51), generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road with a new 330 kV double circuit overhead transmission line. The new transmission line structures for this section of the project would be up to around 56 metres in height

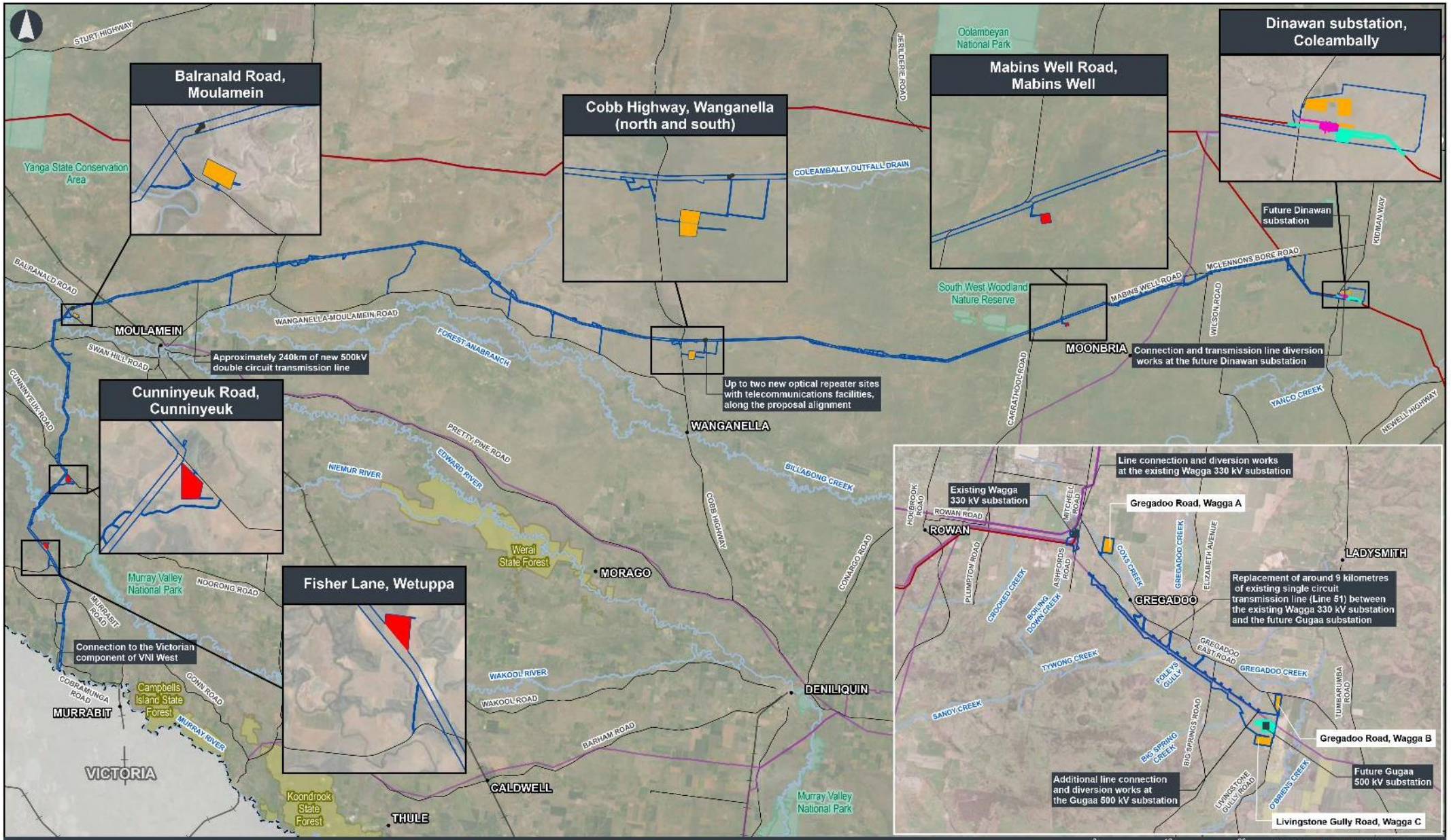
- substation works comprising:
    - connection and line diversion at the future Dinawan substation to allow for connection of the proposed 500 kV switchyard
    - expansion of the future Dinawan substation to include a new 500 kV switchyard and two new 330 kV transformer bays
- connection and line diversion work at the existing Wagga 330 kV substation and at the future Gugaa 500 kV substation, Livingstone Gully Road to allow for connection to the newly replaced Line 51
- ancillary activities comprising:
    - new and upgraded temporary and permanent access tracks
    - construction of utilities infrastructure and power supply
    - installation and operation of two telecommunication facilities (optical repeater sites) along the transmission line between the NSW/Victorian border and future Dinawan substation including connections to the local power supply
    - temporary facilities required for construction of the project including construction compounds, temporary worker accommodation facilities, laydown and staging areas, stockpiling areas, concrete batching plants, brake and winch sites, site offices, parking areas, and utilities supplies.

All components of the project would be located within the project footprint shown in Figure 1-2. The project footprint is the area that has been assessed in this EIS as being directly affected by the construction, operation and maintenance of the project.

The 500 kV transmission line between the NSW/Victorian border and the future Dinawan substation would be located within an easement approximately 70 metres wide except at two transposition locations (where the conductors of a transmission line swap positions to improve transmission voltage balance) requiring a wider 110 metre easement for around one kilometre in length.

The section of the transmission line to be replaced generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road would be contained within the existing 60 metre easement. These easements would provide a legal right of access to construct, operate and maintain the transmission lines and other operational assets associated with these lines.

A detailed description of the project features and construction methods is further described in Chapter 3 (Project description) of the main EIS document.



WSP

VNI West (NSW)

Figure 1.2
Overview of the VNI West (NSW) Project

Data sources: NSW EPI, DELWP, WSP, EnergyConnect

1.2.2 Construction

1.2.2.1 Key construction work

Key construction work for the project would typically include (but not be limited to):

- pre-construction minor works which would include:
    - installation of mitigation measures, including but not limited to erosion and sediment controls, temporary exclusion fencing and monitoring equipment
    - property acquisition adjustment work including installation of property fencing, barricades and gates
- site establishment works, which may include (but not be limited to):
    - establishment of combined temporary worker accommodation facilities and construction compounds, including excavations, surface preparation, access roads and utility connections
    - vegetation clearing
    - road and intersection improvement works (where required)
    - establishment of access tracks and watercourse crossings
    - relocating, adjusting or protecting utilities
- construction of the proposed transmission lines, which would include (but not be limited to):
    - earthwork (including establishment of construction pads) and the construction of footings and foundations for each transmission line structure
    - erection of the new transmission line structures using crane(s) and/or helicopter(s), noting, where cranes are proposed, is assumed that the final height of the cranes would extend around 20 metres above the respective transmission line structure heights
    - stringing of the conductors and overhead earth wires and optical ground wire (utilising either ground-based and/or helicopter/drone stringing construction methods)
    - installation of earthing conductors
    - testing and commissioning of the transmission lines
- works to replace around nine kilometres of Line 51 generally between Ivydale Road (south of the existing Wagga 330 kV substation) and the future Gugaa 500 kV substation, Livingstone Gully Road, which would include (but not be limited to):
    - demolition of existing transmission line structures and footings and removal of waste materials
    - erection of the new transmission line structures
    - stringing of the conductors and overhead earth wires and optical ground wire
    - testing and commissioning of the new transmission lines

- expansion of the future Dinawan substation, which would include (but not be limited to):
    - civil construction works including earthworks
    - slab construction for the new 500 kV switchyard and 330 kV transformer bays
    - electrical fit out with new substation equipment
    - testing and commissioning of the new substation equipment
- utility service connections to telecommunication facilities (optical repeater sites) and construction compounds/temporary worker accommodation facilities, and adjustments of existing utilities that intersect the transmission line corridor (as required)
- connection and transmission line diversion works at the existing Wagga 330 kV substation and future Gugaa 500 kV substation, Livingstone Gully Road.

Prior to energisation of the infrastructure, a series of pre-commissioning activities would be conducted. This would include testing the new transmission lines and additional substation infrastructure.

A detailed description of construction work for the project is further outlined in Chapter 3 (Project description) of the main EIS document.

1.2.2.2 Construction program

Subject to NSW and Commonwealth planning approvals and potential construction staging, the project is expected to commence in late 2026 (site establishment works phase). Once construction has commenced, the project is estimated to take around two years to complete. Initial operation is anticipated to commence by early 2029, and at full capacity by late 2029.

Site decommissioning and remediation would extend up to around six months beyond the initial commissioning (operational) phase, with estimated completion by the end of 2029.

The final construction program would be confirmed as part of the finalisation of the project development following approval of the project.

1.2.2.3 Indicative duration of transmission structure construction

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Figure 1-3 presents an indicative duration of construction activities associated with the transmission line structures. These durations could vary and breaks between activities may be shorter, which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line structure. Duration of any particular construction activity, and respite periods, may vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing, and location.

These activities would also have multiple work fronts, therefore (for example) foundation works or structure erection would be occurring in several locations, along the transmission line easement, at the same time.

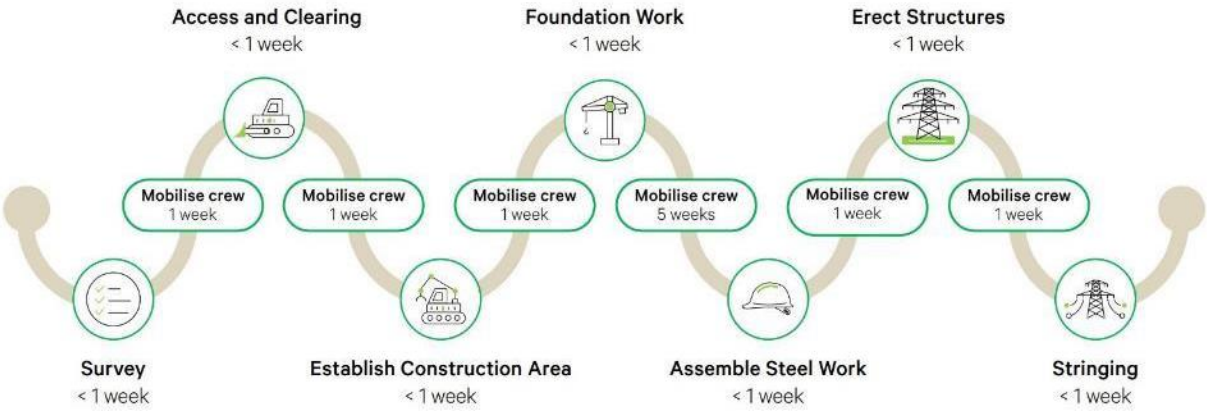


Figure 1-3 Indicative construction activities for transmission line structures

1.2.3 Operation

Once operational, the new infrastructure would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Key maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of transmission lines and structures, including annual fly overs and routine ground inspections on an approximate six-yearly cycle
- vegetation clearing/trimming within the transmission line easement, and access along road/tracks
- inspection and maintenance of the future Dinawan substation including:
    - routine substation infrastructure inspection (such as transformers, electrical plant and equipment and fire detection systems) throughout the year
    - routine/planned substation maintenance of equipment, property and switchyard areas on a scheduled basis
    - ad hoc fault and emergency works for repair of any damaged infrastructure (for example through a weather event or other failure of infrastructure)
    - maintenance of asset protection zones (as required)
- inspection and maintenance of other ancillary infrastructure including the telecommunication facilities and associated asset protection zones
- stormwater drainage maintenance.

It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the work required).

1.3 Purpose of this technical paper

The purpose of this technical paper is to identify and assess the potential agricultural impacts in relation to the construction and operation of the project and has been prepared to support and inform the EIS. It responds directly to the project's Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning, Housing and Infrastructure (DPHI) on 22 May 2025 (refer to section 1.3.1).

This report has the following objectives:

- describe the existing environment of the study area as it relates to agriculture
- determine the potential impacts to agriculture from construction and operation of the project
- provide recommended mitigation and management measures to avoid, minimise and manage any potential impacts to agriculture from construction and operation of the project.

The agricultural impact assessment assesses the impacts of the project on property access; agricultural operations; livestock and machinery movements; livestock and crop production activities, and biosecurity risks. The impact on agricultural productivity is quantified and mitigation strategies to minimise resource loss, biosecurity risks and other impacts are addressed.

1.3.1 Secretary's Environmental Assessment Requirements

This technical paper addresses the SEARs relevant to the assessment of agricultural impacts. The requirements specific to this assessment and where these aspects are addressed in this are outlined in Table 1-1.

Table 1-1
Secretary's Environmental Assessment Requirements – Agriculture

Reference	Assessment requirement	Location where it is addressed
Key issue – Land	An assessment of impacts of the project on soils and land capability of the site and surrounds.	Impacts on land capability are discussed in sections 5.1 and 6.1. Soil impacts relating to contamination are considered in *Technical paper 17 – Contaminated land impact assessment.* Soil impacts relating to erosion and sediment control are considered in *Technical paper 9 – Hydrology, flooding and water quality impact assessment*.
	Assessment of impact of the project on agricultural land, biosecurity, land reserved under the *National Parks and Wildlife Act 1974*, Crown lands including State Forests and travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors	Impacts on agricultural land are discussed in Chapters 5 and 6. Impacts on biosecurity are discussed in sections 5.2 and 6.2 Impacts on travelling stock reserves are discussed in sections 5.11 and 6.10 Impacts on land reserved under the *National Parks and Wildlife Act 1974*, Crown lands including State Forests, mineral resources, exploration licenses, rail reserves and pipeline corridors are addressed in the Chapter 10 of the EIS (Land use and agriculture).

Reference	Assessment requirement	Location where it is addressed
Key issue – Hazards	Assess potential impacts on aviation safety, including: safe and efficient aerial application of agricultural fertilisers and pesticide, and aerial fire control;	Impacts on the efficient application of agricultural fertilisers and pesticide are discussed in sections 5.6 and 6.5. Potential impacts on aviation safety are assessed in *Technical paper 14 – Aviation impact assessment*.

1.3.2 Related technical papers

This technical paper is linked to the assessments completed in the following technical papers:

- *Technical paper 6 – Economic impact assessment*; the agricultural impact assessment contains some calculations of the economic impact on agriculture.
- *Technical paper 9 – Hydrology, flooding and water quality impact assessment*; surface water is a component of the existing agricultural environment, as it is used for agricultural purposes. Flooding may also have an impact on agricultural businesses.
- *Technical paper 10 – Groundwater impact assessment*; groundwater is a component of the existing agricultural environment, as it is used for agricultural purposes.
- *Technical paper 12 – Bushfire impact assessment*; bushfire would likely have an impact on agricultural businesses.
- *Technical paper 14 – Aviation impact assessment*; aviation is used for agricultural activities such as spraying, monitoring and fertiliser application.

1.4 Structure of the paper

The structure and content of this agriculture paper is as follows:

- Chapter 1 – Introduction (this chapter)
- Chapter 2 – Legislation and policy context. This chapter provides an overview of the relevant regulatory context for the assessment, including an overview of the legislation, policy and guidelines that apply to the project
- Chapter 3 – Methodology
- Chapter 4 – Existing environment. This chapter describes the existing environment of the study area as it relates to agriculture
- Chapter 5 – Construction impacts.
- Chapter 6 – Operational impacts.
- Chapter 7 – Cumulative impacts. This chapter describes the cumulative impacts to agriculture in relation to other relevant future projects
- Chapter 8 –Management and mitigation. This chapter provides the mitigation and management measures that have been identified to further avoid, minimise and manage any potential impacts to agriculture from construction and operation of the project
- Chapter 9 – References.

Appendices to this paper are:

- Appendix 1 Land use maps
- Appendix 2 Land and soil capability maps
- Appendix 3 Other regional weed species of concern

2 Legislation and policy context

Planning approval for the project is required in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project is a controlled action and therefore also requires Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This section describes the Commonwealth and State legislation and policies relevant to the assessment of agricultural impacts.

2.1 NSW Legislation

Legislation specific to the agricultural impact assessment includes the *Biosecurity Act 2015, Local Land Services Act 2013* and State Environmental Planning Policy (Primary Production) 2021 (Primary Production SEPP). A summary of the relevance of each legislation is provided in the following sections.

2.1.1 Biosecurity Act 2015

The *Biosecurity Act 2015* (NSW) came into effect on 1 July 2017[1] and complements the *Biosecurity Act 2015*[2] (Cth). The primary objective of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks. The Act is tenure neutral, that is, it applies to all lands in NSW, both public and private tenure.

The Act defines key concepts such as biosecurity matter, carrier, biosecurity impact, biosecurity risk and pests and specifies a wide range of prohibited matter including pests and diseases of plants and animals.

Importantly, the Act defines 'biosecurity matter' as any living thing or part or product of a living thing (other than a human), or a disease, prion, contaminant or disease agent that can cause disease in a living thing (other than a human) or that can cause disease in a human via transmission from a non-human host to a human. It also includes anything declared by the regulations to be biosecurity matter.

Under the Act, the responsibility for biosecurity risk is shared between the NSW Government, industry and the community. Specifically, the Act establishes a general biosecurity duty, as follows:

> *'Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.'*

The NSW Department of Primary Industries (DPI) holds the primary responsibility for management of biosecurity under the Act, and has a lead role in preventing, preparing for, responding to, and recovering from emergencies and outbreaks of significant emergency pests, diseases and weeds.

Local Land Services (LLS) supports and works collaboratively with landholders across NSW to implement best practice biosecurity practices to improve animal health, crop production, and control pest animals and weeds. LLS plays a leading role in the coordination of wide-scale, cross-tenure pest animal control campaigns that help reduce the impacts of pest animals on agricultural production and the environment. LLS delivers regional strategic weed management plans and assists with education and community outreach programs (DPI 2022).

[1] legislation.nsw.gov.au/#/view/act/2015/24

[2] legislation.gov.au/Series/C2015A00061

Regional biosecurity strategies developed by DPI and LLS covering the study area include:

- NSW Invasive Species Plan 2023-2028 (DPI 2023a)
- Regional Strategic Weed Management Plans 2023-2027 (Riverina LLS 2022 and Murray LLS 2022
- Regional Strategic Pest Animal Management Plans 2024-2028 (Riverina LLS 2024 and Murray LLS 2024).

The above listed strategies are considered in sections 5.2 and 6.2 of this report.

2.1.2 Local Land Services Act 2013

The *Local Land Services Act 2013* (NSW) establishes a statutory corporation (known as LLS) which has the responsibility for the management and delivery of local land services in the social, economic and environmental interests of the State in accordance with any State priorities. Objectives of the *Local Land Services Act 2013* include ensuring the proper management of natural resources in the social, economic and environmental interests of the State, and providing a framework for financial assistance and incentives to landholders.

The *Local Land Services Act 2013* deals with issues such as the management of native vegetation, private native forestry, the management and regulation of travelling stock reserves (TSRs), and the regulation of the use of public roads by travelling stock and persons. Impacts on TSRs are discussed in sections 5.11 and 6.10.

2.1.3 Primary Production SEPP

The Primary Production SEPP consolidates the previous Primary Production and Rural Development SEPP 2019 and the Sydney Regional Environmental Plan No 8 (Central Coast Plateau Areas). The SEPP contains planning provisions to manage primary production and rural development, including supporting sustainable agriculture.

The relevant part of the Primary Production SEPP is 'Chapter 2 – Primary production and rural development'. This chapter includes the following relevant aims:

> *(a) to facilitate the orderly economic use and development of lands for primary production*
>
> *(b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources*
>
> *(c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations*
>
> *(e) to encourage sustainable agriculture, including sustainable aquaculture.*

Part 2.2 deals with State significant agricultural land within which clause 10 states that *'the objects of this Part are as follows—*

> *(a) to identify State significant agricultural land and to provide for the carrying out of development on that land,*
>
> *(b) to provide for the protection of agricultural land—*
>
> *(i) that is of State or regional agricultural significance, and*
>
> *(ii) that may be subject to demand for uses that are not compatible with agriculture, and*
>
> *(iii) if the protection will result in a public benefit.'*

Clause 1 of section 2.8 states that land is State significant agricultural land if it is listed in Schedule 1 of the Primary Production SEPP. Schedule 1 does not list any State significant agricultural land at present. However, a draft map of State significant agricultural land (SSAL) has been released (DPI 2021). Impacts to SSAL are further discussed in sections 4.4.3, 5.8 and 6.8.

2.2 Guidelines

Policies and guidelines relevant to the agricultural impact assessment include:

- The land and soil capability assessment scheme (OEH 2012). Sets out a scheme for the assessment of the biophysical characteristics of land and the extent to which these would limit agricultural land use.
- Agricultural land use mapping resources in NSW (Squires 2017). Outlines the datasets used to map agricultural lands and agriculture's dependent resources within NSW for land use planning purposes.
- Infrastructure proposals on rural land (DPI 2013). Provides recommendations to minimise impacts on agricultural resources and enterprises from infrastructure development proposals.
- Interim protocol for site verification and mapping of biophysical strategic agricultural land (OEH 2013). This dataset sets out the assessment methodology and the required criteria for biophysical strategic agricultural land (BSAL).
- Relevant Regional Strategic Weed Management Plans 2023-2027 (Riverina LLS 2022 and Murray LLS 2022). Provides a framework for regional weed management. Describes how weeds will be managed across each region, on both public and private land, and outlines the shared responsibility for biosecurity risks (including weeds) between the government, community and industry.
- Relevant Regional Strategic Pest Animal Management Plans 2024-2028 (Riverina LLS 2024 and Murray LLS 2024). Outlines a strategic regional approach to improving the coordination and delivery of on ground pest animal management activities for terrestrial vertebrate and freshwater aquatic pest species. Provides a framework to protect the environment, community and economy from the negative impacts of pest animals and support positive outcomes for biosecurity and sustainable landscapes.

3 Methodology

The methodology for this agricultural impact assessment has been designed to meet the requirements of the SEARs (refer to section 1.3.1).

3.1 Overview

The assessment methodology of this agricultural impact assessment has included the following key elements:

- interviews with landholders representing a range of locations and agricultural enterprises within the project footprint to obtain information on their enterprises and perceived impacts of the project on agriculture.
- review of information from consultations undertaken with landholders by the social impact assessment team and by Transgrid representatives
- consultation with local representatives of Ricegrowers' Association of Australia in March and April 2025
- consultation with councils and LLS to identify the main biosecurity risks associated with the project and recommended mitigation measures in March 2025
- the existing environment was described primarily using desktop research using publicly available data, including Australian Bureau of Statistics (ABS) statistics, satellite imagery, reference material and public GIS datasets
- the assessment of the impacts on agriculture was based on the desktop study, consultation with landholders and councils, property inspections and professional knowledge
- cumulative impacts with other major developments in the region were assessed, based on the type, degree and proximity of the impacts of each development
- the identification of mitigation and management measures that minimise potential impacts.

3.2 Study area

The study area for this assessment is defined as the project footprint with a 1.5 kilometre buffer on either side. The total area of the project footprint is 6,610 hectares and the study area is 102,436 hectares, as shown in Figure 3-1.

The project footprint would include all proposed infrastructure elements (including the proposed transmission line corridor, substation site works and other ancillary works) as well as locations for currently proposed construction elements such as construction compounds, access tracks and site access points, laydown and staging areas, concrete batching plants, brake/winch sites, site offices and temporary accommodation worker facilities.

Indicative disturbance footprints are also defined to calculate the loss of agricultural land during construction (section 5.1.2) and operation (section 6.1.2). The agricultural construction disturbance footprint consists of the transmission line easement, access tracks, construction compounds, accommodation facilities and telecommunication facilities. The agricultural operation disturbance footprint consists of a disturbance area and access exclusion zone (AEZ) for each transmission line structure, access tracks and telecommunication facilities.

WSP

VNI West – Technical Paper Agriculture

Figure 3.1
Agriculture Study Area

Legend

- Main road
- Rail line
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Combined temporary worker accommodation facility
- Substation

Data sources: NSW EPI, DELWP, WSP, EnergyConnect

3.3 Consultation

3.3.1 Landholder interviews

Landholder interviews were conducted on 12 and 13 February 2025 at Moulamein Bowling Club and Wanganella Hall by Peter Tremain of Tremain Ivey Advisory. The landholders' properties are briefly described in Table 3-1.

Table 3-1
Summary of landholder interviews

Property Number	Location	Enterprises
1	Mallan	Sheep and cattle grazing
2	Wanganella	Commercial and stud sheep breeding
3	Wanganella	Commercial and stud sheep breeding

The interviews were structured to obtain information on the agricultural enterprises at each property including usual crops grown, crop areas, normal livestock numbers, types of livestock, type of pastures and property areas, as well as their perceived impacts of the project.

In addition, summaries of engagement and discussions the social impact assessment team had with landholders were reviewed. These covered consultations with 16 community members in August 2024 and from field visits in November 2024 with another 12 community members. The latter group included six agricultural landholders located at Mallan, Jerilderie, Deniliquin, Wanganella and Moulamein.

Further information on the properties affected by the project (such as information on vegetation cover, soil type, land capability, land use, type and locations of horticultural crops, extent of cleared areas and type of cropping) was gained through examination of satellite imagery, reference material and public GIS datasets.

3.3.2 Stakeholder consultation

Meetings were held in March 2025 with biosecurity officers from Murray LLS, Murray River Council, Edward River Council, Murrumbidgee Council and Wagga Wagga City Council to identify the main biosecurity risks associated with the project and discuss recommended mitigation measures.

While LLS is the government authority which delivers biosecurity services to landholders in partnership with DPI, local government has a legal responsibility for managing weeds across their lands under the *Biosecurity Act 2015* (NSW).

Discussions were undertaken with representatives of the Ricegrowers' Association of Australia from the Wakool district in March and April 2025.

3.4 Existing environment and impact assessment

The description of the existing environment was primarily based on publicly available data, which, was evaluated with reference to the information gathered during the landholder interviews and landholder engagement by Transgrid. The assessment of the existing environment concentrated on:

- geographical factors (such as climate, topography and soils) that have the greatest influence on agriculture in the study area
- measures which best appraise the nature and productivity of agricultural enterprises in the study area (such as land and soil capability (LSC), land use and value of production).

The potential impacts of the project on the existing environment have been separately assessed for construction and operation of the project. The impacts were further categorised as follows:

- permanent or temporary loss of agricultural land use due to leasing or acquisition of land for construction or operation purposes
- biosecurity risks during construction and operation
- other impacts which do not preclude continued agricultural land use, but may affect the productivity of agricultural enterprises, including:
    - temporarily restricted livestock and vehicle movements
    - disruptions to on-ground and aerial agricultural operations
    - disruptions to livestock and grazing management
    - radio communication and global positioning system (GPS) interference
    - fire risks.

The areas unavailable to agricultural activities during construction and operation are calculated as described in sections 5.1.2 and 6.1.2.

Mitigation measures are defined as actions or processes, which minimise or eliminate the impacts of the project. The mitigation measures have been developed to address the potential impacts.

The severity of impacts are described in accordance with the scale of consequences set out in the *Land Use Conflict Risk Assessment Guide* (DPI 2011b) where appropriate. This scale is summarised in Table 3-2.

Table 3-2
Consequence scale - Land Use Conflict Risk Assessment Guide

Descriptor	Description
Level 1 - Severe	• Severe and/or permanent damage to the environment • Irreversible • Severe impact on the community
Level 2 – Major	• Serious and/or long-term impact to the environment • Long-term management implications • Serious impact on the community
Level 3 – Moderate	• Moderate and/or medium-term impact to the environment and community • Some ongoing management implications
Level 4 – Minor	• Minor and/or short-term impact to the environment and community • Can be effectively managed as part of normal operations
Level 5 – Negligible	• Very minor impact to the environment and community • Can be effectively managed as part of normal operations

3.5 Consideration of biosecurity issues

Relevant information on biosecurity issues for the project were identified from the following sources:

1. landholder interviews (refer to section 3.3.1)
2. consultation with various local government weed officers and LLS biosecurity officers (refer to section 3.3.2)
3. reference to the *Biosecurity Act 2015* (NSW)
4. reference to the relevant regional strategic weed and pest animal management plans
5. review of other documents set out in section 2.2.

The methodology for the biosecurity assessment was similar to the impact assessment set out in section 3.4. Identification of existing biosecurity issues and potential biosecurity risks were primarily based on a desktop study including pest, disease and weed distribution data, and various legislation, regional plans and surveys referenced in section 2.2. Information gathered from landholder and stakeholder consultation was also considered.

3.6 Limitations

Economic quantification of losses arising from impacts is limited to the land taken out of agricultural production either temporarily during construction or permanently during operation. It is not feasible to accurately quantify possible economic losses associated other types of impacts.

4 Existing environment

4.1 General description

4.1.1 Location

The study area is located within four different local government areas (LGAs), namely Murray River, Edward River, Murrumbidgee and Wagga Wagga (the impacted LGAs).

The NSW/Victorian border to Dinawan substation component of the project is located in the Murray River, Edward River, Murrumbidgee LGAs. The majority of this component (and study area) is located in the Edward River LGA which hosts approximately 135 kilometres of the transmission line. Murray River and Murrumbidgee LGAs host approximately 80 kilometres and 25 kilometres, respectively.

The study area for the network augmentation works is located within the Wagga Wagga LGA.

4.1.2 Topography

The study area is primarily a landscape of alluvial plains. However, the network augmentation works component is characterised by undulating land of low relief.

The NSW/Victorian border to the future Dinawan substation component is at an elevation of approximately 115 metres above Australian Height Datum (mAHD) at the future Dinawan substation and declines to approximately 75 mAHD around Moulamein. It mainly remains at an elevation of approximately 70 to 75 mAHD between Moulamein and the NSW/Victorian border.

The elevation in the network augmentation works component ranges from approximately 225 to 330 mAHD.

4.1.3 Climate

Climate, especially rainfall and temperature, has a large impact on the productivity of dryland agricultural properties such as those found across most of the study area. The climate, as illustrated by rainfall records and elevation vary by a moderate amount across the study area for the NSW/Victorian border to the future Dinawan substation component, but the network augmentation works component has a substantially different climate.

Four Bureau of Meteorology (BoM) stations have been chosen to illustrate the range of rainfall and temperature, as set out in Table 4-1. Few BoM stations near the study area record temperature (BoM 2024).

Table 4-1
Summary of BoM stations

Station name and number (BoM 2024)	Data available	Elevation
Rainfall only		
077025 Lake Boga	120 years	71 metres
075046 Moulamein Post Office	135 years	72 metres
074040 Jerilderie (Pooginook)	134 years	117 metres
Rainfall and temperature		
077094 Swan Hill Aerodrome	28 years	71 metres
072150 Wagga Wagga AMO	82 years	212 metres

Swan Hill is excluded from the rainfall analysis due to the limited data available.

The average rainfall generally increases from west to east and declines from higher elevations to lower elevations (refer to Table 4-2). The study area for the NSW/Victorian border to the future Dinawan substation receives an average rainfall of less than 400 millimetres per annum. Rainfall in the study area for the network augmentation works component (represented by the Wagga Wagga station) is much higher (around 570 millimetres per annum).

Rainfall at all stations is slightly winter and spring dominant, receiving 16 to 29 per cent more monthly rainfall in summer than in the rest of the year.

Records indicate that the lowest 10 per cent of years has rainfall of approximately 52 to 60 per cent of the long-term mean at the three western stations, with Wagga Wagga having a higher ratio of 69 per cent. The highest 10 per cent of years has rainfall of approximately 235 to 256 per cent of the long-term mean at the three western stations, while the ratio was 195 per cent in Wagga Wagga.

The study area between the NSW/Victorian border to the Dinawan substation component has moderate rainfall variability whereas the study area for the network augmentation works component has moderately low rainfall variability according to rainfall records (BoM 2022). Variability is generally much greater in late summer and early autumn than at other times of the year.

Table 4-2
Summary of rainfall records

BoM 2024	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean													
Lake Boga	23.6	21.8	22.1	22.1	34.3	32.2	31.8	32.9	33.8	33.0	27.1	23.9	335.4
Moulamein	24.5	23.7	26.0	25.8	34.2	33.5	30.7	33.7	31.1	34.8	28.0	30.6	357.2
Pooginook	31.5	24.1	30.8	30.5	38.7	42.7	36.3	34.0	31.9	39.2	30.9	26.9	397.6
Wagga Wagga	42.2	39.4	46.5	40.3	50.3	50.3	53.1	50.3	48.6	56.5	49.4	46.2	573.0
10th percentile													
Lake Boga	0.5	0.0	0.0	0.8	4.9	9.1	9.1	6.6	8.0	3.8	3.4	0.5	173.0
Moulamein	0.4	0.0	0.0	1.5	4.8	9.5	8.1	7.2	7.5	4.9	0.9	1.1	201.3
Pooginook	0.7	0.0	0.0	2.0	6.2	12.0	9.9	6.7	7.1	6.4	3.9	1.2	238.0
Wagga Wagga	7.0	4.1	1.8	8.1	8.2	19.8	21.9	10.9	16.0	14.7	12.0	5.1	396.8
90th percentile													
Lake Boga	62.0	65.8	51.6	46.7	65.5	54.9	52.0	56.8	64.6	69.9	60.5	59.4	443.7
Moulamein	58.0	65.8	73.2	60.6	71.8	65.3	53.1	58.7	62.7	80.0	65.8	77.4	498.2
Pooginook	76.9	64.3	66.1	68.9	85.2	76.4	72.0	60.5	63.0	76.0	64.0	62.7	559.3
Wagga Wagga	91.6	84.9	113.9	86.4	99.6	88.7	93.1	88.7	82.1	112.4	96.6	91.0	772.0

Maximum temperature records for the selected stations are set out in Table 4-3. The mean maximum monthly temperatures reach a peak of 33.3°C in January at Swan Hill but are 1.4 degrees lower at Wagga Wagga. The mean maximum monthly temperature is 14.8°C in July (the coldest month) at Swan Hill, and two degrees colder in Wagga Wagga.

The average number of days per annum over 35°C ranges from 20.3 days at Wagga Wagga to 35.5 days at Swan Hill.

Minimum temperature records are set out in Table 4-3. The mean minimum temperatures falls to 3.6°C in July at Swan Hill and 2.8°C in Wagga Wagga. The highest mean minimum temperatures occur in January and are similar at both Swan Hill and Wagga Wagga (16.3°C and 16.5°C, respectively).

A minimum temperature under 2°C is generally regarded as the approximate temperature at which frost will occur. Swan Hill records an average of 38.1 such days per annum, while Wagga Wagga averages 49.6 days per annum.

Table 4-3
Summary of temperatures

Statistic Element (BoM 2024)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)													
Swan Hill	33.3	32.3	28.7	23.7	18.8	15.3	14.8	16.8	20.4	24.2	28.1	30.7	23.9
Wagga Wagga	31.9	31.0	27.8	22.6	17.4	13.9	12.8	14.6	17.8	21.7	25.9	29.5	22.2
Mean number of days >= 35°C													
Swan Hill	11.4	8.8	3.4	0.2	0.0	0.0	0.0	0.0	0.0	0.9	3.7	7.1	35.5
Wagga Wagga	8.1	4.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	4.3	20.3
Mean minimum temperature (°C)													
Swan Hill	16.3	15.9	13.0	9.2	6.3	4.4	3.6	4.1	5.8	8.1	11.7	13.8	9.4
Wagga Wagga	16.5	16.4	13.5	9.2	5.9	3.7	2.8	3.5	5.1	7.9	11.0	14.0	9.1
Mean number of days <= 2°C													
Swan Hill	0.0	0.0	0.0	0.4	3.6	7.7	10.5	9.3	5.4	1.1	0.1	0.0	38.1
Wagga Wagga	0.0	0.0	0.0	0.9	5.6	10.2	13.3	10.7	6.7	2.0	0.2	0.0	49.6

4.1.4 Climate change

The effect of climate change on the study area is somewhat uncertain but is likely to be multi-faceted and include several impacts. Climate projections are available from NSW and Australian Regional Climate Modelling (NARCliM 2024), with the Riverina Murray region being the relevant region for the study area.

Rainfall

NARCliM (2024) predict a 11.8 per cent reduction in annual rainfall by 2050 under a low emissions scenario and a 16.1 per cent reduction under a high emissions scenario. A reduction is expected across all seasons, but the predicted decline is higher in spring and summer and lower in winter.

Heavy rainfall intensity is projected to increase with high confidence. Time spent in drought is projected to increase (CSIRO & BoM 2022).

Temperature

NARCliM (2024) predict mean temperatures to rise by 1.1°C by 2050 and by 1.2°C by 2090 under a low emissions scenario. However, under a high emissions scenario the predicted increases are 1.9°C by 2050 and 3.7°C by 2090.

NARCliM (2024) predict that the average number of days above 35°C in 2050 will increase by 13.0 days per year under a low emissions scenario and by 20.8 days per year under a high emissions scenario. Nights under 2°C in 2050 are predicted to decline by 12.3 days per year under a low emissions scenario and by 18.7 days per year under a high emissions scenario. Therefore, fewer frosts are projected.

Other Issues

Increased temperature is likely to result in lower relative humidity, higher evapotranspiration, shorter growing seasons, and a greater potential for heat and moisture stress on crops, pasture and animals.

NARCliM (2024) predict the number of severe fire weather days will increase for the Riverina Murray region by 2050 (2.6 to 4.8 days per year) for both a low-emissions and a high-emissions scenario, with an even greater increase projected by 2090 under a high-emissions scenario (8.0 days per year). They also predict:

- an increased risk of lower inflows in key river catchments such as the Murray and Murrumbidgee Rivers
- reduced frequency, extent and duration of spring floods, and
- large-scale bushfires to become more common in the future.

The risk of heatwaves, flash flooding and a longer fire season is also anticipated (CSIRO & BoM 2022).

The average crop and pasture growth is likely to be reduced in spring and summer by higher temperatures and constrained by lower soil moisture levels. Conversely, plant growth rates may benefit from higher carbon dioxide levels and warmer average temperatures during autumn and winter. Frost damage risk may decline.

4.1.5 Soils

Inherent soil fertility in NSW has been mapped by OEH (2017). Inherent soil fertility is one of the criteria (hazards) used to determine LSC (section 4.3). Low to moderate fertility soils make up all of the study area, with most soils being of moderate fertility, as set out in Table 4-4.

Table 4-4
Summary of Inherent soil fertility

Inherent soil fertility	Project footprint		Study area	
OEH (2017).	Area (ha)	Proportion	Area (ha)	Proportion
Low	505	7.6%	8,397	8.7%
Moderately low	270	4.1%	151	0.2%
Moderate	5,832	88.3%	8,397	91.2%
Sub Total	**6,607**	100.0%	**96,833**	100.0%
Unclassified	3		5,604	
Total	**6,610**		**102,436**	

The study area for the NSW/Victorian border to the future Dinawan substation component of the project is dominated by moderate fertility vertosols with some rudosols. Vertosols comprise approximately 85 per cent of the entire study area and have clay texture throughout the profile, display strong cracking when dry, and shrink and swell considerably during wetting and drying phases (Agriculture Victoria 2024). Rudosols have low inherent fertility and a sandy, weakly developed profile.

The study area for the network augmentation works component is characterised by moderately low fertile kandosols, natric kurosols and sodosols, with smaller areas of low fertility rudosols and moderate fertility chromosols and kurosols (DPIE 2021).

Kurosols are moderately fertile with a distinct texture contrast between the topsoil (A horizons) and a strongly acid subsoil (B horizons) with higher clay content. Natric kurosols have sodic topsoils. Sodosols are similar to kurosols but have a sodic sub soil which is not strongly acidic (Agriculture Victoria 2024).

Kandosols are non texture contrast soils, with little increase or a gradual increase in clay content with depth. They have massive, weak to non-structured subsoils. Chromosols have moderate fertility and a distinct texture contrast between the A horizons and the B horizons, but the latter is neither strongly acidic nor sodic (Agriculture Victoria 2024).

A map of inherent soil fertility (OEH,2017) across the study area is provided in Figure 4-1.

4.1.6 Surface water

There are numerous watercourses within the study area for the NSW/Victorian border to Dinawan substation component of the project, but most are intermittent and do not provide reliable water for stock and domestic use. Major watercourses crossing this section of the study area includes Murray River, Delta Creek, the Coleambally Outfall Drain (also referred to as the West Coleambally Channel), Edward River (also known as Kolety), Niemur River and Wakool River [1]. However, surface water for agriculture is mainly supplied by earthen farm dams and irrigation canals.

Surface water for agriculture in the study area for the network augmentation works component is supplied by waterways and earthen farm dams[1]. Water is used for stock and domestic use, but no irrigation is undertaken. Key watercourses crossing this section of the study area are small creeks (6th Strahler order or lower). This includes (but is not limited to) Tywong Creek and Big Springs Creek.

Earthen farm dams capture and store local runoff and are mainly used for livestock purposes. Surface water is reticulated on many grazing properties using a system of pumps, pipes, tanks and livestock troughs.

There is also a large amount of irrigation undertaken within the study area between the NSW/Victorian border and Moulamein from irrigation canals. However, east of Moulamein, the study area largely avoids any irrigation land, although some is located nearby.

Further detail on the surface water catchments relevant to the study area is provided in *Technical paper 9 – Hydrology, flooding and water quality impact assessment*.

4.1.7 Groundwater

The study area covers various groundwater resources, including:

- the Lower Murray Shallow Groundwater Source, generally located between NSW/Victorian border and Moulamein
- the Lower Murrumbidgee Shallow Groundwater Source and the Lower Murrumbidgee Deep Groundwater Source, which are generally located between Moulamein and the future Dinawan substation
- Lachlan Fold Belt Murray Darling Basin Groundwater Source underlies the entire study area, outcropping only in the network augmentation works component of the project
- the Oaklands Basin Groundwater Source near the future Dinawan substation.

There are two registered irrigation bores and no stock and domestic bores registered within the Murray Alluvial Groundwater Sources 2020 Water Sharing Plan area (*Technical paper 10 – Groundwater impact assessment*, DPE 2022b).

[1] Further details of the watercourses in the study area is provided in *Technical paper 9 – Hydrology, flooding and water quality impact assessment*.

There are numerous registered bores within the Murrumbidgee Alluvial Groundwater Sources 2020 Water Sharing Plan area, almost all of which are for stock and domestic use. Most bores within the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2020 water sharing plan area are also used for stock and domestic use. However, several production bores near the study area are used for irrigation, especially between the Cobb Highway and the future Dinawan substation (DPE 2022a).

There are some irrigation and stock and domestic bores in the study area of the network augmentation works component, mainly in the south east part around the future Gugaa 500 kV substation, Livingstone Gully Road .

Salinity in the Murray Alluvium groundwater source, as indicated by groundwater electrical conductivity varies from fresh (400 µS/cm) to brackish (7,000 µS/cm) in shallow aquifers and fresh (400 µS/cm) to saline (20,000 µS/cm) in deep aquifers according to *Technical paper 10 – Groundwater impact assessment*.

Indicative groundwater salinity in the Murrumbidgee Alluvium groundwater sources ranges from fresh (585 µS/cm) to saline (32,800 µS/cm) within shallow aquifers and from 369 to 8,930 µS/cm (fresh to brackish) within deep aquifers (*Technical paper 10 – Groundwater impact assessment* and DPE 2023).

Salinity in the Porous Rock groundwater source is unknown, while in the Lachlan fractured rock groundwater source, salinity ranges from fresh to saline depending on rock type, fracture density and aquifer depth (*Technical paper 10 – Groundwater impact assessment).*

Groundwater is reticulated on most grazing properties using a system of pumps, pipes, tanks and livestock troughs.

Further detail on hydrogeology relevant to the study area is provided in *Technical paper 10 – Groundwater impact assessment*.

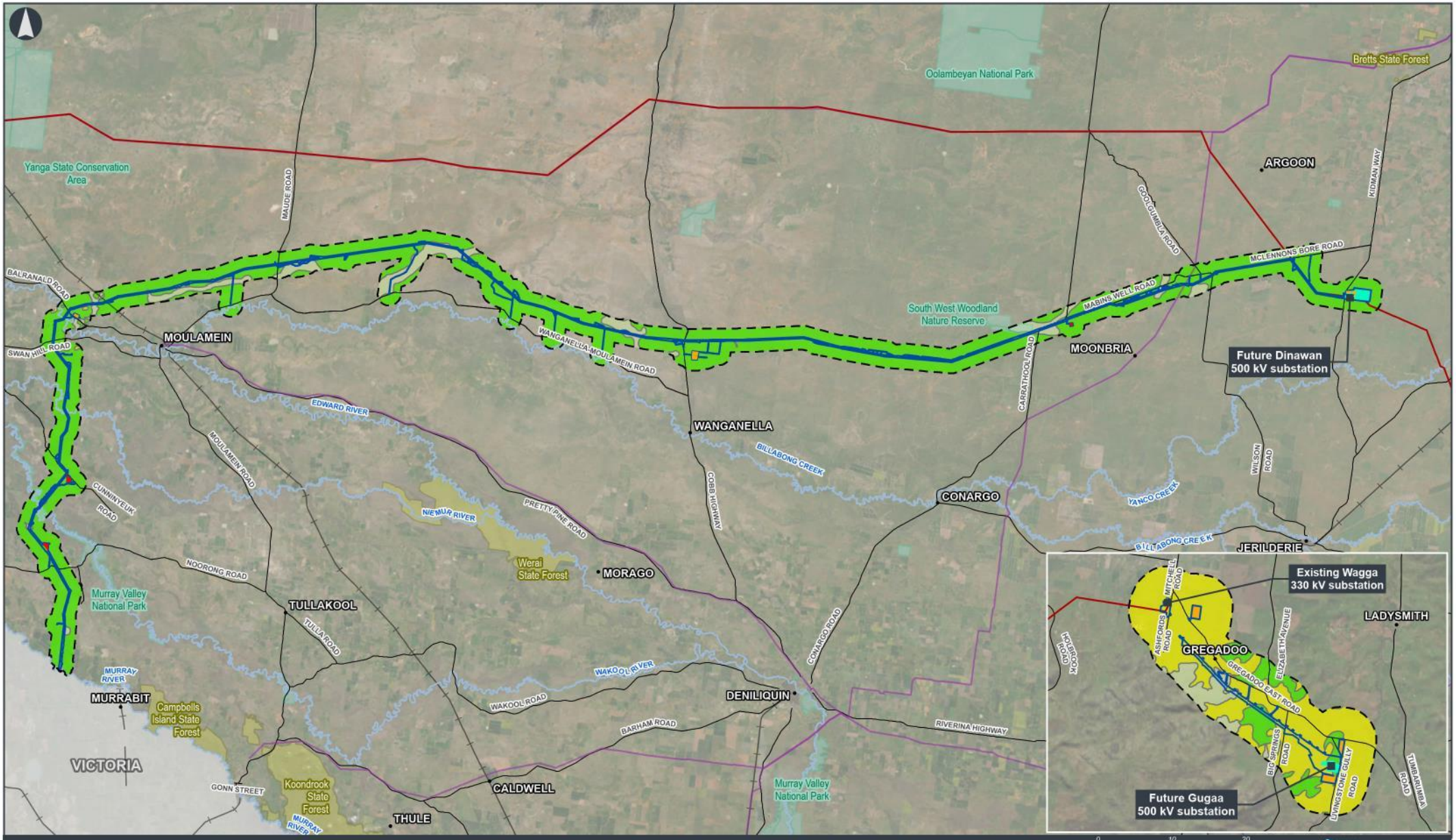


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Figure 4.1
Inherent soil fertility

Legend

- Main road
- Rail line
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Combined temporary worker accommodation facility
- Substation

Inherent soil fertility

- 1 - Low
- 2 - Moderately low
- 3 - Moderate
- 4 - Moderately high
- Not assessed
- Water

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

4.1.8 Land use

Land use across the study area has been analysed using 2017 NSW land use GIS data (DPIE 2022). Maps of land use have been included as Figure 4-2 and Appendix 1. Relevant areas of land use are summarised in Table 4-5.

Most of the land on and around the study area is used for grazing of native vegetation. However, land use varies considerable in different parts of the study area.

The study area between Carrathool Road and the future Dinawan substation is mainly used for grazing of native vegetation with some irrigated cropping and grazing of modified pastures, and some dryland cropping in the vicinity of the study area for NSW/Victorian border to the future Dinawan substation component. Land use within the study area located between Carrathool Road and the Berrambong Railway Road near Moulamein is dominated by grazing of native vegetation with little other agricultural uses.

Between NSW/Victorian border and Moulamein, there is a high proportion of cropping, irrigated cropping and grazing of modified pastures within the study area in addition to substantial grazing of native vegetation.

Land use in the study area for network augmentation works component is dominated by grazing of modified pastures and cropping, with small areas of grazed native vegetation.

Across the study area, around 94 per cent of land is used for agricultural activities, while grazing of native vegetation comprises 73 per cent. Arable land was estimated as the sum of areas occupied by the grazing of modified pastures (8.6 per cent) and cropping (12.4 per cent) and is equivalent to around 21.1 per cent of the study area.

Approximately seven per cent of the project footprint and eight per cent of the study area is irrigated crops, pasture or tree crops. Data on land use gathered during landholder consultations show a similar area of irrigated land.

Grazing of cattle and sheep (for wool and meat) is common throughout the study area.

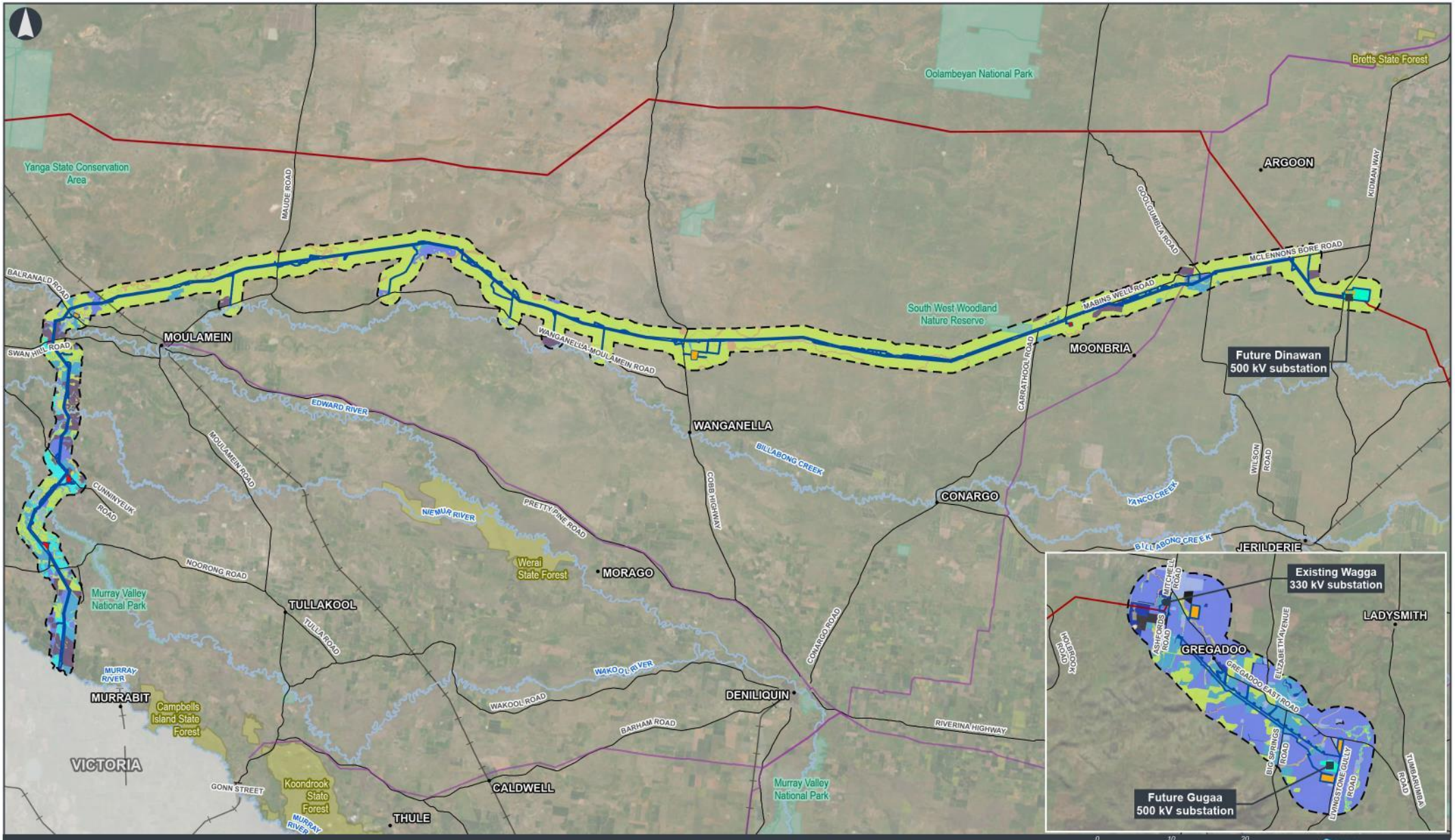

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Figure 4.2
Land use

Legend

- Main road
- Rail line
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Combined temporary worker accommodation facility
- Substation

Land Use (2017)

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 4.4.0 Irrigated perennial horticulture
- 5.2.0 Intensive animal production
- 5.4.0 Residential and farm infrastructure
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.4.0 Channel/aqueduct
- 6.5.0 Marsh/wetland

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

Table 4-5
Summary of land use

Land Use (DPIE 2022)	Project footprint		Study area	
	(ha)	(%)	(ha)	(%)
Agricultural land uses				
Grazing native vegetation	5,106	77.2%	74,786	73.0%
Grazing modified pastures	455	6.9%	5,983	5.8%
Cropping	444	6.7%	7,372	7.2%
Grazing irrigated modified pastures	277	4.2%	2,873	2.8%
Irrigated cropping	208	3.1%	5,339	5.2%
Irrigated tree fruits	0	0.0%	9	<0.1%
Intensive animal production	0	0.0%	26	<0.1%
Sub-total - Agriculture	**6,490**	**98.2%**	**96,388**	**94.1%**
Other land uses				
Nature conservation	1	<0.1%	802	0.8%
Managed resource protection	13	0.2%	314	0.3%
Transport and communications	10	0.2%	148	0.1%
Residential and farm infrastructure	2	<0.1%	371	0.4%
Dams, rivers, marsh, wetlands	79	1.2%	4,251	4.2%
Other land uses[1]	15	0.2%	162	0.2%
Total	**6,610**	**100.0%**	**102,436**	**100.0%**

Note on Table 4-5:

Individual amounts are approximate and may not sum to the amount of the totals due to rounding.

[1] In this case, 'Other' land uses include 'other minimal use', services, utilities, mining, waste treatment and disposal, channels, and aqueducts which are present in small areas.

4.1.9 Travelling stock reserves and livestock routes

The grazing industry uses a network of Crown reserves called travelling stock reserves (TSRs) for moving or grazing stock on foot around NSW. Some of these reserves are linear, providing a route for livestock to move from place to place. Other reserves are blocks of varying sizes providing a place for livestock to be temporarily grazed or held (e.g., for overnight yarding). In addition to the TSRs, livestock can also be moved along public roads subject to a permit from the LLS.

The project footprint intersects with five linear category 2 TSRs (LLS 2022). Category 2 TSRs are defined as those that "are used for travelling stock, emergency management or biosecurity purposes, but they are also important and used for other reasons, e.g. biodiversity, conservation, Aboriginal cultural heritage or recreational purposes" (LLS 2022). The intersecting TSRs are as follows:

- Bullock Hide (Noorong Road, near Mellool)
- 8 Mile Balranald Rd (Balranald Road near Moulamein)
- Raubelle Tank (Maude Road)
- Wanganella-Halfway (Cobb Highway)
- Moonbria-Steam Plains (Carrathool Road).

Carrathool Road, Cobb Highway, Maude Road and Balranald Road are also designated 'livestock highways'. The NSW Department of Industry defined 'livestock highways' as a key network of livestock routes connecting key agricultural regions within NSW, and with Queensland and Victoria (Department of Industry, 2017).

The project footprint is adjacent to two category 3 TSRs, Caroonboon and Widrington. A category 3 TSR is described as 'rarely, if ever used for travelling stock or emergency management, but is important, valued and used for other reasons such as biodiversity conservation, First Nations Peoples' heritage or recreation' (LLS 2022).

The project footprint is also adjacent to four linear category 2 TSRs and one block category 2 TSR, and within 10 kilometres of approximately another 15 TSRs. The adjacent TSRs are all between the future Dinawan substation and Four Corners and are as follows:

- Fernbank Road
- McLennons Bore Road
- Mabins Well
- Steam Plains (block)
- Carrathool – Four Corners.

For the network augmentation works component, there are three category 2 TSRs within the study area (Simpson, Big Springs/Gregadoo Tooles Creek).

One of these (Simpson) is adjacent to the project footprint (temporary accommodation worker facility).

There is one further category 2 TSR, Tooles, located around 1.5 kilometres south east of the study area on the intersection of Gregadoo East Road and Tumbarumba Road.

Refer to Figure 4-3 for the location of TSRs relative to the project.

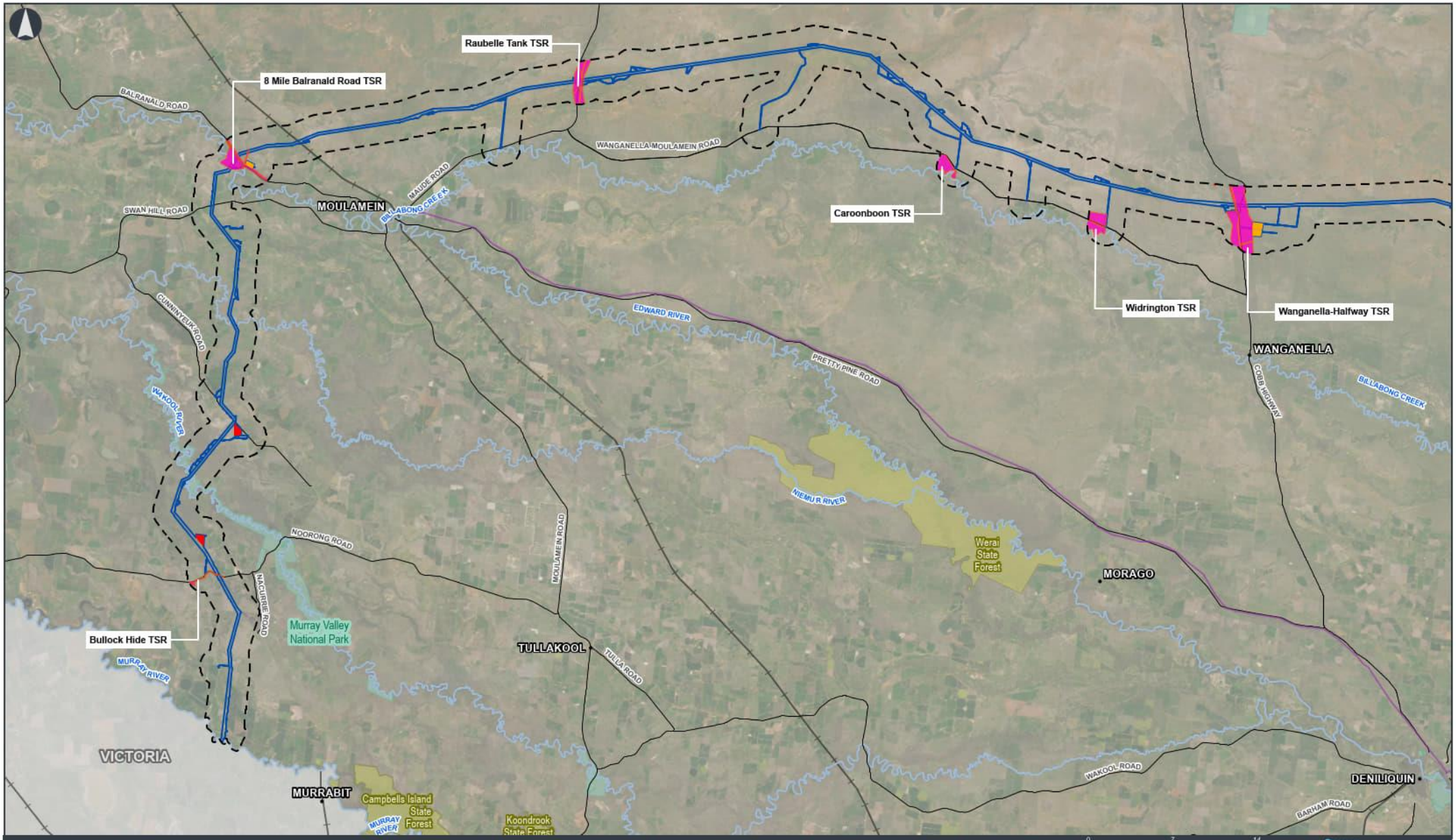

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Figure 4.3a
Travelling stock routes and livestock highways

Legend

- Main road
- Rail line
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Combined temporary worker accommodation facility
- Substation
- Travelling stock reserves within the agricultural study area

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

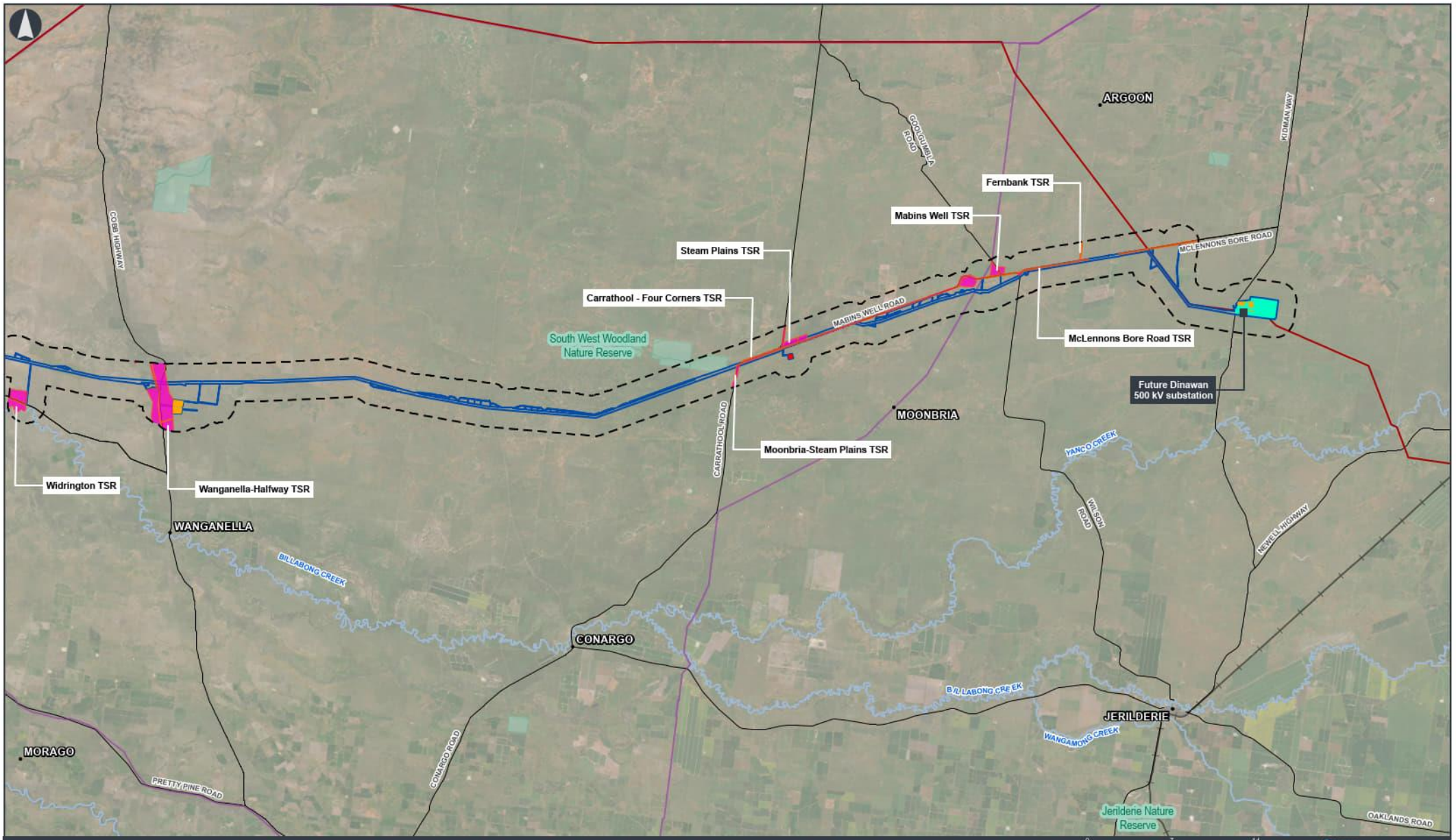

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Figure 4.3b
Travelling stock routes and livestock highways

Legend

- Main road
- Rail line
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Combined temporary worker accommodation facility
- Substation
- Travelling stock reserves within the agricultural study area

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

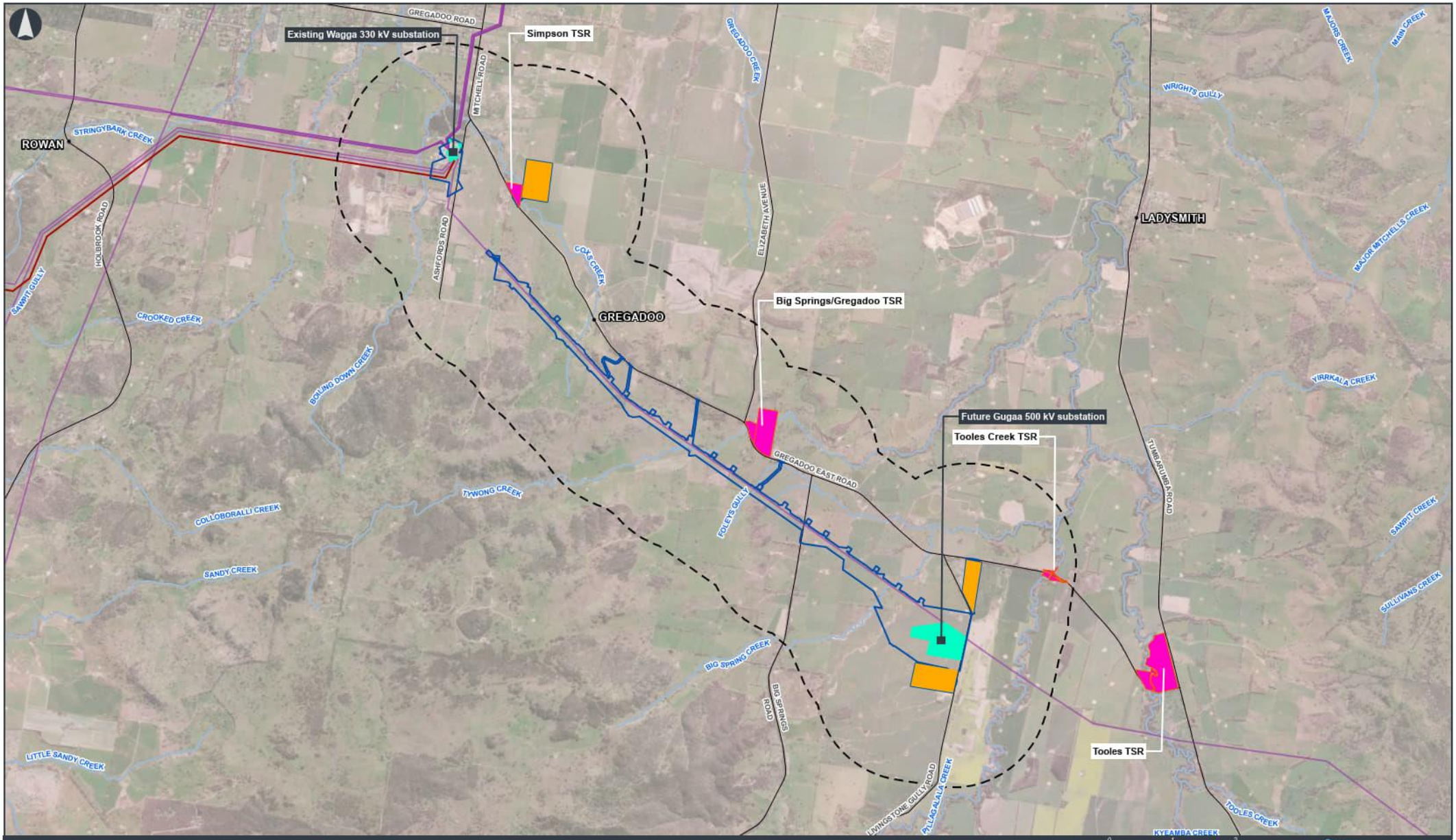

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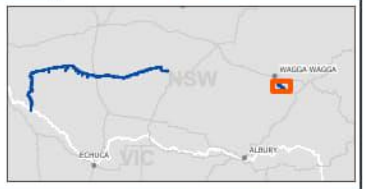
Figure 4.3c
Travelling stock routes and livestock highways

Legend

- Main road
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility
- Substation
- Travelling stock reserves within the agricultural study area



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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

4.2 Biosecurity issues

The agricultural industry in the NSW/Victorian border to the future Dinawan substation component is generally less affected by biosecurity issues due to its separation from major populations and intensive agricultural industries, and its semi-arid climate which is challenging for exotic animals and plants to survive. However, there are some biosecurity issues in this component, and higher degree of biosecurity issues exist in the more intensive agricultural areas located in the study area for the network augmentation works component of the project.

4.2.1 Weeds

The most common weeds recorded by authorised officers[1] during property inspections near the study area for the NSW/Victorian border to the future Dinawan substation component (DPI 2024a) were African boxthorn (*Lycium ferocissimum*), khaki weed (*Alternanthera pungens*) and horehound (*Marrubium vulgare*). Together they comprised 82 per cent of all records. Khaki weed was common within the study area between Moulamein and the future Dinawan substation but much less prevalent within the study area between the NSW/Victorian border and Moulamein. Other common weeds included Bathurst burr (*Xanthium spinosum*), silverleaf nightshade (*Solanum elaeagnifolium*), spiny burrgrass (*Cenchrus* spp), galvanised burr (*Sclerolaena birchii*), Noogoora burr (*Xanthium occidentale*), prickly pears (*Opuntia* spp) and tobacco bush *(Solanum mauritianum).*

Blackberry (*Rubus fruticosus* species aggregate) comprised approximately 65 per cent of all weeds recorded by authorised officers during property inspections near the study area for the network augmentation works component (DPI 2024a). Other common weeds included Cape tulip (*Moraea flaccida*), horehound, Paterson's curse (*Echium plantagineum*), silverleaf nightshade and St. John's wort (*Hypericum perforatum*).

Other "weeds of concern" are listed in the relevant Regional Strategic Weed Management Plans (Riverina LLS 2022 and Murray LLS 2022). They are described as *"species for which a consistent and/or collaborative approach to management will provide the best outcome across the region" or "species that are high risk, high priority for a number of current regional weed programs, though not feasible to contain or eradicate from the region"*. These weeds are listed in Appendix 2.

4.2.2 Pest animals

Foxes and wild rabbits have a widespread distribution across the study area (Murray LLS 2024, Riverina LLS 2024). Rabbits are mostly in low abundance but there are higher numbers in a large area east of Moulamein and within the study area for the network augmentation works component of the project. Feral pigs have low to medium abundance with the highest numbers also east of Moulamein. Feral goats have a more scattered distribution and are not found in high numbers around the study area (Murray LLS 2024, Riverina LLS 2024).

Feral deer are present in the study area between the NSW/Victorian border and Moulamein, in a large area between Moulamein and Deniliquin and within the study area for network augmentation works component of the project. Wild dogs and wild horses are generally not found near the study area (Riverina LLS 2018, Murray LLS 2024, Riverina LLS 2024).

[1] As defined under the *Biosecurity Act 2015.*

4.2.3 Animal and plant diseases

Footrot is a contagious bacterial disease of sheep and goats, caused by the organism *Dichelobacter nodosus (D. nodosus)* in association with several other bacteria. The bacterium *D. nodosus* may persist for many years in the feet of infected sheep and may pass from infected sheep into the soil. Footrot is introduced into a clean flock by the inclusion of infected sheep, or by exposure to contaminated land under favourable conditions.

The occurrence of sheep footrot in the vicinity of the study area has been low in recent years. DPI reported a total of 14 flocks infected with virulent footrot as of December 2022 across the Murray LLS region. The total number of all flocks across the Murray LLS region was 1,263. Therefore, the infection rate was around 1.1 per cent (DPI 2023b).

Across NSW there was 59 new cases of virulent footrot in 2022, a decline on the 73 recorded in 2021, but an increase on the previous three years (2018 to 2021), which averaged 14 cases per annum. The increase was attributed to wetter, more favourable conditions for spread in 2021 and 2022 (DPI 2023b).

Little recent data is available on the prevalence of ovine Johne's disease (OJD) in NSW. However, the study area was in a low prevalence area in 2010 with less than 0.8 per cent of flocks estimated to be infected (DPI 2011a). OJD is an incurable infectious wasting disease caused by the bacterium *Mycobacterium paratuberculosis*.

Under the *Biosecurity Act 2015* (NSW), sheep footrot and OJD are notifiable diseases.

No specific data is available on sheep lice infestations near the study area.

Horticultural enterprises are particularly susceptible to plant diseases and pests. The study area is within the Phylloxera Exclusion Zone to which movement of grapes and grape vine material is prohibited, and other movement restrictions apply. Parts of the study area are relatively close to an important wine region near Griffith, Swan Hill and in the Sunraysia region.

The entire state of NSW is a potato biosecurity zone. The potato biosecurity zone restricts the movement of any restricted potato biosecurity matter (including Solanaceae plants and certain material that has been in contact with a Solanaceae plant) into the potato biosecurity zone.

4.3 Land and soil capability

There are several measures of land capability relevant to agriculture. Some classify all agricultural land into various grades, while others seek to identify and protect the highest quality land.

This report primarily utilises the land and soil capability based on the Land and Soil Capability (LSC) Assessment Scheme (OEH 2012). However, other measures are also examined in the following sections.

4.3.1 Background

The LSC assessment scheme was published in 2012 by the former Office of Environment and Heritage (OEH) (OEH 2012), representing a revision of an earlier scheme that was first published by the former Soil Conservation Service of NSW in 1986 (Emery 1986). The LSC system builds on the earlier scheme, but with more emphasis on a broader range of soil and landscape properties.

LSC is based on an assessment of the biophysical characteristics of the land, the extent to which these would limit a particular type of land use, and the current technology that is available for the management of the land. It indicates the broad agricultural land uses most physically suited to an area. That is, it determines the best match between the physical requirements for the agricultural use and the physical qualities of the land. It also addresses the potential hazards and limitations associated with specific agricultural uses over a site. The LSC system can provide guidance on the inputs and management requirements associated with different intensities of agricultural land use (Woodward 1988).

The LSC assessment is based on the premise that using land beyond its capability may have serious consequences for the land and soil resources of the State as well as broader environmental impacts on water, air and biodiversity (Woodward 1988).

The LSC assessment scheme comprises eight land capability classes (1 to 8) with values representing a decreasing capability of the land to sustain intensive agricultural land use. Class 1 represents land capable of sustaining most intensive land uses including those that are often associated with regular soil cultivation, whereas class 8 represents land that can only sustain very low intensity land uses.

The current LSC scheme was initially developed for the NSW property vegetation planning program under the former *Native Vegetation Act 2003* and further updated for the NSW Natural Resources Monitoring, Evaluation and Reporting program.

The LSC assessment scheme uses the biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards. These hazards include water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement. Each hazard is given a rating between 1 (best, highest capability land) and 8 (worst, lowest capability land). The final LSC class of the land is based on the most limiting hazard.

The LSC class gives an indication of the land management practices that can be applied to a parcel of land without causing degradation to the land and soil at the site and to the off-site environment. As land capability decreases, the management of hazards requires an increase in knowledge, expertise and investment. In lands with lower capability, the hazards cannot be managed effectively for some land uses.

The LSC assessment scheme is most suitable for broad-scale assessment of land capability, particularly for assessment of lower intensity, dryland agricultural land use. It is less applicable for high intensity land use, or for irrigation (Woodward 1988).

4.3.2 LSC classes

The definition of the LSC classes is provided in Table 4-6.

Table 4-6
LSC class definitions (OEH 2012)

LSC class	Definition
Class 1 land (very slight to negligible limitations)	Extremely high capability land: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices
Class 2 land (slight but significant limitations)	Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation
Class 3 land (moderate limitations)	High capability land: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation
Class 4 land (moderate to severe limitations)	Moderate capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology
Class 5 land (severe limitations)	Moderate–low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation
Class 6 land (very severe limitations)	Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation
Class 7 land (extremely severe limitations)	Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation
Class 8 land (extreme limitations)	Extremely low capability land: Limitations are so severe that the land is incapable of sustaining land use apart from nature conservation. There should be no disturbance of native vegetation

4.3.3 LSC in the study area

Maps of LSC across the study area are included in Figure 4-4 and Appendix 2. The area of each LSC class is summarised in Table 4-7.

The study area for the NSW/Victorian border to the future Dinawan substation component of the project consists mostly of LSC classes 4 and 5, but with a relatively small additional area of class 6, mainly along various watercourses. There are no high capability classes 1 to 3 or very low capability 7 and 8 land within in this section of the study area. The eastern part of the study area between the Cobb Highway and the future Dinawan substation is dominated by the class 4 land, while class 5 land dominates between the Cobb Highway and Moulamein. The study area from the NSW/Victorian border to Moulamein consists of class 4 and 5 land in relatively equal amounts.

The study area in the network augmentation works component of the project consists mostly of LSC classes 4 and 5, with small areas of classes 6 and 7. There is also a small area of class 3 land (high capability) on and near the future Gugaa 500 kV substation, Livingstone Gully Road. There are no classes 1, 2 or 8 land within in the study area for the network augmentation works component.

Table 4-7
Summary of land and soil capability

	Project footprint		Study area	
LSC class (OEH 2012)	**(ha)**	**(%)**	**(ha)**	**(%)**
3 - High capability	45	0.7%	236	0.2%
4 - Moderate capability	3,715	56.2%	49,213	48.1%
5 - Moderate–low capability	2,277	34.5%	39,165	38.3%
6 - Low capability	565	8.6%	13,275	13.0%
7 - Very low capability	4	0.1%	498	0.5%
Sub Total	**6,607**	**100.0%**	**102,386**	**100.0%**
Unclassified	3		49	
Total	**6,610**		**102,436**	

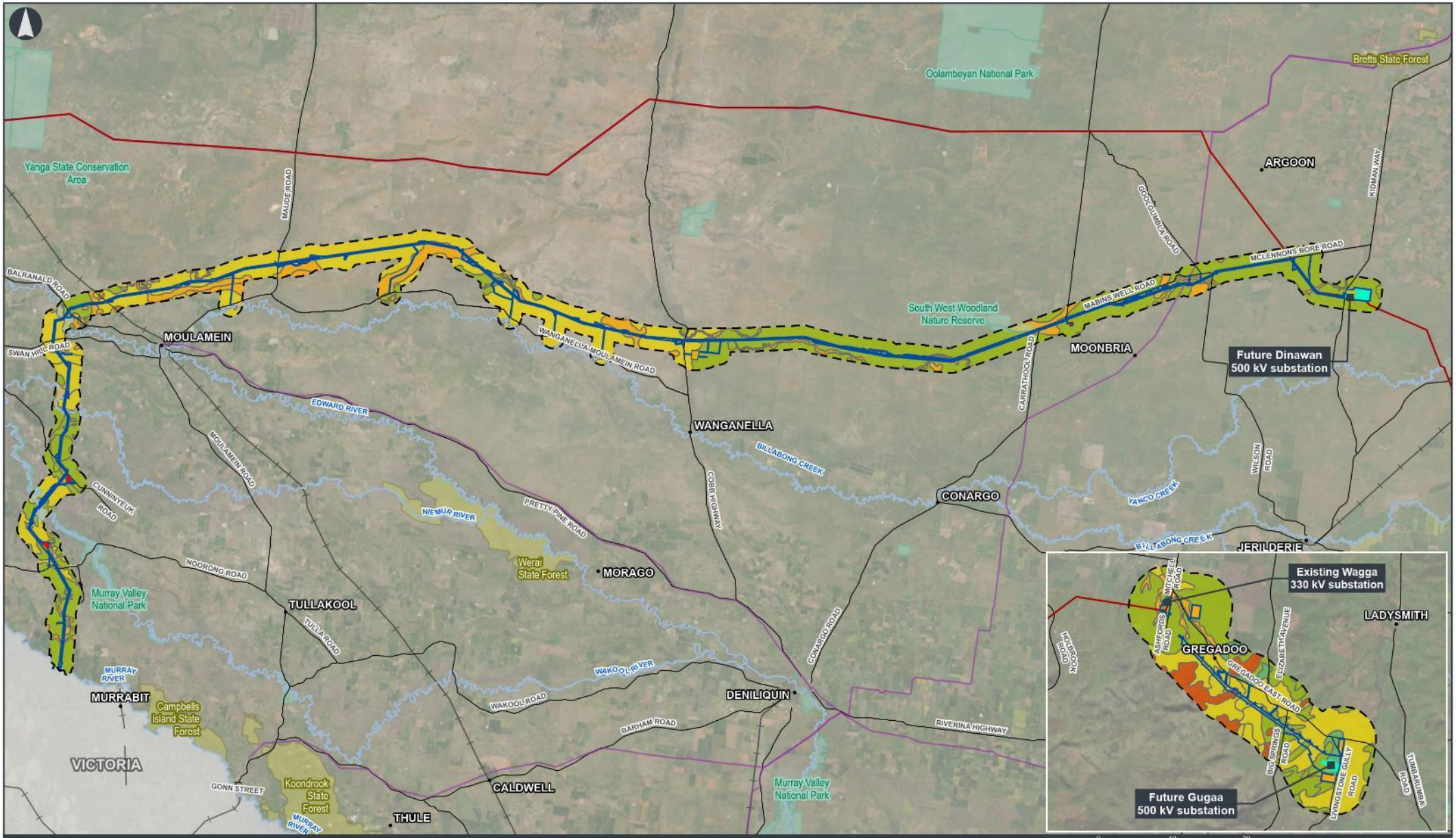

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Figure 4.4
Land and soil capability

Legend

- Main road
- Rail line
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Combined temporary worker accommodation facility
- Substation

Land Soil Capability

- 3 - Moderate limitations
- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations
- 7 - Extremely severe limitations
- 8 - Extreme limitations
- Not assessed
- Water

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

4.4 Other measures of land capability

4.4.1 Agricultural land classification

The Agricultural Land Classification (ALC) system is similar to the LSC assessment scheme. The current ALC system (Hulme, et al 2002) was developed by the former NSW Agriculture (now DPI).

Under the ALC system, land is classified by evaluating biophysical, social and economic factors that may constrain the use of land for agriculture. In general terms, the fewer the constraints on the land, the greater its value for agriculture. Each type of agricultural enterprise has a particular set of constraints affecting production.

The ALC system is not considered in detail in this assessment due to its similarity to the LSC assessment scheme, and its limitations. Squires (2017) states that the ALC system has limitations with *"poor quality control of product, limited availability and suitability for digital conversion (available as paper maps only in some areas), does not identify specific industry needs and excludes non-soil based agricultural needs".*

4.4.2 Biophysical strategic agricultural land

Biophysical strategic agricultural land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. The protocol for determining BSAL is set out in OEH (2013). BSAL has the best quality intrinsic landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management to maintain the high quality (DPE 2013).

Mapping of BSAL undertaken by DPE (2013) indicates that there is no BSAL in the study area.

4.4.3 State significant agricultural land

A draft map of State significant agricultural land (SSAL) has been released (DPI 2021). The distribution of SSAL across NSW is greater than for BSAL. Although the assessment of both is based on similar parameters, SSAL includes large areas of irrigated land which is not classified as BSAL. Therefore, substantial areas of draft SSAL are located on or near the study area mostly corresponding to irrigated land uses (refer section 4.1.8). However, GIS data on SSAL is not available, and it has not been possible to quantify the areas.

There is scattered SSAL in the study area between the future Dinawan substation and the Carrathool Road[1]. This is consistent with irrigated cropping land use. There is also a moderately high proportion of the land in the study area between the NSW/Victorian border and Moulamein that is classified as SSAL, broadly matching irrigation activities.

There is also a small area of SSAL (approximately 45 hectares) corresponding to the area of LSC class 3 land within the study area near the future Gugaa 500 kV substation, Livingstone Gully Road.

[1] GIS data on SSAL is unavailable and the area cannot be reliably determined.

4.5 Agricultural productivity

4.5.1 Employment

Table 4-8 sets out total employed persons at the 2021 Census in the impacted LGAs, and the number and proportion employed in the agriculture industry (ABS 2022a). Agriculture is the largest industry (by number of persons employed) in Murray River, Edward River, Murrumbidgee LGAs (the western LGAs). However, the proportion of people employed in agriculture is much higher in Murrumbidgee LGA than in Edward River and Murray River LGAs.

The rate of employment in agriculture is much lower in the Wagga Wagga LGA, than in the other LGAs. Consequently, the figures for Wagga Wagga LGA are treated separately in Table 4-8. Agriculture, forestry and fishing employs approximately four per cent of the total workforce, due to the large influence of the Wagga Wagga urban centre and high employment in the service industries.

Table 4-8
Employment in agriculture

ABS 2022a	Agriculture, forestry and fishing		Total
LGA	Number	Proportion	Employment
Murray River	1,011	17.9%	5,646
Edward River	660	17.5%	3,773
Murrumbidgee	598	36.4%	1,644
Sub total	**2,269**	**20.5%**	**11,063**
Wagga Wagga	1,398	4.2%	33,283

In 2021, there were 2,932 'agriculture, forestry and fishing' businesses in the western LGAs. This is approximately 41 per cent of all businesses, but the proportion was much higher in Murrumbidgee LGA than in Edward River and Murray River LGAs (ABS 2022a).

The proportion of 'agriculture, forestry and fishing' businesses in the Wagga Wagga LGA, at 15 per cent, is much lower than for the western LGAs.

4.5.2 Agricultural land use

The total area of agricultural holdings across the three western LGAs in 2020-21 is summarised in Table 4-9. The average agricultural holding is approximately 2,255 hectares across these LGAs (ABS 2022b). The average agricultural holding size in the Murrumbidgee LGA is slightly lower than the overall average.

Table 4-9
Total area of agricultural holdings 2020-21

ABS 2022b LGA	Area of holdings (ha)	Number of businesses	Average size (ha)
Edward River	859,344	364	2,361
Murray River	930,332	347	2,681
Murrumbidgee	616,635	356	1,732
Sub total	**2,406,311**	**1,067**	**2,255**
Wagga Wagga	444,995	463	961

The average size of agricultural holdings in the Wagga Wagga LGA is much smaller at approximately 961 hectares, and the nature of the agricultural land use (Table 4-10) is substantially different. Consequently, the figures for Wagga Wagga LGA are treated separately in Table 4-9.

The same ABS data show broad land uses on agricultural holdings across the western LGAs which are set out in Table 4-10 and discussed below.

Cropping accounts for approximately 20.9 per cent of total land use, but horticulture comprises less than one percent. Non-agricultural uses, including forestry, account for approximately 5.6 per cent of land use on agricultural holdings.

The ABS data provide details for cropping and horticulture land uses but do not specify the land use for the 'other' agricultural land, which total 1.76 million hectares across the western LGAs. This is mostly grazing land as indicated by separate ABS data that shows 1.64 million hectares of the holdings in the western LGAs were mainly used for grazing. However, this data is collected separately and is not entirely consistent with the data in Table 4-10.

The DPE land use data (refer section 4.1.8) also indicates that most of the study area is used for grazing of native vegetation or grazing of modified pastures.

Overall, 'other' agricultural land across the western LGAs comprises 73 per cent of the total area of holdings. As 'other' agricultural land is mostly used for grazing, it is estimated that approximately 73 per cent of the total area of holdings is used for grazing. The percentage of 'other' agricultural land varies from 60 per cent in the Murrumbidgee LGA where a higher percentage of land is used for cropping, to 77-78 per cent in the Edward River and Murray River LGAs.

There is a much higher proportion of cropping in the Wagga Wagga LGA, and a corresponding lower level of grazing land use estimated at 46 per cent.

Table 4-10
Land use on farms 2020-21

ABS 2022b	**Area (ha)**	
Land use	**Western LGAs**	**Wagga Wagga LGA**
Wheat for grain	211,246	85,056
Other broadacre crops	246,208	106,501
Hay and Silage	45,312	13,922
Grapes	3,367	35
Fruit and nuts	4,069	25
Other horticulture	1,927	269
Other agriculture - mostly grazing	1,760,308	203,481
Total agricultural area	**2,272,437**	**409,289**
Forestry	10,092	900
Land not used for agricultural production	123,782	34,806
Total area of holdings	**2,406,311**	**444,995**

4.5.3 Livestock carried

Table 4-11 sets out total livestock numbers across the impacted LGAs in 2020-21.

'Stock units' in Table 4-11 are calculated as one unit for sheep, lambs, goats and 'other', and 10 units each for meat cattle and dairy cattle. Pigs and poultry are disregarded for this calculation as they are generally intensively raised rather than grazed on pasture. The 'stock units per hectare' amount calculated in Table 4-11 is calculated as the total grazing stock units, divided by the estimate of land mainly used for grazing. This calculation indicates the average stocking rate of pastures.

The average stocking rate of 1.46 stock units per hectare across the western LGAs in 2020-21 is similar to the average stocking rate across all of NSW of 1.53 stock units per grazing hectare (ABS 2022b). The rate in Wagga Wagga is much higher at 5.71 stock units per grazing hectare. The NSW average includes large areas of semi-arid rangeland with low livestock carrying capacity in the western part of NSW.

Table 4-11
Total livestock numbers

ABS 2022b	**Number**	
Livestock type	**Western LGAs**	**Wagga Wagga LGA**
Grazing livestock		
- Sheep and lambs	1,410,714	629,271
- Meat cattle	86,897	51,667
- Dairy cattle	29,130	2,243
- Goats and other livestock	4,140	9,419
Sub total – grazing stock	1,530,880	692,600
Total grazing stock units	2,575,119	1,177,789
per hectare[1]	1.46	5.79
Other livestock		
- Pigs	76,960	6,948
- Poultry	2,036,244	81

1 Excluding cropping and horticultural areas

4.5.4 Value of agricultural production

The total gross value of agricultural production across the impacted LGAs in 2020-21 (ABS 2022c) is shown in Table 4-12 at $1,111 million.

Table 4-12
Total gross value of agricultural production

Product (ABS 2022c)	Total gross value	
	Western LGAs	Wagga Wagga LGA
Broadacre crops		
Wheat	$197,258,898	$102,825,948
Hay	$291,057,783	$107,147,735
Other crops	$44,953,834	$17,056,059
Total - Broadacre crops	$533,270,515	$227,029,743
Horticulture		
Grapes	$29,397,189	$98,204
Fruit and nuts	$83,322,083	$94,549
Vegetables	$100,307,192	$6,087,630
Other horticulture	$33,620,492	$6,310,035
Total - Horticultural crops	$246,646,957	$12,590,418
Livestock products		
Wool	$48,055,071	$21,435,705
Sheep and lambs	$72,833,849	$30,141,104
Cattle and calves	$71,867,562	$33,480,191
Milk	$70,366,792	$4,841,438
Pigs	$35,663,343	$3,219,703
Poultry and eggs	$32,391,518	$1,586
Goats and other livestock	$91,924	$132,409
Total - Livestock products	$331,270,058	$93,252,136
Total – Agriculture	**$1,111,187,531**	**$332,872,296**

Broadacre crops comprised 48 per cent of the total value of agricultural production in the western LGAs and 68 percent in the Wagga Wagga LGA. Wheat was the largest single crop, but barley, rice, canola and cotton were also high value commodities.

Livestock income was widely diversified. The disposal of 'cattle and calves' and 'sheep and lambs' (mostly for meat) were the most valuable livestock product, followed by milk and wool.

Horticulture contributed approximately 22.2 per cent of the total gross value of agricultural production in the western LGAs, despite the small proportion of land used for horticulture, but contributed only 3.8 per cent in the Wagga Wagga LGA. Vegetables were the most valuable horticultural product with tomatoes being the main commodities. 'Fruit and nuts' products were also relatively valuable, dominated by citrus fruit, stone fruit and almonds.

The nature of agricultural production in the Murrumbidgee LGA differs somewhat from the other LGAs in that there is a much higher value of horticulture. This is due to the intensive irrigation of horticultural crops undertaken in areas such as the Coleambally Irrigation Area. There is only a small area of irrigated horticulture in the study area (Table 4-5).

The average gross value of agricultural production in 2020-21 was equivalent to $489 per hectare over the total area of agricultural holdings in the western LGAs and was $813 per hectare in the Wagga Wagga LGA.

There was a large difference between the average value of broadacre cropping production ($1,074 per hectare), horticulture production (approximately $26,711 per hectare) and grazing production ($216 per hectare). There was also a large difference between the value of grazing production in the western LGAs ($188 per hectare) and Wagga Wagga LGA ($458 per hectare). Conversely, the average gross value of cropping was similar in the western LGAs ($1,061 per hectare) and Wagga Wagga LGA ($1,105 per hectare).

The value of agricultural production is greatly influenced by seasonal and market conditions and can fluctuate widely from year to year.

5 Construction impacts

5.1 Loss of land use

5.1.1 Impacts

The land required to support construction of the project would impact upon agricultural production in varying ways across the project footprint. For example, all agricultural activities are likely to be excluded on the land required for temporary accommodation worker facilities, the future Dinawan substation expansion, access tracks, construction compounds, laydown and staging areas, stockpiling areas, concrete batching plants, brake and winch sites, site offices, parking areas, and other ancillary activities to support the construction of the project. However, the land required for transmission lines would restrict agricultural uses during construction, but would not completely exclude all activities such as grazing at times during the construction period.

Irrigated and dryland cropping would likely be prevented or considerably affected on most of the project footprint. However, grazing of livestock may continue where transmission lines are proposed to be constructed, subject to the timing and location of planned construction activities. To minimise potential impacts, property management plans will be prepared in consultation with affected landholders to identify access arrangements, protocols to regularly communicate programmed construction works, and identifying sensitive agricultural periods and locations, such as lambing times, lambing paddocks and crucial cropping activities.

Table 4-5 indicates that approximately 88.3 per cent of the project footprint is used for grazing. Therefore, a similar percentage of the land impacted during construction is expected to be grazing land. Cropping land would likely be impacted to a greater degree than grazing land, but it is only 9.9 per cent of the project footprint, which comprises almost all the remaining agricultural land.

5.1.2 Area affected

The agricultural area affected by construction would be influenced by several factors, as follows:

- Due to the dispersed nature of the infrastructure proposed and transient manner in which transmission lines are constructed, the scale and intensity of construction activities varies within the project footprint. For example, the project footprint between transmission line structures would not be affected to the same degree as the immediate area around each structure.
- It is expected that some agricultural land uses such as grazing may continue during construction in lesser impacted parts of the project footprint, subject to the timing and location of proposed construction activities, and the ability to implement safe access arrangements. This would include consideration of access arrangements that minimise impacts to livestock movements.

  It may be necessary in some instances to exclude livestock from the entire paddock in which the construction is taking place. The exclusion of livestock from entire paddocks would be subject to the extent and duration of construction activities, protective controls in place (e.g. temporary fencing) and landholder preferences. Consultation for the EIS found one landholder has a preference to destock the entire 'construction area' during construction while others have indicated they would remove lambing ewes away from the construction activities.
- The timing of construction activities in relation to cropping cycles.

To minimise impacts to livestock grazing and cropping, property management plans would be prepared in consultation with landholders. These would include requirements to notify landholders of construction activities and access arrangement.

The indicative area that would be unavailable to agricultural activities during construction is defined as the 'agricultural construction disturbance footprint'. This was calculated based on the indicative disturbance areas of various project components. The components of the agricultural construction disturbance footprint are as follows:

1. The disturbance area is limited to the transmission easement width of 60 to 110 metres[1], rather than the project footprint width of 200 metres.
2. Access tracks beyond the transmission line easement, construction compounds, temporary worker accommodation facilities, telecommunication facilities and low voltage power line (plus asset protection zones - APZ) outside the easement.

The following was excluded from the agricultural construction disturbance footprint:

1. The Dinawan substation expansion site and the Dinawan substation combined temporary worker accommodation facility and construction compound. These features are wholly contained within freehold land owned by Transgrid and is not used for agriculture.
2. Line connection and diversions works within the existing Wagga 330 kV substation and the future Gugaa 500 kV substation, Livingstone Gully Road.
3. Access tracks established by the HumeLink project in the network augmentation works component.

On this basis, the area of the agricultural construction disturbance footprint is calculated in Table 5-1.

Table 5-1
Area of agricultural construction disturbance footprint

	NSW/Victorian border to the future Dinawan substation		Network augmentation works		Total	
Component	**Area (hectares)**	**Percentage**	**Area (hectares)**	**Percentage**	**Area (hectares)**	**Percentage**
Transmission line easement	1,677	81%	137	67%	1,815	80%
Access tracks	179	9%	2	1%	181	8%
Construction compounds and temporary worker accommodation facilities	210	10%	65	32%	275	12%
Telecommunication facilities	<0.5	<1%	-	-	<0.5	0%
Total	**2,066**		**205**		**2,271**	

Note: Numbers and percentages have been rounded

The assessed agricultural construction disturbance footprint (2,271 hectares) is equivalent to approximately 0.080 per cent of the total agricultural holdings in the four impacted LGAs (2,851,306 hectares). The proportion is 0.086 per cent in the western LGAs, and 0.046 per cent in the Wagga Wagga LGA.

[1] Mainly a 70 metre easement in the NSW/Victorian border to Dinawan substation component, with some instances of a 110 metre easement. The easement would be 60 metres wide in the network augmentation works component, with an increase to a 70 metre easement around the future Gugaa 500 kV substation, Livingstone Gully Road.

The types of agricultural land use present in the components of the agricultural construction disturbance footprint are set out in Table 5-2.

Table 5-2
Land use in agricultural construction disturbance footprint

Component	NSW/ Victorian border to the future Dinawan substation		Network augmentation works		Total	
	Area (hectares)	Percentage	Area (hectares)	Percentage	Area (hectares)	Percentage
Grazing native vegetation	1,621	78%	13	6%	1,634	72%
Grazing modified pastures	119	6%	66	32%	185	9%
Cropping	79	4%	114	56%	193	8%
Grazing irrigated modified pastures	148	7%	-	-	148	7%
Irrigated cropping	70	3%	-	-	70	3%
Non-agricultural land uses	28	1%	12	6%	40	2%
Total	**2,066**		**205**		**2,271**	

Note: Numbers and percentages have been rounded

The NSW/Victorian border to the future Dinawan substation component is dominated by grazing of native vegetation, comprising 78 per cent of the agricultural construction disturbance footprint. Grazing modified pastures, cropping, grazing irrigated modified pastures and irrigated cropping each comprise between three per cent and seven per cent of agricultural construction disturbance footprint.

The network augmentation works component of the agricultural construction disturbance footprint is mostly comprised of cropping (56 per cent of the total) and grazing modified pastures (32 per cent).

Construction is estimated to take about two years to complete. However, construction activities associated with transmission line construction, including transmission line structure erection, transmission line stringing and vehicle and machinery movements along access tracks, would be intermittent and would not occur for the full duration at any one location. The length of disruption at other locations such as substations, temporary accommodation worker facilities, construction compounds (including concrete batching plants and site offices) is expected to be longer.

For the purposes of estimating the economic impact, it is conservatively assumed that no agricultural land use would be undertaken across the project during the expected 2-year construction period.

5.1.3 Value of production loss

The total gross annual value of grazing and crop production across the western LGAs in 2020-21 is estimated at $188 per hectare and $1,061 per hectare, respectively (section 4.5.4). Grazing and cropping occupies approximately 91 per cent and seven per cent, respectively, of the agricultural construction disturbance footprint in the NSW/Victorian border to the future Dinawan substation component. This indicates that the average gross annual value of production across the agricultural construction disturbance footprint in the NSW/Victorian border to the future Dinawan substation component is approximately $249 per hectare.

The total gross annual value of grazing and crop production across the Wagga Wagga LGA in 2020-21 is estimated at $458 per hectare and $1,105 per hectare, respectively (section 4.5.4). Grazing and cropping occupies approximately 38 per cent and 56 per cent, respectively, of the agricultural construction disturbance footprint in the network augmentation works component. This indicates that the average gross annual value of production across the agricultural construction disturbance footprint in the network augmentation works component is approximately $792 per hectare.

The impact during construction on the value of agricultural production is estimated in Table 5-3 at approximately $1.354 million, subdivided as approximately $1.029 million in the NSW/Victorian border to the future Dinawan substation component and $324,720 in the network augmentation works component. These amounts are equivalent to approximately 0.05 per cent of the total gross annual value of agricultural production across the relevant LGAs over the same impact period (refer Table 4-12) for both the NSW/Victorian border to the future Dinawan substation component and the network augmentation works component.

Table 5-3
Loss of agricultural production during construction

Component	Agricultural impact area (ha)	Impact period (years)	Loss of gross production ($ per ha per year)	Loss of gross production ($)
NSW/Victorian border to Dinawan substation	2,066	2.0	$249	$1,028,950
Network augmentation works	205	2.0	$792	$324,720
Total	**2,271**			**$1,353,670**

5.2 Biosecurity

The following sections address the potential biosecurity impacts during construction of the project.

5.2.1 General biosecurity risks

There is a risk that animal diseases, plant diseases, feral pests and weeds could be introduced or spread during construction of the project. A biosecurity breach of this nature is likely to increase costs and decrease income of agricultural enterprises in the vicinity of the project. Depending on the biosecurity matter, impacts on both costs and income could be short to long term (more than three years).

Increased costs could include expenses associated with monitoring pests, weeds or diseases and implementing control measures. Lost income could arise from reduced livestock, crop or pasture production and lower quality of produce.

Potential carriers of weed seeds, plant material and diseases include vehicles (especially tyres), machinery and personnel (clothing and footwear). These can transport biosecurity matter over relatively long distances (Animal Health Australia 2018).

Biosecurity matter also has the potential to be spread by soil and water movements associated with construction works. These latter movements generally occur over relatively short distances.

The use of pesticides on the project footprint is also a potential biosecurity risk due to the risk of contamination, the need to declare pesticide use upon sale of agricultural products and the need for withholding periods.

The biosecurity risks would generally be highest during construction due to earthworks and the greater frequency of machinery, vehicle and personnel movements.

Biosecurity controls and property management plans (section 8.2) would be implemented to manage potential biosecurity risks during construction. Following implementation of these mitigation measures, minor biosecurity risks are expected.

5.2.2 Weed biosecurity risks

Weeds which present a high biosecurity risk of the project are those that:

- are spread readily by activities associated with the project,
- are adapted to the environmental conditions of the region, and
- would have a moderate to major economic impact if they were to spread.

Weeds that are present in the region and present a potential biosecurity threat are discussed in section 4.1.9.

Weeds such as some cactuses, parthenium weed, blue heliotrope, spiny burrgrass, caltrops, khaki weed, Noogoora burr and Bathurst burr are readily spread by vehicle, machinery and human activity. Some also have a potential high effect on the income and costs of agricultural enterprises. For example, silver-leaf nightshade and blue heliotrope are difficult to control in pastures, while spiny burrgrass containment presents a challenge in pastures and crops, and parthenium weed causes health problems in both humans and livestock. Noogoora burr, spiny burrgrass and Bathurst burr are known to contaminate and decrease wool quality and prices.

There are numerous other weeds which could potentially have a large impact on the agricultural enterprises, however the risk is moderated by:

- most weeds are not readily spread by activities associated with the project, and
- the limited adaptability of some weeds to the environmental conditions of the region.

In particular, the relatively high temperatures and low rainfall of most of the project footprint limits the type and number of weeds that are able to thrive and become important weeds with a moderate to major economic impact.

There is a moderate risk of weed spread associated with construction of the project, and the maximum potential risk would occur during construction due to earthworks, the relatively high frequency of vehicle and personnel movements, and increased weed growth due to disturbance of ground cover and soil.

Recommended mitigation measures to limit and manage the weed biosecurity risk are provided in Chapter 8 (Management and mitigation). These would reduce the risk to low levels.

5.2.3 Livestock pests and diseases biosecurity risks

Sheep lice, OJD and ovine footrot are likely to be the most important livestock pest and disease risks associated with the project. These sheep diseases are present in the region and can have large productivity effects on sheep enterprises.

Footrot is the greatest risk despite its low current prevalence (refer to section 4.1.9), due to the relative ease of its spread and its high potential economic effect. The spread of virulent footrot would cause considerable economic loss from reduced wool growth, lower wool quality, poor ewe fertility, slow growth rates, losses from blowfly strike, and reduced value of sale sheep. In infected flocks, there are also substantial costs associated with the control of the disease.

An OJD outbreak would result in sizeable economic losses on infected farms due to sheep deaths, lost meat production, fewer lambs and less wool. Sheep lice outbreaks would cause considerable losses in sheep enterprises due to treatment costs, reduced wool growth and lower meat production. However, the risks associated with these diseases are low due to the low probability of spread being caused by project activities and the low prevalence of disease in the study area (refer to section 4.1.9).

There are many other important diseases of domestic livestock. Some diseases, such as bovine Johne's disease, leptospirosis, pestivirus and those caused by internal parasites, have the potential to be spread by uncontrolled livestock movements or carried by humans. However, because of the low prevalence of these diseases, the limited interaction with livestock and the low rate of spread by human activities, the chance of the spread or introduction of these diseases from activities associated with the project would be low.

Other diseases, such as anthrax, bovine respiratory disease, cheesy gland, clostridial diseases, ovine brucellosis, pinkeye, three-day sickness, trichomoniasis and vibriosis, are very unlikely to be spread by proposed construction activities.

Exotic diseases are an issue for international travel associated with the project. Appropriate measures would be implemented if there is a risk of the introduction of an exotic disease via the project. These risks have been heightened by the recent outbreaks of foot and mouth disease and lumpy skin disease in Indonesia, and Japanese encephalitis in NSW and other states in 2022.

5.2.4 Vertebrate pest biosecurity risks

The most important vertebrate pests in the vicinity of the project footprint are likely to be foxes, pigs, kangaroos and rabbits. Other pest species such as deer, goats and wild dogs have a more restricted distribution, and lower overall economic impact. All these pests have economic impacts on agricultural enterprises arising from lamb predation, fence damage or consumption of pasture and crops. The project is unlikely to significantly change the number or movement patterns of vertebrate pests and therefore the impacts from vertebrate pest spreading would be negligible.

Restrictions on aerial applications resulting from the project's transmission line may affect the efficiency of aerial control of feral pigs by LLS. This is discussed in section 5.6.

5.2.5 Plant disease and pest biosecurity risks

There are biosecurity risks associated with plant diseases and pests in the horticultural industries within and surrounding the project footprint. In particular, there is a ban on taking grapevines, cuttings, budwood, or soil that has been in contact with grapevine material into the Phylloxera Exclusion Zone. This zone covers most of NSW including the project footprint.

The project footprint is also in the Potato Biosecurity Zone which covers all of NSW. The movement of plants belonging to the family Solanaceae and associated matter is banned from entering the zone.

There is a wide range of exotic and endemic pests and diseases of the apple and other fruit industries. People moving between orchards, nurseries and other horticultural regions can spread pests on vehicles, equipment, boots and clothing. The most obvious risks are pests carried in soil and plant material. Many pests and diseases can be spread by infected plant material (Plant Health Australia 2010).

LLS expressed concern that exotic plant pests such as khapra beetle or brown marmorated stink bug) could be introduced into Australia via imported materials required for the project. These pests present a greater risk as they can be introduced in materials or packaging. Other exotic pests or diseases (such as Xylella) which a spread in food or plant materials should present a lower risk.

Biosecurity risks to beehives pollinating horticultural crops are also a concern. There are a number of exotic pests that have the potential to severely affect the honeybee and pollination-dependant industries if they were to become established. In addition, the spread of pests already established in Australia, such as the small hive beetle, American foulbrood and European foulbrood pose a biosecurity risk (Plant Health Australia 2010). Almond orchards grown in the vicinity of the NSW/Victorian border to Dinawan substation component are heavily reliant on pollination by bees.

Consequently, there are substantial biosecurity risks to horticultural enterprises if activities associated with the project were to result in inappropriate plant material or soil being brought into the project footprint. Biosecurity risks would be highest during construction due to the larger number of personnel and vehicle movements to, and within, the project footprint.

The limited number of horticultural crops in proximity to the project footprint would limit the risk of spreading plant diseases and pests. The land use data summarised in Table 4-5 includes no horticultural land in the project footprint, while only 0.4 per cent of the area of agricultural holdings across the western LGAs is devoted to horticultural crops (Table 4-10). Balanced against this is the high value of production generated by horticulture in the western LGAs (Table 4-12). Therefore, the potential economic consequence to a horticultural crop of any biosecurity incident is relatively large due to its high value.

Plant diseases or pests are not a substantial issue for most grazing enterprises in the region. However, there are several important crop diseases in the region and pathogens such as rusts can be spread on vehicles, footwear and clothing (Plant Health Australia 2017). Activity associated with the project has the potential to result in the spread of crop or pasture diseases or pests, but the risk would be lower than for the horticultural industry due to the extensive and annual nature of production. The risk would be minor, and would be reduced to negligible with the implementation of appropriate mitigation measures (refer to Chapter 8 (Management and mitigation)).

Restrictions on aerial applications resulting would affect the efficiency of aerial control of plague locusts by LLS in vicinity of the project's transmission line. This is discussed in section 5.6.

5.2.6 Biosecurity risks to organic producers

Organic producers face the same pest, weed and disease biosecurity risks as non-organic producers. However, there is an additional risk associated with the introduction of non-organic plants or materials to an organic property, which can affect the property's organic certification. These plants or materials could include genetically modified plants, mineral fertilisers and synthetic pesticides.

Any proposed rehabilitation would not use genetically modified plants and the risk of the accidental introduction of genetically modified plants by construction activities would be very small. There are also alternatives to the use of mineral fertilisers and synthetic pesticides. Therefore, the risk to organic producers would be negligible with appropriate mitigation measures (refer to Chapter 8 (Management and mitigation)).

5.3 Restricted movement

It is unlikely that construction activities would substantially restrict movements of landholders, agricultural workers, their livestock or equipment within the project footprint for extended periods. It is possible that some movement would be affected temporarily due to restricted access to the project footprint. However, these restrictions would be generally short in duration, in a limited location and would be undertaken in consultation with relevant landholders, and therefore unlikely to markedly affect movements for agricultural purposes.

Restrictions in movements of vehicles and personnel are more likely to occur in cropping areas than grazing areas due to the higher intensity of land use. In addition, there are generally greater restrictions in movement of livestock and vehicles across cropped areas than pasture areas, irrespective of the impact of the project. Further restrictions caused by construction activities could exacerbate existing restricted access in cropping areas, and limit the movement of cropping machinery, vehicles and personnel around cropping areas.

Concerns were expressed by some consulted landholders about the possible deterioration of local roads due to use by construction vehicles. Landholders were concerned that this could make local travel more difficult and could increase the likelihood of vehicle damage. Mitigation measures to reducing the impact of the project on local roads are set out in *Technical paper 8 – Traffic and transport impact assessment*.

5.4 Impacts to on-ground agricultural operations

Ground cropping or pasture management operations may not be possible across the project footprint during the construction period. In addition, it may not be possible to prepare any part of the project footprint for a crop or sow a crop on the project footprint during construction activities. It is also likely that the start and end of the construction period would overlap cropping seasons and impacts on planned or actual on-ground cropping activities would also occur.

Construction activities on pasture or cropping land (including earthworks along transmission lines and access tracks) would disrupt planned or actual on-ground husbandry operations. Critical times include crop sowing (approximately April to June for winter crops) and harvesting periods (typically October to December).

Summer crops such as rice or cotton have a markedly different program. Rice is usually sown in October or November and harvested between March and May. Cotton is usually planted in September or October and harvested in April and May.

Spraying operations, which can occur throughout the year as required, are also critical. Delays to these activities can result in large income losses due to sub-optimal sowing times, weed infestations, pest damage and weather damage.

Some direct damage to crops and pastures may also occur due to vehicle and machinery movement and the construction of transmission line structures, access tracks and ancillary works.

Airborne dust from vehicle movements and construction activities can reduce the yield and quality of crops and pastures. Dust can block stomata, hinder transpiration, reduce photosynthesis, foster pathogens and make pasture less palatable to livestock.

Technical paper 15 – Air quality impact assessment indicates that the earthworks activities and trackout by construction vehicles (being the tracking of dirt, mud or other material on public roads) are considered to have a high risk of impacts on adjacent agricultural land, while construction activities (such as the assembly of transmission line structures) are considered to have a low risk of impacts. With the implementation of site-specific mitigation measures, the residual dust impacts were considered to have a low risk. The air quality assessment only identified the potential risk of these activities to adjacent agricultural activities prior to mitigation and did not specifically address the potential impact of dust on crop and pastures, as outlined in the preceding paragraph.

The impact of dust generated by construction activities on crops and pastures is likely to be minor due to the limited earthworks, and the relatively low amount and duration of construction traffic along access tracks. The extensive nature and the relatively low value of production in most of the pasture areas on or adjacent to the project footprint would also reduce the impact of dust.

If cropping or pasture husbandry is undertaken during the construction period, usual cultivation, crop establishment and spray travel patterns would also need to be adjusted to avoid transmission line structures and other infrastructure elements during the construction process, and exclusion zones would need to be established to ensure safe operation of construction machinery and farming equipment. The impacts of the infrastructure elements such as electricity transmission line structures on controlled traffic farming (CTF), steering guidance, weed control and cropping under transmission lines would commence during construction and continue into the operational phase. These impacts are discussed further in section 6.4.

The impact on crop and pasture operations in the project footprint would be minor due to the relatively small size of the project footprint (refer to section 5.1) and the relatively short construction period at each location.

5.5 Impacts on irrigation activities

The cropping impacts outlined in section 5.4 also apply to irrigated cropping areas, but would generally have a greater impact on irrigated cropping or horticulture enterprises due to their higher productivity. In addition, irrigated enterprises may be subject to other impacts, as follows.

Construction activities may cause conflict with proposed applications of irrigation water. Irrigation applications are generally time-critical and a change in irrigation scheduling could cause a large reduction in crop production. In addition, the application of irrigation water to a crop area would make it temporarily unsuitable for construction activities. Consultation with landholders would minimise the potential conflict.

Construction activities, transmission structures and other project facilities would have the potential to interfere with moving irrigation equipment, particularly mechanised centre pivot or linear move systems. However, there does not appear to be any centre pivot or linear move systems currently operating within the immediate vicinity of the project.

5.6 Impacts on aerial agriculture operations

Moderate, localised impacts on aerial agriculture operations (such as aerial spreading of fertilisers and aerial spraying) and drones have the potential to arise from the construction of transmission line structures in agricultural areas. Other construction activities are likely to have negligible impact.

The construction of the transmission line may restrict the use of nearby airstrips for aerial agriculture in some cases where safe landing and take-off is compromised.

Safety issues may also prevent the aerial application of fertiliser and pesticides while construction personnel are present on site. However, the safety risk would generally not be long-lasting and would be minimised through consultation with landholders.

Aerial agriculture is uncommon on the extensive grazing areas in the western LGAs. Despite this, the use of drones for mustering and monitoring in rangeland areas is increasing. However, the major use of aerial agriculture around the NSW/Victorian border to the future Dinawan substation component would be on irrigated cropping enterprises, especially for rice and cotton crops. Aerial agriculture is also extensively used in the mixed dryland farming areas adjacent to the network augmentation works component (refer *Technical paper 14 - Aviation impact assessment)*.

The impacts on aerial agriculture operations would commence during construction and continue into the operational phase and are discussed further in section 6.5.

5.7 Impacts on livestock enterprises

The main potential impact on livestock enterprises would be disturbance of sheep and cattle caused by noise and vehicle movements, and disruption to grazing management.

Although livestock habituate to disturbances, the noise and movement of construction vehicles and other construction activities may have an impact on livestock in specific circumstances, especially during calving and lambing periods. Livestock can be panicked, particularly if they are new to the area near the project (such as relocated, agisted or newly purchased animals) or if they are not accustomed to human contact.

In some instances, livestock would need to be moved relatively frequently across access tracks used during construction. This can occur where livestock facilities such as stockyards and shearing sheds are located on the opposite side of an access track or road to grazing paddocks. Potential impacts could include disruption to livestock movements and livestock impacts. The potential for disruption would be greater for those access tracks or roads with high traffic volumes.

Most of the project footprint is located on extensive rangeland grazing properties. Paddocks are generally large, and stocking rates are low on these properties, so livestock can move a considerable distance away from any source of disturbance. Balanced against this is that livestock in rangeland areas are often unaccustomed to human contact and therefore more susceptible to noise and vehicle disturbance.

Conversely, paddocks are generally smaller and stocking rates higher in higher rainfall areas such as the network augmentation works component. In these areas the ability of livestock to move away from a source of disturbance, is limited, but they are generally more accustomed to human contact.

The use of helicopters or drones during construction would increase the risk of livestock disturbance.

Although there is potential for some disturbance, the effect on productivity is expected to be minor as impacts would be managed by mitigation measures and any disturbance is unlikely to result in large effects on production.

The removal of vegetation from the project footprint may impact the availability of shade or shelter in a few areas. In most cases, there would be sufficient shade and shelter remaining to meet livestock requirements. In affected areas, grazing management may need to be modified (for example, undertaking lambing in alternative more sheltered paddocks) and replacement shade and shelter vegetation may need to be established. Overall, the potential reduction in availability of shade shelter on livestock productivity is expected to be small.

Disruption to livestock enterprises (such livestock deaths, illness, stress, disease spread; mixing of animals and uncontrolled breeding) is possible if stock water pipelines or fences are damaged and not promptly repaired during construction, or if gates are left open. Mitigation measures outlined in Chapter 8 (Management and mitigation) will minimise the chance of any potential significant disruption.

Grazing management would also be disrupted if construction activities result in paddocks being temporarily unavailable for grazing, or cause a disruption to the grazing pattern of livestock. The degree of disruption would depend on several factors such as the availability of alternative pasture, the length of disruption, and the sensitivity of the subject livestock to disturbance.

There may be minor impacts on livestock movement and husbandry activities where stockyards and loading facilities are located within the project footprint. Yards and loading ramps cannot be located within the earthing and centreline exclusion zones, which are 30 metres from transmission line structures and 17 metres from the centreline of the conductors (Transgrid 2024a). On two properties, where stockyards are located within the project footprint, these facilities may need to be relocated.

Other infrastructure, including ten dams, a bore, two water tanks, two windmills and a machinery shed are also located on the project footprint, and may need to be relocated if the project affects their utility.

Dust generated by construction activities is very unlikely to have an effect on wool prices. This is because a large amount of dust is required to have a significant effect on wool prices. A high dust contamination appears is highly unlikely given the low intensity of construction activities, the prevalent low stocking rates, the distances from dust production sites to grazing sheep and proposed mitigation measures.

5.8 Impact on bores

Technical paper 10 – Groundwater impact assessment identified eight stock and domestic water supply bores within the project footprint.

The *Technical paper 10 – Groundwater impact assessment* concluded that these bores were at risk of being accidently damaged during construction activities. Impacts would be avoided, where possible during detailed design or through the selection of construction methods.

If a bore were to become unusable due to construction activities, this could cause significant disruption to grazing activities depending on other available sources of water. Paddocks watered by the affected bore may need to be destocked, necessitating the relocation or sale of livestock, and reducing production.

The *Technical paper 10 – Groundwater impact assessment* outlines mitigation measures to minimise impacts on water supply including:

- avoidance of direct impacts to registered bores during construction planning
- make good provisions for affected bores
- condition assessments to be conducted to identify any adverse impacts on registered bores during construction..

5.9 Important agricultural land

As discussed in section 4.4.2, mapping of BSAL undertaken by DPE (2013) indicates that there is no BSAL on the project footprint.

However, there is a small area of draft SSAL near the proposed Gugaa substation (approximately 45 hectares) and other areas on or near the project footprint mostly corresponding to irrigated land between the NSW/Victorian border and Moulamein, and between Carrathool Road and the future Dinawan substation[1].

[1] GIS data on SSAL is unavailable and, apart from the SSAL area near the proposed Gugaa substation, the areas cannot be reliably determined.

Despite this, the impact on draft SSAL would generally be minor due to:

- the small amount of draft SSAL within the project footprint,
- the small amount of SSAL affected compared to the total SSAL in the impacted LGAs, and
- the loss of agricultural production being only temporary on most of the SSAL affected by construction. Most of the affected SSAL would be rehabilitated (if required) and returned to its former land use after construction is completed or as agreed with the landholder.

There would be small areas of SSAL with longer term impacts due to permanent structures (refer section 6.8).

5.10 Fire risk

Fires have the potential to be started by human activities, equipment and vehicles during construction. The risk and impact of fire can be reduced to low levels by mitigation measures, but they can cause damage to livestock, agricultural infrastructure (such as dwellings, stock yards, sheds and fences), pasture, shade and shelter trees, and agricultural equipment.

Fire risk during construction, including proposed mitigation measures, is discussed in further detail in *Technical paper 12 – Bushfire impact assessment*.

5.11 Travelling stock reserves and livestock routes

Five TSRs intersect with the project footprint and a further eight TSRs are adjacent to the project footprint (refer to section 4.1.9). It is possible that some livestock moved along, or held within, these TSRs or on livestock highways or other public roads would be affected temporarily by restricted access to the project footprint or disturbance from the project.

The TSRs, livestock highways and other public roads in the Murray LLS region are more intensively used than those further east. Despite this, their use for livestock movements is infrequent and the restrictions or disturbance would be of a short duration during construction and stringing procedures. Impacts would be minimised by consultation with landholders and other users (refer to Chapter 8 (Management and mitigation)). Therefore, the project is not expected to significantly prevent or hinder livestock movements or impact the use of TSRs or other livestock routes.

Construction personnel would need to be aware of the possibility of livestock being present on TSRs, access tracks and public roads, drive accordingly and heed warning signs, as per the mitigation measure in Chapter 8 (Management and mitigation).

6 Operational impacts

6.1 Loss of land use

Operation of the project would result in permanent change in land use, from the existing agricultural land use to electrical infrastructure, where permanent infrastructure would be established (e.g., transmission line structures, permanent access tracks, and other infrastructure). The agricultural production in these areas would be lost during the operational life of the project.

Grazing and cropping operations would be able to continue on other areas of the project footprint, such as the land under the conductors between transmission line structures, subject to certain restrictions such as height of machinery, and exclusion zones around transmission structures as set out in *Easement Guidelines – Living and working with electricity transmission lines* (Transgrid 2024a).

6.1.1 Impacts

The easements for the new 500 kV transmission line between the NSW/Victorian border and the future Dinawan substation would typically be 70 metres wide. However, transposition locations would require wider easements up to 110 metres wide. The existing easement for the replacement of nine kilometres of Line 51 as part of the network augmentation works component is 60 metres wide. A 70 metre easement around the future Gugaa 500 kV substation, Livingstone Gully Road is also required for the network augmentation works and is associated with new 500 kV transmission line structures.

These easements would be established along the transmission line to ensure Transgrid can access its infrastructure for maintenance purposes and also ensure safe electrical clearances during the operation of the lines. These easements would reduce the area available for certain land uses such as fruit tree orchards and agroforestry due to the four-metre height limitation of crops that would be permitted within the easement (Transgrid 2024). Although no tree horticulture or forestry is currently present on the project footprint, it is possible that these land uses may be considered in the future. The land within an easement and immediately next to proposed infrastructure could continue to be used for grazing and other agricultural activities such as cropping, subject to certain restrictions (refer to section 6.4).

Some of the project footprint (such as base of the transmission line structures) would not be permanently removed from agricultural production. For example, grazing may continue under and around the transmission line structures. However, in cropping areas, the transmission line structure and a safe buffer around the structure would result in some areas being permanently unable to be cropped. Transgrid (2024a) indicates that cropping is permitted up to 20 metres from the base of a transmission line structure.

Other parts of the project footprint, such as retained access tracks, are likely to affect soil characteristics to the extent that these locations would no longer be productive cropping or pasture areas. This would greatly reduce the productivity of these locations.

The potential impact of a new transmission line on irrigated land is greater than for dryland cropping and grazing land due to its high productivity. In addition to direct impacts on irrigation land, some further land may be lost if flood irrigation layouts need to be changed due to the project. However, it is estimated that only 34 hectares of irrigated land, and no irrigated horticultural land, would be taken out of production by the operation of the project (refer to Table 6-2). This is equivalent to four per cent of the total operation disturbance footprint.

6.1.2 Area affected

The following calculations set out the area of agricultural land use that would be permanently lost due to operation of the project ('agricultural operation disturbance footprint').

The components of the agricultural operation disturbance footprint are as follows:

1. A disturbance area for each 500 kV transmission line structure of 22 metres by 22 metres plus an AEZ of 20 metres.
2. A disturbance area for each new Line 51 structure of 16 metres by 16 metres plus an AEZ of 20 metres.
3. Access tracks and telecommunication facilities (plus 20 metre APZ).

Less

4. The current disturbance area for each redundant Line 51 structure replaced of 16 metres by 16 metres plus an access exclusion zone of 20 metres.

The following are excluded from the agricultural operation disturbance footprint as they are either located within existing non-agricultural land, would have a neutral impact when it is a minor adjustment to existing infrastructure, or have been previously accounted in the EIS for EnergyConnect (NSW – Eastern section) or Humelink projects.

1. The Dinawan substation expansion.
2. Low voltage line adjustments
3. Line connection and diversions works within Wagga substation and Gugaa substation.
4. Access tracks established by HumeLink in the network augmentation works component.

There may be some additional permanent impact on flood irrigation paddocks where the irrigation layout is changed due to the project. The magnitude of this specific impact is not able to be quantified as the area impacted in this way is not known. However, the lost production on irrigated areas due to the agricultural operation disturbance footprint is included in the calculations in this section.

On this basis, the area of the agricultural operation disturbance footprint is calculated in Table 6-1.

Table 6-1
Area of agricultural operation disturbance footprint

	NSW/Victorian border to Dinawan substation		Network augmentation works		Total	
Component	**Area (hectares)**	**Percentage**	**Area (hectares)**	**Percentage**	**Area (hectares)**	**Percentage**
Transmission line structures and AEZ[1]	689	79%	10.7	84%	700	79%
Access tracks	179	21%	2.0	16%	181	21%
Telecommunication facilities	<0.5	<1%	-	-	<0.5	<1%
Total	**868**		**12.7**		**880**	

1. This includes the gain of 10 hectares through the removal of redundant transmission line structures and associated AEZ for Line 51 (network augmentation works).
2. Numbers and percentages have been rounded

Table 6-1 shows that the total agricultural operation disturbance footprint for the network augmentation works component is only 13 hectares. The impact of the network augmentation works on the land use during operation, and other operational impacts generally, are small because this component is largely associated with the replacement of the existing 330 kV transmission line (Line 51) within an existing easement.

The assessed agricultural operation disturbance footprint (880 hectares) is equivalent to approximately 0.031 per cent of the total agricultural holdings in the four impacted LGAs (2,851,306 hectares). The proportion is 0.036 per cent in the western LGAs, and 0.003 per cent in the Wagga Wagga LGA.

The types of agricultural land use present in the components of the agricultural operation disturbance footprint are set out in Table 6-2.

Table 6-2
Land use in agricultural operation disturbance footprint

Component	***NSW/ Victorian border to the future Dinawan substation***		**Network augmentation works**		**Total**	
	Area (hectares)	**Percentage**	***Area (hectares)***	**Percentage**	**Area (hectares)**	**Percentage**
Grazing native vegetation	699	81%	1.4	11%	700	80%
Grazing modified pastures	57	7%	6.8	54%	64	7%
Cropping	35	4%	4.0	32%	39	4%
Grazing irrigated modified pastures	31	4%	-	0%	31	4%
Irrigated cropping	34	4%	-	0%	34	4%
Non-agricultural land uses	11	1%	0.5	4%	11	1%
Total	**868**		**13**		**880**	

Note: Numbers and percentages have been rounded

The NSW/Victorian border to Dinawan substation component is dominated by the grazing of native vegetation, comprising 81 per cent of the agricultural operation disturbance footprint. Grazing modified pastures, cropping, grazing irrigated modified pastures and irrigated cropping each comprise between four per cent and seven per cent of agricultural operation disturbance footprint.

The network augmentation works component of the agricultural operation disturbance footprint is mostly comprised of grazing modified pastures (54 per cent of the total) and cropping (31 per cent).

The total area of agricultural land use lost due to operation in the NSW/Victorian border to Dinawan substation component is therefore assessed at 858 hectares. This is equivalent to 0.036 per cent of the total area of agricultural holdings in the western LGAs. Cropping in this area would be precluded, but grazing could continue in sections, such as underneath and around transmission line structures.

6.1.3 Value of Production Loss

The total gross annual value of grazing and crop production across the western LGAs in 2020-21 is estimated at $188 per hectare and $1,061 per hectare, respectively (section 4.5.4). These amounts include the value of irrigated cropping and the grazing of irrigated pastures. Grazing and cropping occupies 90.8 per cent and eight per cent, respectively, of the agricultural operation disturbance footprint in the NSW/Victorian border to the future Dinawan substation component. This indicates that the average gross annual value of production across the agricultural operation disturbance footprint in the NSW/Victorian border to Dinawan substation component is approximately $256 per hectare.

The total gross annual value of grazing and crop production across the Wagga Wagga LGA in 2020-21 is estimated at $458 per hectare and $1,105 per hectare, respectively (section 4.5.4). Grazing and cropping occupies 64.7 per cent and 31.7 per cent, respectively, of the agricultural operation disturbance footprint in the network augmentation works component. This indicates that the average gross annual value of production across the agricultural operation disturbance footprint in the network augmentation works component is approximately $647 per hectare.

The estimated impact of operation on gross agricultural production is $230,360 per annum, subdivided as approximately $222,115 in the NSW/Victorian border to Dinawan substation component and $8,245 in the network augmentation works component. These amounts are equivalent to approximately 0.02 per cent of the total gross annual value of agricultural production across the western LGAs, and 0.002 per cent of production in the Wagga Wagga LGA (refer Table 4-12).

Table 6-3
Estimated impact of operation on gross agricultural production

Component	Agricultural Impact area (ha)	Annual loss of gross production ($ per ha)	($)
NSW/Victorian border to Dinawan substation	868	$256	$222,115
Network augmentation works	13	$647	$8,245
Total production loss	**880**		**$230,360**

6.2 Biosecurity

Any activity during operation (such as inspections, maintenance and repairs) that requires access of personnel, vehicles or machinery to the transmission line easement poses a potential biosecurity risk to agricultural operations in the vicinity of the project. The mitigation measures set out in Chapter 8 (Management and mitigation) would reduce the risk to a minor or negligible level.

The biosecurity risks and potential impacts outlined in section 5.2.2 in relation to construction are also applicable to the operational phase. The major difference is that excavation, vehicle, machinery and personnel activity would be less intense and frequent during operation. The transport of project material into the project footprint. Therefore, the risk of weed, pest or disease spread would be much lower.

6.3 Restricted movement

It is unlikely that the operation of the project would significantly restrict the movements of landholders, agricultural workers, livestock or equipment.

6.4 Impacts to on-ground agricultural operations

6.4.1 Obstacles

The presence of transmission line structures or other project features such as access tracks and telecommunication facilities on arable crop and pasture land would disrupt, to some extent, normal on-ground operations around the structure or facility. Additionally, the presence of transmission line structures could restrict the ability of some irrigators to install irrigation channels in the future. Usual cultivation, sowing and spraying travel patterns must be adjusted to avoid the structure or facility, and care needs to be taken to avoid collisions when using wide farming equipment. However, the overall impact of the project on production would be minor due to the small areas directly affected, and the ability to continue ground cropping activities across most of the transmission line easement during operation.

Infrastructure elements such as electricity transmission line structures are problematic for controlled traffic farming (CTF) as the permanent wheel tracks would need to be adjusted to avoid any infrastructure elements. In some instances, where straight parallel tracks are currently used, the adjusted tracks would not be straight or parallel in parts, leading to inefficiencies in cropping operations.

There are not many large-scale cropping enterprises operating on land impacted by the project footprint, and the use of CTF is likely to limited at present and remain uncommon in the future.

6.4.2 GPS interference

Some landholders in the project footprint, including those employing CTF, use precision agriculture[1] and/or GPS guidance for their cropping equipment. GPS systems use receivers in the equipment, and sometimes in a fixed base station. Concerns regarding potential interference of transmission lines on GPS reception by base stations and cropping equipment, or with signals sent by base stations to equipment, were expressed by landholders.

Many landholders in the project footprint, including those employing controlled traffic farming, use precision agriculture and/or GPS guidance for their cropping equipment. GPS systems use receivers in the equipment, and sometimes in a fixed base station. Concerns regarding potential interference of transmission lies on GPS reception by base stations and cropping equipment, or with signals sent by base stations to equipment were expressed by landholders.

Should interference with GPS guidance occur this could cause an impact on cropping operations. Where interference is observed, signal boosting equipment or antenna enhancement would be offered to limit the impacts on landholders (refer to Table 8-1 in Chapter 8 (Management and mitigation)).

6.4.3 Weed control

Effective weed control within crop or pasture areas would also be affected by the inability to apply herbicides with normal boom spray operations to the area around infrastructure elements such as transmission line structures. These areas may need separate manual applications of herbicides and extra attention to prevent a build-up of weeds and their spread onto adjacent crop or pasture areas.

Spraying equipment would not exceed Transgrid's restriction that machinery cannot extend more than five metres above ground level under the project's transmission lines.

[1] Precision agriculture uses advanced technologies such as GPS and drones to collect data on soil, crops, and animals to improve crop yields and resource management.

6.4.4 Working Height

Some cropping plant can exceed the height restrictions of transmission lines. Large grain harvesters and augers are generally the tallest cropping machinery. The working height of standalone augers can vary widely but can be greater than 10 metres. A large harvester has an operating height of around four metres and a total height of approximately five metres with its in-built auger extended while unloading grain.

As set out in EIS Chapter 3, within the 500 kV easement, the use of plant and equipment up to a height of five metres would be permitted, which is higher than the maximum height of 4.3 metres as specified in Transgrid's Easement guidelines – living and working with electricity transmission lines (Transgrid, 2024a). Consequently, even with the greater safe working clearance, areas within the transmission line easement would not be suitable for grain loading and unloading activities.

Allowable approach distances to 500 kV transmission lines are eight metres and 4.4 metres, respectively, for 'ordinary persons' and vehicles (WorkCover 2006)[1].

6.4.5 Burning off

Transgrid's guidelines indicate that burning off is not permitted in transmission line easements (Transgrid 2024a).

This would result in a change in stubble management on cropping properties, where stubble burning would normally be undertaken. Alternatives to stubble burning are usually available, however they may not be as effective as burning in some circumstances.

Burning off for other agricultural purposes would be rare in the study area. Therefore, the impact of any required change in management would be minor.

6.5 Impacts on irrigation activities

The cropping impacts outlined in section 6.4 also apply to irrigated cropping areas. In addition, irrigated enterprises may be subject to other impacts, as follows.

Transmission line structure in flood irrigation areas will require the irrigation system to be modified so that the base of the structure is not inundated. This is especially crucial in rice crops which are inundated for most of their growing season. In comparison, other irrigated crops are periodically irrigated as required.

Irrigation results in wet soils for a greater part of the growing season than for rain-fed (dryland) crops. This would result in the transmission line easement in irrigated areas being inaccessible for maintenance for longer periods than for dryland crops and pastures. Again, rice fields which are inundated for most of their growing season, would present additional difficulties related to an extended period of inaccessibility, or a requirement for dewatering during the growing season which would markedly decrease yields. The loss of yield experienced would depend on factors such as the length and timing of the dewatering.

[1] An 'ordinary person' means a person without sufficient training or experience to enable them to avoid the dangers which overhead power lines and associated electrical apparatus may create.

The movement of individual lengths of metal irrigation pipes by hand around overhead transmission lines can be an additional safety hazard due to their considerable length and the potential for them to exceed the maximum allowed height within an easement. However, it is unlikely that hand-move irrigation pipes are used much in the area around the project footprint due to the extensive nature of typical irrigation enterprises which generally rely on flood and overhead irrigation.

6.6 Impacts on aerial agriculture operations

6.6.1 Aerial applications

Localised impacts on aerial agriculture operations (such as mustering, monitoring, aerial spreading of fertilisers, aerial rice seeding and aerial pesticide spraying with drones, fixed wing aircraft or helicopters) have the potential to arise from the presence of transmission lines in agricultural areas.

The efficiency and effectiveness of aerial agriculture operations can decline as application procedures must be amended to compensate for the presence of infrastructure elements. Transmission line structures and transmission lines are a potential hazard for low level aviation activities, and these must be considered in planning a safe aerial application program. The direction of flight, release heights and run lengths may have to be adjusted to maintain safe operations. This can lead to parts of paddocks near infrastructure elements being less effectively treated due to increased release heights, sub-optimal flight paths, or some areas may not be able to be treated safely at all. Efficiency of the aerial agricultural operations may decrease and become more time consuming and costly due to restrictions in aircraft movements.

Table 6-4 summarises the approximate length of transmission lines in the NSW/Victorian border to the future Dinawan substation component are within two kilometres of cropping land, based on the investigations completed by Transgrid.

Table 6-4
Transmission lines near cropping land

Agricultural activity	Approximate Length (km)	Proportion of total
Irrigation cropping	33.6	14.0%
Dryland and irrigated cropping plus grazing	41.3	17.2%
Dryland cropping	3.4	1.4%
No cropping	161.8	67.4%
Total	**240**	**100.0%**

Of the total transmission line set out in Table 6-4, approximately 10.6 kilometres of transmission line (approximately 4.4 per cent of the total transmission line) in three locations would have a high impact on aerial agricultural activities, according to Transgrid's investigations. These locations are near Lake Nangtree (Mallan) , Mallan Branch Canal (Moulamein) and Kaylock Road (Mallan).

In the high impact areas, aerial agricultural activities may not be possible on some nearby cropping land or application time would increase by 40 to 70 per cent thereby increasing costs. Of the total length of 10.6 kilometres, approximately 7.2 kilometres are near irrigated cropping areas and 3.4 kilometres are near dryland cropping.

An inability to use aerial agricultural operations on a parcel of cropping land would not preclude cropping on that land. However, it may:

- prevent the cultivation of some crops such as rice
- require alternative application methods (such as ground or drone application)
- increase costs and/or
- decrease yields.

In some instances, areas unable to be treated with aerial agriculture could be treated by on-ground applications. However, this would be less efficient, less timely and more costly in some cases.

The loss could be moderated by growing alternative crops, adopting alternative application methods and alternatively using irrigation water that would otherwise be used on the impacted areas.

The investigations by Transgrid also indicate that approximately 57 kilometres of transmission line (approximately 23 per cent of the total transmission line) would have a moderate impact on aerial agricultural activities so that some activities would be restricted and crop productivity may be reduced. Application time would increase by 10 to 70 per cent, with most of the impact being between 20 and 50 per cent. Of the total length of 57 kilometres, approximately 16 kilometres are near irrigated cropping areas and 41 kilometres are near mixed irrigated cropping, dryland cropping and grazing areas between Cunninyeuk and the NSW/Victorian border.

The remaining 10.6 kilometres of transmission line (approximately 4.4 per cent of the total transmission line) located near cropping areas would have a low impact on aerial agricultural activities so that crop productivity may be reduced. This length of transmission line is near irrigated cropping areas.

6.6.2 Airstrips

The location of the transmission line in the proximity of existing airstrips employed for aerial agriculture may restrict their use in some cases. In these cases, use of the airstrips may not be possible in certain conditions, the airstrip may be usable in only one direction, or the airstrip may need to be relocated. The efficiency of aerial agricultural applications would likely decline under these circumstances.

Technical paper 14 - Aviation impact assessment identifies seven published uncertified aerodromes within 10 kilometres of the transmission line, of which four are within three nautical miles (5.56 kilometres). One of these (Glenrowan Park) is in the network augmentation works component. Some of the runways appear to be inactive, as indicated by satellite imagery.

The aviation impact assessment also indicates that there are up to 38 further unpublished uncertified aerodromes (private airstrips) within 10 kilometres of the transmission line, giving a total of up to 45 uncertified aerodromes within 10 kilometres.

The aviation impact assessment indicate that the project would have a major impact on up to 15 of these uncertified aerodromes, indicating that they would be compromised by the nearby location of the transmission line. This may include the aerodrome being unusable or a significant modification to its layout being required to enable aviation operations to continue.

A moderate impact is assessed for up to four further uncertified aerodromes indicating the project would result in some flight paths not being available or requiring a moderate adjustment to avoid the transmission line for most types of flight operations.

A minor impact is assessed for up to nine further uncertified aerodromes indicating the project would result in a minor adjustment to some flight paths to avoid the transmission line for some types of flight operations.

The remaining 17 uncertified aerodromes have no impact. The frequency and type of use of these uncertified aerodromes is not known. Several of the affected airstrips are located near irrigated cropping areas.

6.6.3 Drones

Proximal sensing using drones is an alternative to remote sensing by satellites for crop and horticultural monitoring purposes. Crop sensing by drones can be more targeted, more timely, less affected by cloud cover, and provides higher quality images, which would probably result in increased future use. Drones can also be used for mustering and livestock monitoring, while their use for pesticide spraying is being developed.

Transmission line structures and transmission lines would restrict drone flight and sensing around the easement. Drones are subject to electric and magnetic interference from transmission lines.

Transgrid's guidelines indicate that drones should not be flown in a transmission line easement within 60 metres of transmission line infrastructure (Transgrid 2024a). This separation distance will limit the use of drones for aerial applications and proximal sensing within the transmission easement.

6.7 Impacts on livestock enterprises

6.7.1 Disturbance

The main potential impact on livestock enterprises during operation would be noise and movement disturbance of sheep and cattle, as discussed in section 5.7. These impacts would be lower during operation than construction and are expected to be negligible due to a lower intensity of personnel and vehicle movements required for maintenance activities. The potential for damage to fences and other livestock infrastructure and gates being left open, is also lower.

6.7.2 Fencing

Overhead transmission lines also impact on the operation of electric fencing. Electric fencing must be located outside the earthing and centreline exclusion zones, which are 30 metres from transmission line structures and 17 metres from the centreline of the transmission lines. They must also be less than 2.5 metres high (Transgrid 2024a). Australian Standard AS/NZS 3014:2003 states that electric fence crossings with overhead power lines must be avoided wherever possible. When a crossing cannot be avoided, it must be made underneath the transmission line and near as possible right angles to it. In addition, all electric fence connecting leads and wires installed near an overhead power line above 33,000 volts must have a clearance of at least eight metres.

These requirements would potentially restrict the siting of electric fences and may require the realignment of some fences, but are unlikely to result in major impacts on the operation of grazing enterprises or the movement of livestock.

Non-electric fences within or near a transmission line easement should be avoided, but if present must be earthed and isolated for safety reasons. All fences must be no greater than 2.5 metres high (Transgrid 2024a). These requirements would add extra construction costs to some fences near the transmission lines.

6.7.3 Lamb predation

One landholder expressed concern that transmission line structures would provide additional perching sites for wedge-tailed eagles (*Aquila audax*), resulting in higher lamb predation. This appears to be possible, because wedge-tailed eagles have been known to perch and nest on transmission line structures. This could change the distribution of wedge-tailed eagles in the landscape increasing their presence in some areas. However, the impact on lamb predation is likely to be minor or negligible, if any, due to the following factors:

1. Ridpath and Brooker (1987) concluded that the availability of nest-sites did not limit the density of eagles in the arid zone of Western Australia. Density was probably related to long-term availability of prey.
2. The use of transmission line structures for nesting has been rarely reported.
3. An eagle's home range is not generally defined by the availability perches on trees or transmission line structures. Other perches such as fences, bushes, stock yards and the ground are used by eagles, and much time is spent soaring above their territory.
4. Research indicates that only one to two per cent of lamb deaths in southern Australia are attributable to predation by eagles (Landscape South Australia 2024, Victorian Department of Environment, Land, Water and Planning 2022).

In addition, wedge-tailed eagles provide some benefits to agriculture including predation of rabbits and foxes, and consumption of carrion which may lead to reduced flystrike in sheep.

6.8 Important agricultural land

As noted in section 5.8, there is no BSAL on the project footprint.

The impact on draft SSAL is minor due to:

- the small amount of draft SSAL affected by operation, and
- the small amount of SSAL affected compared to the total SSAL in the impacted LGAs.

The small areas of draft SSAL affected by long term impacts due to permanent structures would be mostly limited to transmission line structures[1]. Cropping and grazing could continue on most of SSAL located within the transmission line easement. In addition, grazing could continue on SSAL located under the transmission line structures.

6.9 Fire risk

Fires have the potential to be started by human activities, equipment and vehicles during operation. This risk would be lower than during construction but is dependent on seasonal and weather conditions. As set out in section 5.10, fires can cause damage to livestock, agricultural infrastructure, pasture, shade and shelter trees, and agricultural equipment.

Fire risk, including proposed mitigation measures, is discussed in greater detail in *Technical paper 12 – Bushfire impact assessment*.

[1] GIS data on SSAL is unavailable and the area cannot be reliably determined.

Transmission lines may result in safety issues during firefighting operations. Live powerlines can arc to surfaces without warning under conditions of intense heat, smoke, flame and water vapour caused by fire and firefighting activities. Wires on transmission lines can also sag lower due to structural failures or high temperatures, reducing the ground clearance (Transgrid 2024b).

Personnel and vehicles must be kept a minimum of 25 metres clear of a head fire or a flank fire burning under or within 25 metres of transmission lines due to the risk of flashover. Flashover risk is also heightened by bushes and trees burning in a transmission line easement. Care must be taken in directing hose streams when firefighting near an easement (Transgrid 2024b). Firefighting control strategies would include consideration of these potential risks across the landscape. However, this can lead to inefficient firefighting activities due to restriction of activities from the vicinity of transmission lines and the creation of a barrier to movement across the fire ground by the transmission line.

As the lead agency in a bushfire emergency, NSW RFS has the power to direct de-energisation of transmission lines. In most cases, the NSW RFS would work with Transgrid's operations team through the local fire control liaison officers to consider the situation on the ground, fire-fighting operational requirements, and potential impacts of de-energisation on the wider community.

6.10 Travelling stock reserves and livestock routes

Thirteen TSRs intersect with, or are adjacent to, the project footprint (refer section 4.1.9). However, it is unlikely that livestock moved along, or held within TSRs or on public roads would be affected by the operation of the project due to the low volume of project traffic during operation.

TSRs and public roads are generally infrequently used for livestock movements, while the restrictions or disturbance would be uncommon and of a short duration during operation. Therefore, the project is not expected to significantly prevent or hinder livestock movements or impact the use of TSRs or other livestock routes during operation.

6.11 Radio communication interference

Overhead transmission lines and high voltage equipment can potentially cause interference with radio communications such as radio and television signals.

Radio communications are used by agricultural businesses in many ways, including:

- reception of radio broadcasting
- reception of television broadcasting
- aviation communications and radar
- emergency services radio (including bush fire brigades)
- private ultra high frequency (UHF) radio communications
- mobile phones
- wireless internet
- satellite television and internet
- GPS and auto-steer applications (refer to section 6.4)
- radio frequency identification (for example, identification of livestock)
- radio frequency control systems (for example, control of irrigation)
- radio frequency telemetry (for example, soil monitoring).

UHF communications, the FM radio band and GPS receivers operate at relatively high frequency and should be unaffected by the operation of the project. The AM radio band and VHF receivers used in conjunction with GPS system may experience some interference in the vicinity of the project footprint. Practical rectification measures (including signal boosting equipment or antenna enhancement) will be considered for those experiencing interference (Chapter 8 (Management and mitigation)).

7 Cumulative impacts

The cumulative impact assessment considers other nearby developments along with the project and assesses the scale and nature of the cumulative impacts on key issues.

The assessment is consistent with the requirements of the *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW Department of Planning, Industry and Environment (DPIE), 2022). These guidelines define cumulative impacts as those arising from incremental, sustained and combined effects of human action and natural variations over time that can be both positive and negative. These impacts can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

Further detail on cumulative impact assessment approach and the other projects considered in the cumulative impact assessment is provided in Chapter 24 (Cumulative impacts) of the EIS.

7.1 Projects considered

The relevant future projects that were considered as having the potential to result in cumulative impacts with the project are listed in Table 7-1. The location of the major relevant future projects are shown in Figure 7-1 and Figure 7-2.

Table 7-1
Projects with the potential for cumulative impacts

Related developments		
1. VNI West (Victoria)	2. EnergyConnect (NSW – Eastern section) (SSI-9172452)	3. HumeLink (SSI-36656827)
Projects currently subject to environmental assessment		
4. Junction Rivers Wind Farm (SSD-30448824)	11. Pottinger Wind Farm (SSD-59235464)	18. Dinawan Solar Farm (SSD-50725959)
5. Keri Keri Wind Farm (SSD-38358962)	12. Pottinger Solar Farm (SSD-59254709)	19. Dinawan Wind Farm (SSD-50725708)
6. Wilan Wind Farm (SSD-51306206)	13. Billabong Creek Environmental Water Regulators (SSI-50831979)	20. Argoon Wind Farm (SSD-64935522)
7. Baldon Wind Farm (SSD-40138508)	14. Bullawah Wind Farm (SSD-50505215)	21. Belhaven Battery Energy Storage System (SSD-57575973)
8. Tchelery Wind Farm (SSD-59701722)	15. Romani Solar Farm (SSD-67105475)	22. Livingstone Solar Farm (SSD-80114208)
9. Abercrombie Wind Farm (SSD-77340978)	16. West Nyangay Solar Farm (SSD-74990235)	23. Mangoplah Battery Energy Storage System (SSD-77527735)
10. Wanganella Wind Farm (SSD-78102208)	17. Conargo Wind Farm (SSD-70611708)	
Approved or changed projects		
24. Yanco Delta Wind Farm (SSD-41743746)	25. Gregadoo Solar Farm (SSD-8825)	26. Inland Rail (Albury to Illabo) (SSI-10055)

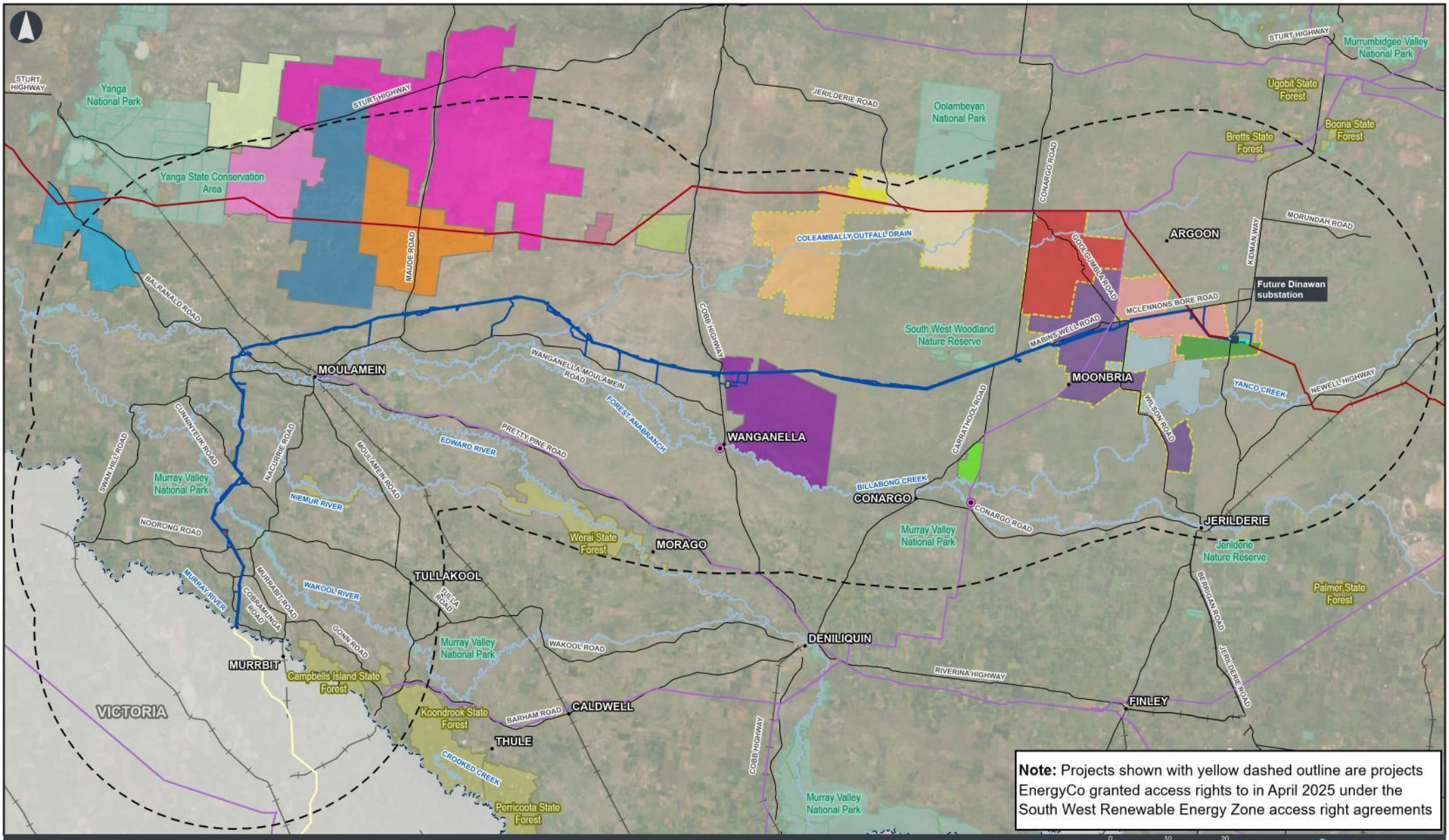
7.1.1 South West Renewable Energy Zone access right agreements

In April 2025, EnergyCo granted access rights to six wind, solar and large-scale battery projects with a combined generation capacity of 3.56 gigawatts[1]. These projects consisted of the following as shown previously in Table 7-1:

- Yanco Delta Wind Farm (project 24)
- Dinawan Energy Hub – consisting of the Dinawan Solar Farm and Dinawan Wind Farm (projects 18 and 19 respectively)
- Pottinger Energy Park – consisting of the Pottinger Solar Farm and Pottinger Wind Farm (projects 11 and 12 respectively)
- Bullawah Wind Farm (project 14).

The combined generation capacity of these proposed or approved projects represents the initial allocation of access rights under the South West Renewable Energy Zone access scheme. In making this decision, the maximum capacity for access rights assigned to each proposed renewable energy project is lower than what has been identified in planning assessment documentation for those projects, and it would alter the likelihood of some of the remaining projects in the South West Renewable Energy Zone proceeding in the short-term. However, for the purposes of this cumulative assessment it is assumed that all identified projects would proceed as described in the relevant planning assessment documentation available at the time of the assessment (in line with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (NSW DPIE, 2022)).

1 Media Release – South West Renewable Energy Zone powers up



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VNI West – EIS

Figure 7.1a
Cumulative impact projects

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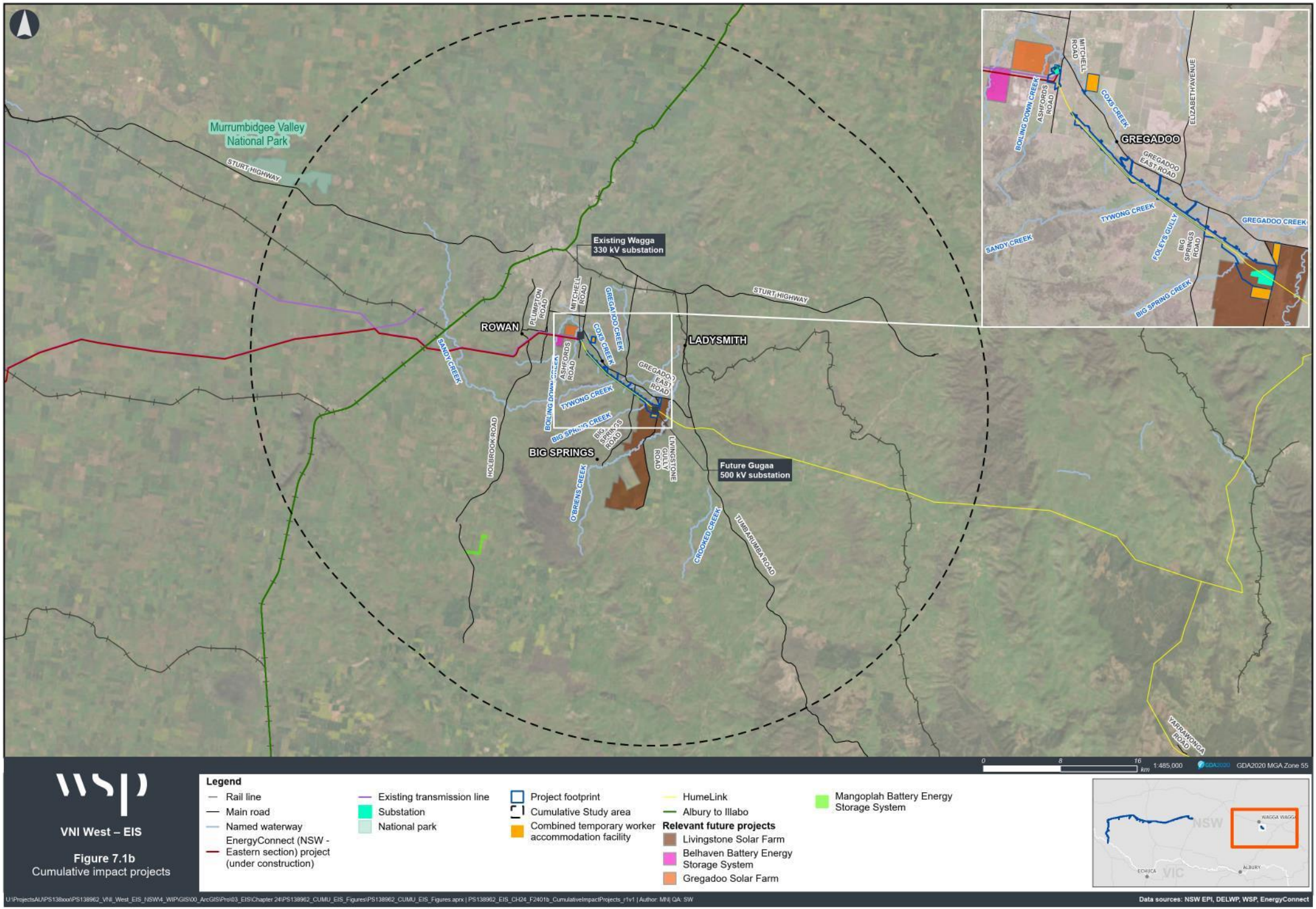
Data sources: NSW EPI, DELWP, WSP, EnergyConnect



VNI West – EIS

Figure 7.1b
Cumulative impact projects

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Data sources: NSW EPI, DELWP, WSP, EnergyConnect

7.2 Cumulative impacts

A discussion on the general cumulative impacts of the various types of relevant future projects is set out in the following sections. Several relevant future projects are also addressed in Table 7-2 due to their higher potential for cumulative impacts with the project.

7.2.1 Related developments

Related development includes existing or approved development or infrastructure that would be incorporated into the project, or development or infrastructure that is required for the project but is subject to a separate approval process. In the context of this project, this includes VNI West (Victoria), EnergyConnect (NSW – Eastern section) and HumeLink projects. Discussion concerning the cumulative impacts arising from each related development in conjunction with the project is provided in Table 7-2.

7.2.2 Wind Farms

The land on which the wind turbine generators would be located is mostly used for low intensity grazing at present. All windfarms considered are located near the NSW/Victorian border to the future Dinawan substation component. It is expected that there would be minor to negligible impact on grazing or crop production once the wind farms are in operation. Consequently, cumulative impacts on agricultural production during operation would be minor on a local basis and negligible on a regional basis covering the impacted LGAs.

Cumulative impacts on production during construction would be higher, but limited by low productivity of most of the wind farm land, and would be minor on a regional basis.

The cumulative impacts related to reduced local agricultural production, disruption, aerial agriculture and biosecurity risks during construction and operation would be negligible for those wind farms located 10 kilometres or more away from the project due to the distance involved. These wind farms are not individually addressed in Table 7-2.

The closer wind farms (Baldon, Tchelery, Dinawan, Argoon, Wanganella and Yanco Delta) may contribute to some cumulative impacts such construction traffic, land removed from production, livestock disturbance, the generation of dust, the effect on aerial agriculture operations, and increased biosecurity risks. However, these impacts are generally minor and can be reduced by the proposed mitigation measures.

The cumulative impacts of the closest wind farms are addressed individually in Table 7-2. It is acknowledged that the landholders hosting wind farm projects would have entered into voluntary negotiated agreements with the developer. These agreements typically set out how agricultural operations would continue, how access, biosecurity and site security would be managed alongside agricultural activities, and ongoing renumeration for the hosting landholder.

7.2.3 Solar Farms

Solar farms generally have the potential for a greater impact on agriculture and therefore may also have a greater cumulative impact than wind farms. This is primarily due to their higher permanent footprint relative to the total size of the solar farm, and exclusion of cropping on the solar farm sites. This is counterbalanced by continued grazing which is proposed or considered for all solar farms reviewed, and typically smaller total solar farm areas than wind farms.

Most proposed solar farms are currently mainly used for grazing with some irrigated or dryland cropping. Those located near in the NSW/Victorian border to the future Dinawan substation component are located on land with a relatively low agricultural productivity, but those near the network augmentation works component are located on land with higher agricultural productivity and would have greater cumulative impacts.

However, the land potentially occupied by solar farms is relatively small compared to the total regional agricultural industry across the impacted LGAs, and the impact of lost productivity during construction at a regional level would also be minor. Consequently, the cumulative impacts on regional agricultural production during construction would also be minor. The cumulative impacts on regional agricultural production during operation would decline to negligible levels if continued grazing were implemented.

Other impacts such those related to disruption and biosecurity risks are also minor for the project and for the solar farms considered and can be mitigated by measures proposed for each project. Therefore, these cumulative impacts on agriculture would also be minor during construction and operation.

Most of the solar farms considered are not individually addressed in Table 7-2 due to the minor and consistent expected cumulative impacts. However, the solar farms located closer than 10 kilometres from the project (i.e. Livingstone, Dinawan and Gregadoo solar farms) have the higher potential for cumulative impacts such as increased construction traffic, land removed from production, livestock disturbance, the generation of dust, and increased biosecurity risks.

These solar farms are addressed individually in Table 7-2. It is acknowledged that landholders hosting solar farm projects would have entered into voluntary negotiated agreements with the developer. These agreements typically set out how agricultural operations would continue, how access, biosecurity and site security would be managed alongside agricultural activities, and ongoing renumeration for the hosting landholder.

7.2.4 Other projects

Cumulative impacts relating to Billabong Creek Environmental Water Regulators, Belhaven Battery Energy Storage System, Mangoplah Battery Energy Storage System and Inland Rail (Albury to Illabo) have different types of impacts to other projects considered are addressed individually in Table 7-2.

7.3 Summary

Cumulative impacts on agriculture in the region covering the impacted LGA which would arise from the project being constructed and operated close to other major projects would be minor and managed by mitigation measures proposed or implemented for the project and the other projects assessed.

All the projects have minor impact on agricultural production, generally allowing agricultural activities to continue across most of the respective project sites. The amount of agricultural land taken out of production is generally small in relation to the total project site, and very small relative to the total regional agricultural area. Consequently, the effect on regional agricultural production would be negligible and no impact on the number of persons employed in the agricultural sector would be expected.

The solar farm projects are likely to have a larger impact on agricultural production per hectare of project footprint than transmission lines or wind farms. Once operational, grazing could most likely continue within the project footprint of the solar farm but solar farms would remove any current arable land from future crop production. However, the area of the solar farms is very small compared to the total regional agricultural area and the cumulative impact on agricultural production would be negligible.

Cumulative impacts arising from construction would also be negligible and limited to projects which are traversed by the project, or are adjacent, and have overlapping construction periods. There would be negligible cumulative construction impacts for projects further afield due to the distances involved.

Table 7-2
Summary of cumulative impacts – Selected projects

Project	Details and status	Proponent and Location	Cumulative Impacts
VNI West (Victoria)	Victorian component of the VNI West project. VNI West (Victoria) would consist of around 240 km of new 500 kV transmission line between the connection point with VNI West (Victoria) and Bulgana, Victoria. Approval and commencement of construction is expected to occur in 2026.	Transmission Company Victoria Provides a direct connection into the project at NSW/Victorian border.	The VNI West (Victoria) project would interface with VNI West (NSW) at the border, and there would be cumulative impacts on agricultural activities in the surrounding area. These impacts would be minor on a regional scale However, the rest of VNI West (Victoria) is distant from the project and would affect different agricultural regions. The impacts of both projects on production would be minor compared to the large scale of regional agricultural production. Therefore, cumulative impacts on production during construction and operation would be minor. Due to the geographical separation, cumulative impacts due to disruption during construction would be negligible.
EnergyConnect (NSW - Eastern section)	Development of a new transmission line connecting Buronga Substation and Wagga Wagga Substation, and construction of the new Dinawan Substation (around 170 km west of Wagga Wagga). Approved in September 2022. Construction began in early 2023 and is expected to continue until around mid to-late 2025 Operation is expected to begin in 2025 with an operational life of around 50 years.	Transgrid Provides a direct connection into the project at the future Dinawan substation.	The magnitude of the impacts of the EnergyConnect (NSW – Eastern Section) project on agriculture is limited by: • the relatively low productivity of agriculture in the area • the minor amount of land removed from agriculture • the continuation of agriculture activity despite construction and operation • the low biosecurity risks. The EnergyConnect (NSW – Eastern section) project would interface with the project at the future Dinawan substation, and there would be local cumulative impacts by project activities in this vicinity. However, construction periods for the projects do not overlap. Much of VNI West (NSW) is distant from EnergyConnect (NSW – Eastern section) and would impact different parts of NSW. Therefore, cumulative impacts on both a local and regional scale would be minor. The impacts of both projects on production would be minor compared to the large scale of regional agricultural production. Therefore, cumulative impacts on production during construction and operation would be minor. There may be some cumulative impacts due to disruption or biosecurity risks during construction, however, these impacts would be minor due to limited areas and duration, and because construction is not anticipated to directly overlap. Construction impacts would be mitigated by the measures set out in Chapter 8 (Management and mitigation) and similar management measures included for the EnergyConnect (NSW – Eastern section) project.

Project	Details and status	Proponent and Location	Cumulative Impacts
HumeLink	Construction and operation of new transmission lines between the existing substations at Wagga Wagga and Bannaby and the proposed Maragle substation, and a new substation at Gugaa. Construction is proposed to commence in 2025 and is expected to take around 2.5 years to complete Operation is expected to begin in mid-2027.	Transgrid The project overlaps the HumeLink footprint between Wagga Wagga and the new substation at Gugaa.	The Humelink project is located adjacent to VNI West (NSW) in the network augmentation works component. There would be moderate impacts of both projects on local agricultural production in this location during their respective construction periods. Therefore, the cumulative impacts on production at a local scale would also be moderate. However, the agricultural area affected is small on a regional scale and therefore the cumulative impacts of construction on production would be negligible as a proportion of total regional production. There would also be some local cumulative impacts due to disruption or biosecurity risks during construction because of the proximity of the projects. However, these impacts are also minor on a regional scale. Local impacts would be mitigated by the measures set out in Chapter 8 (Management and mitigation) and similar management measures included for the HumeLink project. There would be minimal additional impact on production by the project during operation as the upgraded transmission line would occupy an existing easement. Therefore, the cumulative impact on agriculture during operation would be negligible.
Baldon Wind Farm	Construction and operation of a proposed new wind farm comprising around 162 wind turbines with an installed capacity of around 1 GW across an area of around 42,500 hectares. EIS exhibited August-September 2024. Construction is expected to begin in early 2026 and take around 36 months.	Goldwind Australia Around 2 km north of the project.	The proposed wind farm is located on land currently used for sheep grazing. The impacts of this wind farm on agriculture would be minor due to the low grazing productivity and the low effect of wind farms on agriculture. Local cumulative impacts on production during construction would be negligible as the projects are on different properties, while the cumulative loss of production would be negligible on regional basis due to the relatively small area affected. It is expected that there would be negligible impact to agricultural activities once the wind farm is in operation. Consequently, the cumulative impacts in relation to production, disturbance and biosecurity risks would also be negligible. The construction periods are likely to substantially overlap. The projects are on different properties and this is would result in negligible cumulative impact relating to disturbance and biosecurity risk for the host properties. There would be no cumulative impact on aerial agriculture operations as there would be little use of aerial agriculture on the wind farm host property.

Project	Details and status	Proponent and Location	Cumulative Impacts
Tchelery Wind Farm	Construction and operation of a wind farm with up to 74 wind turbines, battery storage and associated infrastructure. EIS being prepared. Construction is proposed to commence in early 2026 and is expected to take around 30 months	Neoen Around 3 km north of the project	The land is currently used mainly for grazing. Although there is some irrigated cropping, it is not directly affected by the wind farm. Therefore, impacts on production during construction would be limited by the low productivity of the grazing enterprises. Local cumulative impacts on production would be negligible as the projects are on different properties, while the cumulative loss of production would be negligible on regional basis due to the relatively small area affected. The construction periods are likely to substantially overlap. The projects are on separate properties and this would result in negligible cumulative impact relating to disturbance and biosecurity risks for the host properties. It is expected that there would be a negligible impact to agricultural activities once the wind farm is in operation. Consequently, the cumulative impacts in relation to production, disturbance and biosecurity risks would also be negligible. There would be no cumulative impact on aerial agriculture activities during operation as the crop area on Tchelery is about 14 kilometres from the project.
Billabong Creek Environmental Water Regulators	Replacement of two existing weirs along Billabong Creek with two new environmental water regulators. The new regulators would allow for flow regulation and fish passage.	NSW DCCEEW About 7 km south of the project	The Billabong Creek project area is about 21 hectares, of which 15 hectares is used for grazing. This Billabong Creek project is very small in the context of the total regional agricultural area. It should have a negligible negative impact on agricultural productivity during construction and operation. Therefore, cumulative impacts would also be negligible. It is relatively distant from the project and therefore cumulative impacts related to disruption and biosecurity risk during construction would be negligible. These cumulative impacts would decline further during operation.

Project	Details and status	Proponent and Location	Cumulative Impacts
Dinawan Solar Farm	Construction and operation of a proposed new solar farm comprising around 1.5 million PV panels with an installed capacity of around 1 GW and a BESS across a development footprint of 2,499 hectares.	Spark Renewables 100 metres south of project.	The solar farm area is currently used for sheep and cattle grazing. Impacts to agricultural productivity during operation will be mitigated where practical by utilising agrisolar practices. This is expected to retain more than 50% of the land's agricultural productivity according to the Dinawan Solar Farm EIS. There would be significant local cumulative impacts on agricultural productivity during construction as grazing on the development footprint would be precluded. However, this impact would be temporary, and negligible on a regional basis due to the relatively small size of the development footprint. The impact of solar farm on agricultural production during operation would be negligible due to agrisolar practices and therefore the cumulative impact on agricultural production would also be negligible. The construction periods are likely to overlap by about 12 months, and the combined construction activities may result in some cumulative impacts related to disruption and biosecurity risks, given the proximity of the two projects. However, these cumulative impacts, if any, would be temporary and would be mitigated by management measures implemented by each project. Impacts related to disruption and biosecurity risks would be lower during operation than construction due to lower vehicle, machinery and personnel activity, and therefore cumulative impacts would be negligible.
Dinawan Wind Farm	Construction and operation of a proposed new wind farm comprising around 200 wind turbines with an installed capacity and a BESS of around 1.5 GW across an area of around 46,000 hectares.	Spark Renewables Dinawan Wind Farm (west) is around 4 km north of the project. The project traverses Dinawan Wind Farm (east).	The wind farm is located on land that is currently used mainly for sheep and cattle grazing plus with some areas of irrigated canola, cotton and cereal crops. Impacts on production during construction would be limited by the low productivity of the primary enterprise - grazing. Local cumulative impacts on production are expected, given the close proximity of the project to Dinawan Wind Farm (east). This will significantly reduce the host property's agricultural production during construction. However, this impact would be temporary, and the cumulative loss of production would be negligible on a regional basis due to the relatively small area affected. Also as stated in section 7.2.2 it is acknowledged that the host landholder has entered into a voluntary agreement for the project. The construction periods are likely to substantially overlap and some cumulative impacts in relation to disturbance and biosecurity risks are expected. These impacts would be mitigated by the measures set out in Chapter 8 (Management and mitigation) and similar management measures proposed for Dinawan Wind Farm.

Project	Details and status	Proponent and Location	Cumulative Impacts
			It is expected that there would be negligible impact to agricultural activities once the wind farm is in operation. Consequently, the cumulative impacts in relation to production, disturbance and biosecurity risks during operation would be negligible. Transmission line structures can cause cumulative impacts on aerial agriculture operations in association with wind turbine generators. Aerial agriculture is used on and around this proposed wind farm. Therefore, some cumulative impacts from the presence of both wind turbine generators and transmission towers would be expected due to their proximity. However, these impacts would be minor to negligible for both projects, and therefore cumulative impacts are expected to be minor.
Argoon Wind Farm	Construction and operation of a wind farm with up to 106 wind turbines, battery storage and associated infrastructure. Currently preparing EIS. The wind farm would be constructed over a period of around 24 to 36 months, but commencement timeframe is currently unknown.	RES Australia Pty Ltd About 1 km south of the project	The wind farm is located on land that is currently used mainly for grazing plus some irrigated and dryland cropping. The location of the wind turbine generators largely avoids the cropping area. The cumulative impacts of the wind farm on agriculture would be minor due to the low grazing productivity and the low impact of wind farms on agriculture. Local cumulative impacts on production would be negligible as the projects are on different properties, while the cumulative loss of production would be negligible on regional basis due to the relatively small area affected. The construction period is unknown. The combined construction activities may result in some cumulative impacts in relation to disturbance and biosecurity risks, given the close proximity to the proposed Dinawan substation and the proposed VNI West (NSW) transmission line. However, these cumulative impacts are likely to be minor, temporary and mitigated by the measures set out in Chapter 8 (Management and mitigation) and similar management measures proposed for Argoon Wind Farm. It is expected that there would be negligible impact to agricultural activities once the wind farm is in operation. Consequently, the cumulative impacts in relation to production, disturbance and biosecurity risks during operation would also be negligible. Aerial agriculture is likely to be used on and around this wind farm area. Therefore, some cumulative impacts from the presence of both wind turbine generators and transmission line structures are expected. The magnitude of the cumulative impacts is not known as the Argoon Wind Farm EIS has not been prepared.

Project	Details and status	Proponent and Location	Cumulative Impacts
Wanganella Wind Farm	Development of a proposed 840 MW wind farm comprising around 105 wind turbines (with a maximum tip height of 270 m), BESS and associated infrastructure across an area of around 30,737 hectares. SEARs issued in November 2024; an EIS is being prepared. Construction is proposed to commence in 2027 and is expected to take around two years Operation is expected to begin in 2030 with an operational life of around 30 years.	Equis Wind Australia Pty Ltd The project traverses the Wanganella Wind Farm	The land is currently used mainly for stud sheep, merino wool production and other animal grazing, with some broadacre crop production using irrigation provided by Billabong Creek. Although there is some irrigated cropping, it is not directly affected by the wind farm. Therefore, impacts on production during construction would be limited to grazing enterprises which are considered to be a low productivity. Local cumulative impacts on production are expected, given the close proximity of the project to the wind farm. The host property's agricultural production would be significantly reduced during construction of the wind farm. However, this impact would be temporary, and the cumulative loss of production would be negligible on a regional basis due to the relatively small area affected. Also, as stated in section 7.2.2, it is acknowledged that the host landholder has entered into a voluntary agreement for the project. The construction periods are likely to substantially overlap and some cumulative impacts in relation to disturbance and biosecurity risks are expected. These impacts would be mitigated by the measures set out in Chapter 8 (Management and mitigation) and similar management measures proposed for Wanganella Wind Farm. It is expected that there would be negligible impact to agricultural activities once the wind farm is in operation. Consequently, the cumulative impacts in relation to production, disturbance and biosecurity risks during operation would be negligible. Transmission line structures can cause cumulative impacts on aerial agriculture operations in association with wind turbine generators. Aerial agriculture is likely to be used on and around this proposed wind farm. Therefore, some cumulative impacts from the presence of both wind turbine generators and transmission towers would be expected due to their proximity. However, these impacts would be minor to negligible for both projects, and therefore cumulative impacts are expected to be minor.

Project	Details and status	Proponent and Location	Cumulative Impacts
Yanco Delta Wind Farm	Construction and operation of a wind farm comprising around 208 wind turbines with an installed capacity of around 1.5 GW and a BESS across an area of around 42,000 hectares. Approved in December 2023. Construction is proposed to begin in 2026 and is expected to take around 36 months	ViRYA Energy The project traverses Yanco Delta Wind Farm	The wind farm is located on land that is currently used mainly for low intensity dryland sheep grazing with some cropping activities. However, the location of the wind turbine generators avoids the cropping areas. Local cumulative impacts on production are expected, given the proximity of the project to the wind farm. This will significantly reduce the host property's agricultural production during construction. However, the cumulative impacts on agriculture would be minor due to the low grazing productivity, and this impact would be temporary. The cumulative loss of production would be negligible on regional basis due to the relatively small area affected, and the low effect of wind farms on agriculture. The construction periods are likely to substantially overlap, and the combined construction activities would probably result in some cumulative impacts, given the proximity of the projects. However, these cumulative impacts would be temporary and minor. It is expected that there would be negligible impact to agricultural activities once the proposal is in operation. A small area of grazing land is expected to be removed from agricultural production resulting in a relatively small loss of agricultural production. The lost annual agricultural production during operation of the wind farm is estimated to be around $46,000, which is less than 0.1 per cent of regional gross value of agricultural production according to the Yanco Delta Wind Farm EIS. Consequently, the cumulative impacts in relation to production, disturbance and biosecurity risks would also be negligible. Aerial agriculture (spraying) is used on two properties within the wind farm area. Therefore, some cumulative impacts from the presence of both wind turbine generators and transmission towers is expected due to their proximity. These impacts will be mitigated by management measures proposed by both projects. However, these impacts would be minor to negligible for both projects, and therefore cumulative impacts are expected to be minor.

Project	Details and status	Proponent and Location	Cumulative Impacts
Livingstone Solar Farm	Development of a proposed 300 to 600 MW solar farm comprising PV panels. BESS and associated infrastructure across a property of around 2,700 hectares, with a project area of around 1,345 hectares. SEARs issued in March 2025; an EIS is currently being prepared The project would be constructed over a period of around 12 to 24 months. Construction and operation commencement timeframe currently unknown An operational life of around 30 to 40 years is expected.	Brunsdon Pastoral Co. South-eastern end of the network augmentation works – close to the future Gugaa 500 kV substation, Livingstone Gully Road	The scoping report indicates that the solar farmland would continue to be grazed with sheep during operation and, upon decommissioning, would be returned to its previous agricultural capacity. Although the solar farm is located on relatively productive land near the network augmentation works component, it would have negligible cumulative impact on regional agricultural production during construction due to its small size relative to the total agricultural industry in the Wagga Wagga LGA. This impact would be temporary. However, the solar farm will reduce the area available for cropping. During operation, the impact of the solar farm on agricultural production would be reduced due to agrisolar practices and therefore the cumulative impact on agricultural production would be negligible. Combined construction activities may result in some cumulative impacts related to disruption and biosecurity risks, given the proximity of the two projects. However, these cumulative impacts, if any, would be temporary and would be mitigated by management measures implemented by each project. Impacts related to disruption and biosecurity risks would be lower during operation and therefore cumulative impacts would be negligible.
Gregadoo Solar Farm	Construction and operation of a solar farm with a generating capacity of around 65 MW (AC). Current proposal includes an update of the current approval to include a BESS. Main solar farm approved December 2018 and will start construction in 2025. Construction of the proposal is expected to take up to 15 months	Gregadoo Solar Farm Pty Ltd Adjacent to the project at Wagga 330 kV substation (Line 51 works).	The Gregadoo Spolar Farm EIS indicates that the solar farmland would continue to be grazed with sheep during operation and, upon decommissioning, would be returned to its previous agricultural capacity. The solar farm occupies around 96 hectares of a 150 hectare property. Although the Gregadoo Solar Farm is located on relatively productive land near the network augmentation works component, it would have negligible cumulative impact on regional agricultural production during construction due to its small size. This impact would be temporary. During operation, the impact of the solar farm on agricultural production would decline due to agrisolar practices and therefore the cumulative impact on agricultural production would be negligible. Combined construction activities may result in some cumulative impacts related to disruption and biosecurity risks, given the proximity of the two projects. However, these cumulative impacts, if any, would be temporary and would be mitigated by management measures implemented by each project. Impacts related to disruption and biosecurity risks would be lower during operation and therefore cumulative impacts would be negligible.

Project	Details and status	Proponent and Location	Cumulative Impacts
Mangoplah Battery Energy Storage System	Development of a proposed 100 MW / 400 MWh BESS including transmission connection and associated infrastructure.	Mangoplah BESS project is located around 21 km south of the network augmentation component of the project	The proposed Mangoplah Battery Energy Storage System project area is only about 13 hectares and therefore there would be relatively little agricultural impact. Consequently, cumulative impacts on agricultural production during construction and operation would be negligible. The BESS is relatively distant from the project. Therefore, construction would not have a significant cumulative impact on agricultural production on the host properties. There are unlikely to be any cumulative impacts relating to disruption and biosecurity risks during construction or operation.
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 is being prepared. Construction is anticipated between 2025 and 2026.	Vena Energy The main site is located about 1.5 km west of the project where it connects to the existing Wagga Wagga 330 kV substation.	The proposed Belhaven Battery Energy Storage System project area is only 25 hectares of low to moderate capability land and therefore there would be relatively little agricultural impact. Consequently, cumulative impacts on agricultural production during construction and operation would be negligible. Based on publicly available information, construction programs are likely to overlap by only about 6 months. Therefore, construction would not have a significant cumulative impact on agricultural production on the host properties. There may be some cumulative impacts relating to disruption and biosecurity risks during construction, but these impacts are likely to be minor. These cumulative impacts would decline during operation.
Inland Rail – Albury to Illabo	Enhancement works to structures and sections of track along 185 kilometres of existing operational standard gauge rail from the Victorian/New South Wales border to Illabo in regional NSW. It forms part of the Inland Rail project. Construction began in January 2025.	ARTC 11.5 km north west of the project	This upgrade section of the Inland Rail would be constructed on an existing rail corridor and only a relatively small area of agricultural land would be affected. Construction programs may not overlap significantly. Therefore, construction would have a negligible cumulative impact on agricultural activities on the host properties. Consequently, cumulative impacts on agriculture would be negligible.

8 Management and mitigation

8.1 Environmental management

This chapter describes the actions already undertaken to avoid and minimise impacts. It also describes how the project would be managed to reduce potential environmental impacts throughout detailed design, construction and operation.

The approach to environmental management and mitigation of potential agriculture impacts for the construction of the project would be carried out through the development of a project specific Construction Environmental Management Plan (CEMP) for the main construction works, and the implementation of individual property management plans developed in consultation with landowners.

Property management plans will address individual property requirements during the construction stage of the project, including adjustments to property infrastructure, biosecurity protocols, and agreed timing and location of works to limit disruption of landholder activities (refer to EIS Appendix F for more details).

Operation of the project would be managed through Transgrid's EMS, which is accredited to ISO 14001 requirements. The EMS includes an *Environmental Assessment Framework*, which contains checklists, procedures, guidance notes and an *Environmental Handbook* (Transgrid, 2021d) to assess and manage the potential impacts of maintenance activities.

8.2 Mitigation measures

Site-specific mitigation measures have been proposed to further avoid or minimise potential agricultural impacts associated with the project. Mitigation measures are presented in Table 8-1.

Other related mitigation measures are set out in the following technical papers:

- *Technical paper 10 – Groundwater impact assessment* - regarding impacts to registered bores and make good provisions
- *Technical paper 12 – Bushfire impact assessment* – regarding fire risk management
- *Technical paper 14 – Aviation impact assessment* - regarding aerial agriculture applications
- *Technical paper 15 – Air quality impact assessment* - regarding the impact of dust.

Table 8-1
Mitigation measures – Agriculture

Reference	Impact	Environmental safeguard	Timing	Relevant locations
LU1	Agricultural – access impacts (construction)	The location of access tracks (temporary and permanent) will be confirmed in consultation with landholders (as part of the Property management plans (mitigation measure G2)) to minimise impacts on agricultural activities. Where permanent tracks are required, a single access track will be designed to serve both temporary and permanent purposes, where possible.	Detailed design and pre-construction	All locations

Reference	Impact	Environmental safeguard	Timing	Relevant locations
LU2	Agricultural – impact of structures	Consultation will be undertaken with landholders where the positioning of transmission line structures and other associated permanent and temporary structures will impact: • cropping land • areas used for set up and pack up of agricultural equipment, entry points and turning areas • stock yards • farm dams • locations of high biosecurity risk, or, • any other area / location of significant importance to the landholder. The consultation will identify opportunities to avoid or minimise these impacts, where practicable, prior to the commencement of relevant works which will impact the applicable area, equipment and/or property infrastructure.	Detailed design and pre-construction	All locations
LU3	Agricultural – disruption (travelling livestock)	Consultation will be undertaken with landholders, Local Land Services and others who use Travelling Stock Reserves, livestock highways, and other public roads to minimise disruption to travelling livestock. Construction workers or Transgrid personnel (operation) will be made aware of the possibility of livestock being present on Travelling Stock Reserves, access tracks and public roads.	Construction and operation	All locations
LU4	Agricultural – biosecurity	Biosecurity controls will be implemented to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls will be documented in individual Property management plans and, as relevant, within the Biosecurity management plan developed as part of the Biodiversity management sub-plan. Controls during operation will also be in accordance with Transgrid's *Biosecurity Procedure* (Transgrid, 2022d) and *Environmental Guidance* Note – Biosecurity (Transgrid, 2022e). The level of biosecurity risks and effectiveness of controls will be monitored in a manner and time interval consistent with the level of risk on each property, and controls adjusted as required. In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority will be notified as per the *Biosecurity Act 2015* (NSW) and Biosecurity Regulation 2017.	Construction and operation	All locations

Reference	Impact	Environmental safeguard	Timing	Relevant locations
LU5	Agricultural – access impacts	Fencing and access arrangements, such as locked gates and requirements for opening and closing of gates, will be determined in consultation with landholders. Any damage to fencing or water supplies caused by maintenance activities will be repaired promptly.	Operation	Transmission line
LU6	Agricultural – GPS impacts	If adverse effects on agricultural precision farming (using GPS) are reported within 12 months of operation, practical rectification measures (including signal boosting equipment or antenna enhancement) will be considered. This will be carried out in consultation with the relevant landholders.	Operation	Transmission line

8.3 Residual impacts

The loss of some agricultural land and production during construction and operation would be unavoidable, and this is quantified in sections 5.1 and 6.1, respectively.

There would be some residual impacts to aerial agricultural operations, which would reduce the efficiency of these operations in some areas, and cause a change in land use away from rice growing in the most impacted areas.

Some restriction to the movement of livestock, personnel and vehicles would also be unavoidable. However, the residual impact would be reduced to minor levels by the proposed mitigation measures including landholder consultation and effective communication.

Other potential impacts including biosecurity risks, impacts on cropping, disturbance of livestock, impact on bores, fire risks, disruption to travelling livestock, and radio communication interference would be eliminated or reduce to minor levels by the proposed mitigation measures.

9 References

ABS (2022a), *Data by region*. Available at: dbr.abs.gov.au. Accessed 4 September 2024.

ABS (2022b), *Agricultural Commodities, Australia, 2020-21*. AGCDCLGA202021. Agricultural commodity estimates local government areas (LGA).

ABS (2022c), *Value of agricultural commodities produced, Australia, 2020-21*. VACPDCLGA202021 Gross and local value estimates by local government areas (LGA).

Agriculture Victoria (2024), *Victorian Resources Online – Soil*. Available at http://vro.agriculture.vic.gov.au/
dpi/vro/vrosite.nsf/pages/soil-home. Accessed 4 September 2024.

Animal Health Australia (2018), *National Farm Biosecurity Manual - Grazing Livestock Production.* April 2018

BoM (2022), *Rainfall Variability*. Available at bom.gov.au/jsp/ncc/climate_averages/rainfall-variability/index.jsp. Accessed 13 November 2022.

BoM (2024), *Climate Data Online*. Available at reg.bom.gov.au/climate/data. Accessed 3 September 2024.

CSIRO and BoM (2022), *State of the Climate 2022*.

Department of Industry (2017), *Travelling stock reserves - Interim update*. Published November 2017.

DPE (2013), *Strategic Regional Land Use Policy (SRLUP) - Strategic agricultural land - biophysical*. Available at datasets.seed.nsw.gov.au/dataset/srlup-salbiophysical. Accessed 15 November 2022.

DPE (2022a), *Lower Murrumbidgee Groundwater Sources - Groundwater annual report 2022.*

DPE (2022b), *Lower Murray Groundwater Sources - Groundwater annual report 2022.*

DPE (2023), *Lower Murrumbidgee Groundwater Sources - Preliminary analysis of the influence of groundwater extraction on water quality 2005–2018.* November 2023

DPI (2011a), *OJD Prevalence Areas 2011-30 Dec 2012*. dpi.nsw.gov.au/animals-and-livestock/sheep/health/other/ojd/about/historical/ojd-prevalence-areas-jan2011. Accessed 5 September 2024.

DPI (2011b), *OJD Prevalence Areas 2011-30 Dec 2012*. dpi.nsw.gov.au/animals-and-livestock/sheep/health/other/ojd/about/historical/ojd-prevalence-areas-jan2011. Accessed 5 September 2024.

DPI (2013), *Infrastructure Proposals on Rural Land*. June 2013, Primefact 1063, second edition. Mary Kovac and Glenda Briggs. Resource Planning and Development Unit

DPI (2021), *Draft state significant agricultural land map - exhibition.* Available at nswdpi.mysocialpinpoint.com/ssal. Accessed 27 August 2024.

DPI (2022), *NSW Biosecurity and Food Safety Strategy 2022-2030.*

DPI (2023a), *NSW Invasive Species Plan 2023-2028*.

DPI (2023b), *NSW Footrot Program - 2022 Report*. NSW Department of Primary Industries, April 2022.

DPI (2024a), *Biosecurity Information System - Weeds*. Available at trade.maps.arcgis.com/apps/webappviewer/index.html?id=a62b0f927ca441f1ba60b2dbfde5e9be.
Accessed 27 August 2024.

DPI (2024b), *NSW WeedWise website.* Available at weeds.dpi.nsw.gov.au/. Accessed 27 August 2024.

DPI (2024c), *Distribution Maps for Vertebrate Pests*. Available at dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/distribution-maps-for-vertebrate-pests. Accessed 27 August 2024.

DPI (2025) *Performance, Data & Insights – Rice*. Available at: dpi.nsw.gov.au/about-us/publications/pdi/2024/rice#. Accessed 17 March 2025.

DPIE (2021), *Australian Soil Classification (ASC) Soil Type map of NSW, Version 4.5*.

DPIE (2022), *NSW Landuse 2017*. Available at data.nsw.gov.au/data/dataset/nsw-landuse-2017. Updated 2022.

Emery K. A. (1986), *Rural Land Capability Mapping*. Soil Conservation Service of NSW, Sydney.

Hulme T., Grosskopf T. and Hindle J. (2002), *Agricultural Land Classification*. AgFact AC.25. NSW Agriculture, Orange NSW.

Indiana Electric Cooperatives (2020), *Drones Pose Electrical Safety Issues.* Available at indianaec.org/2020/05/27/drones-pose-electrical-safety-issues/. Accessed 17 November 2022

Landscape South Australia (2024), *Wedge-tailed eagles in agricultural areas.*

LLS (2022), *Travelling Stock Reserves - State Classification Map*. Available at arcgis.com/apps/webappviewer/index.html?id=dd585551cd5c4320bfcd2d671d8f2364. Accessed 6 September 2024.

Murray LLS (2022), Murray *Regional Strategic Weed Management Plan 2023-2027.*

Murray LLS (2024), Murray *Regional Strategic Pest Animal Plan 2024-2028.*

NARCliM (2024). *Riverina Murray - Climate Change Snapshot*. Published: August 2024.

OEH (2012), *The Land and Soil Capability Assessment Scheme (second approximation) – a General Land Evaluation System for New South Wales*. Office of Environment and Heritage, Sydney.

OEH (2013), *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land.* NSW Office of Environment and Heritage, Sydney.

OEH (2017), *Estimated Inherent Soil Fertility of NSW.* NSW Office of Environment and Heritage, Sydney.

Plant Health Australia (2010), *Orchard Biosecurity Manual for the Apple and Pear Industry.* Version 2.0.

Plant Health Australia (2017), *Biosecurity Manual for Grain Producers.* Version 4.1 January 2017.

Ridpath M.G. and Brooker M.G. (1987), Sites and Spacing of Nests as Determinants of Wedge-tailed Eagle Breeding in Arid Western Australia. *Emu* 87(3) 143 – 149.

Riverina LLS (2018), *Riverina Regional Strategic Pest Animal Plan 2018-2023.*

Riverina LLS (2022), *Riverina Regional Strategic Weed Management Plan 2023-2027.*

Riverina LLS (2024), *Riverina Regional Strategic Pest Animal Plan 2024-2028.*

Squires H. (2017), *Agricultural Land Use Mapping Resources in NSW - User's guide*. Primefact 1538 first edition February 2017.

Transgrid (2013), *Network Management Plan 2013-2018*.

Transgrid (2024a), *Easement Guidelines – Living and working with electricity transmission lines.* June 2024.

Transgrid (2024b), *Managing Bushfire Risk.* Factsheet February 2024.

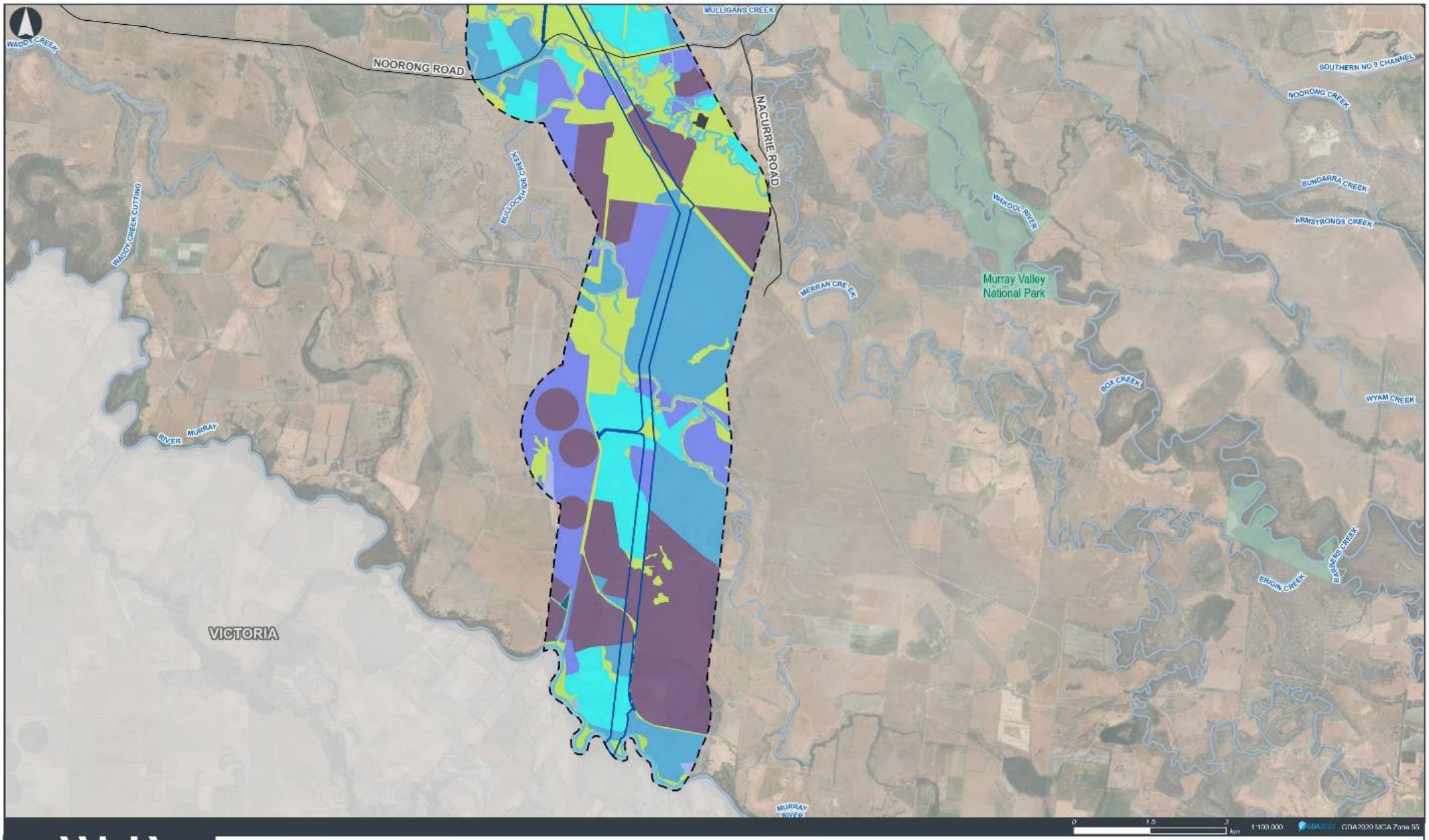
Victorian Department of Environment, Land, Water and Planning (2022), *Living with Wedge-tailed Eagles*.

Weeds Australia (2022), *Weed profiles*. Available at: *w*eeds.org.au/weeds-profiles/. Accessed 20 November 2022.

Woodward R. (1988), *Rural Land Evaluation: a Manual for Conducting a Rural Land Evaluation* Exercise at the local planning level, revised edition. Department of Planning, Sydney NSW.

WorkCover (2006), *Work Near Overhead Power Lines*. Industry code of practice, WorkCover NSW.

Appendices



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VNI West – Technical Paper
Agricultural impact assessment

Appendix 1
Land use

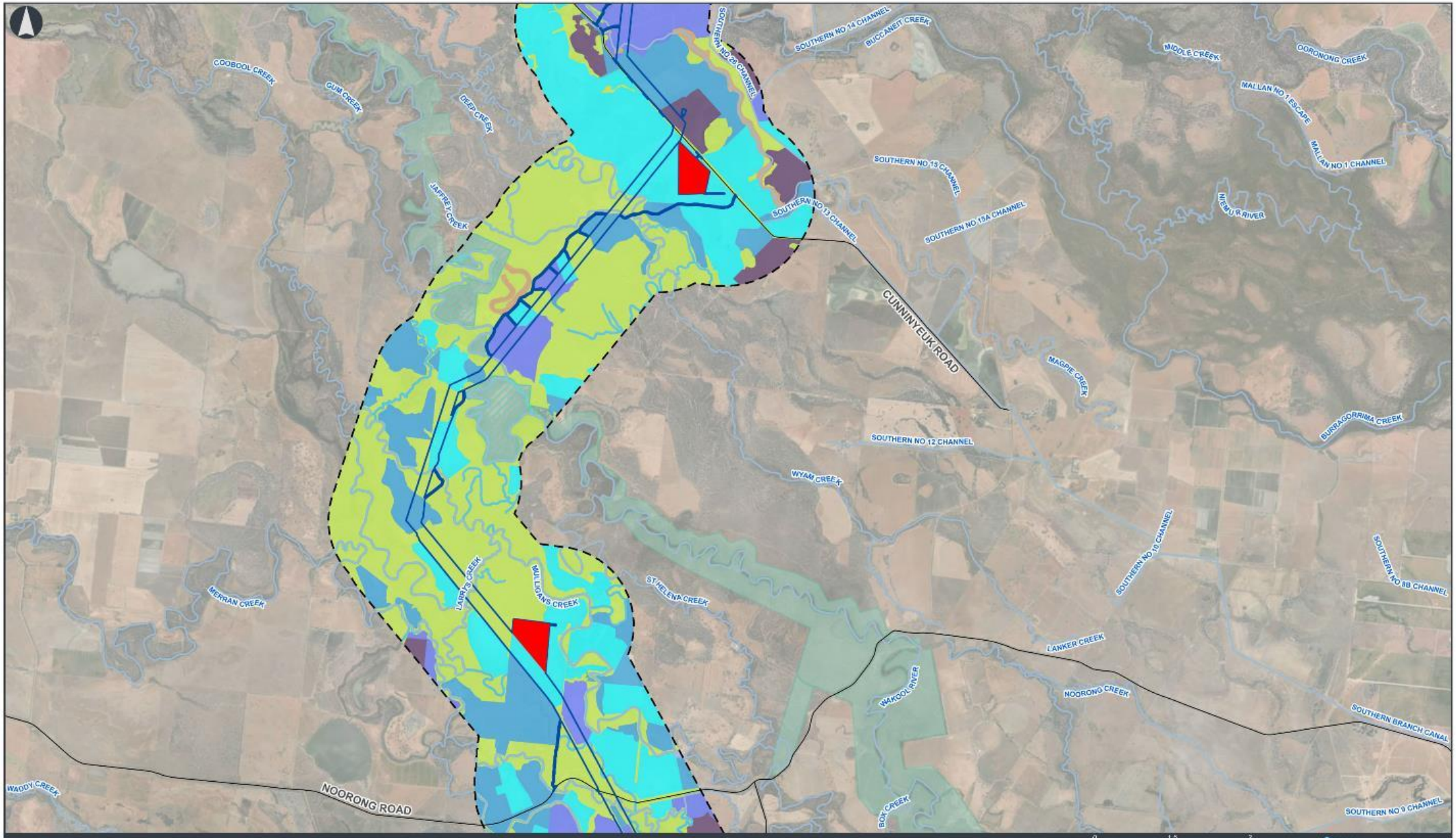
Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Substation

Land Use (2017)

- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 5.4.0 Residential and farm infrastructure
- 5.8.0 Mining
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.4.0 Channel/aqueduct

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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VNI West – Technical Paper
Agricultural impact assessment

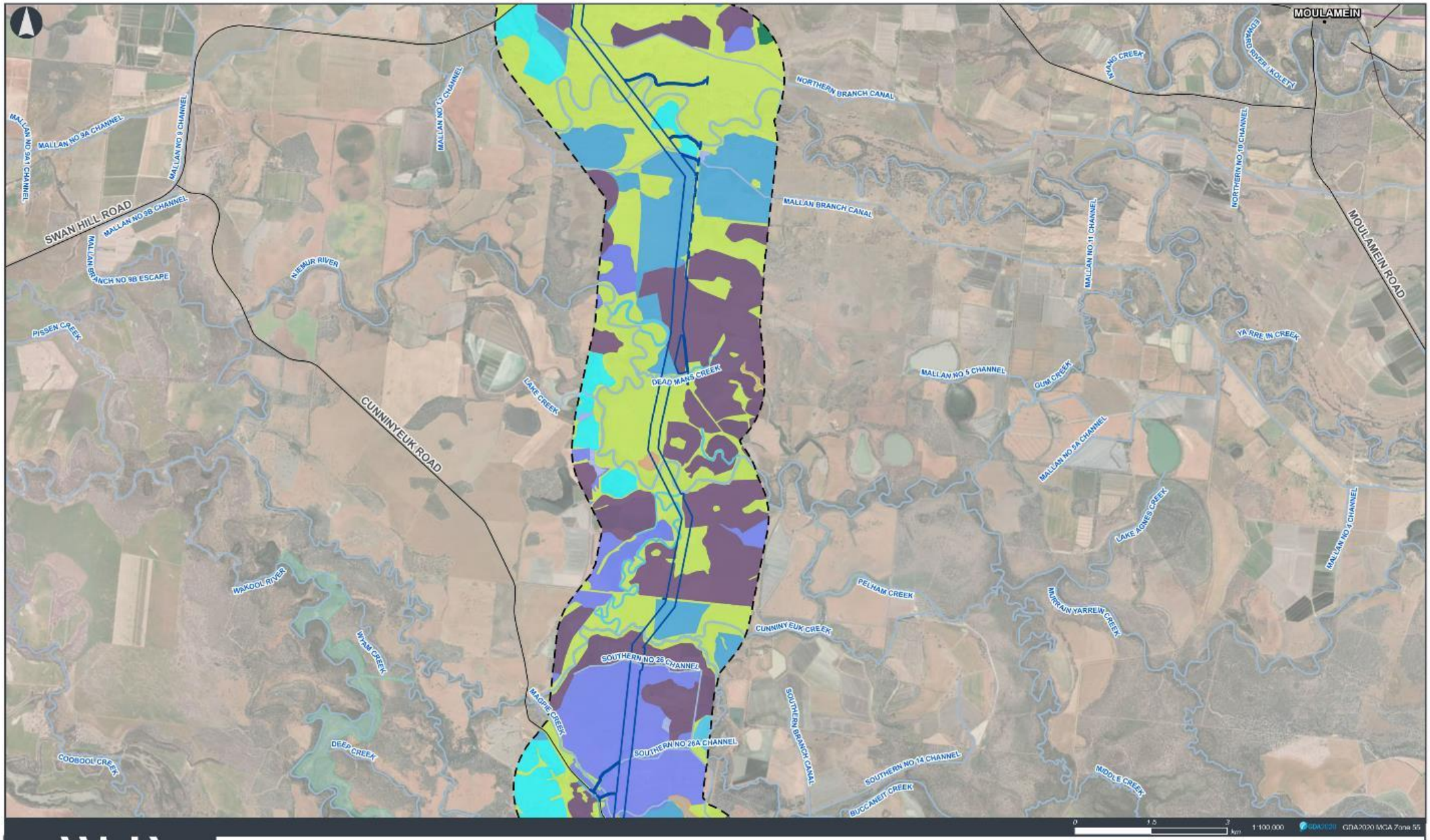
Appendix 1
Land use

Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound
- Substation

Land Use (2017)

- 1.1.0 Nature conservation
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 5.4.0 Residential and farm infrastructure
- 6.3.0 River
- 6.5.0 Marsh/wetland



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VNI West – Technical Paper
Agricultural impact assessment

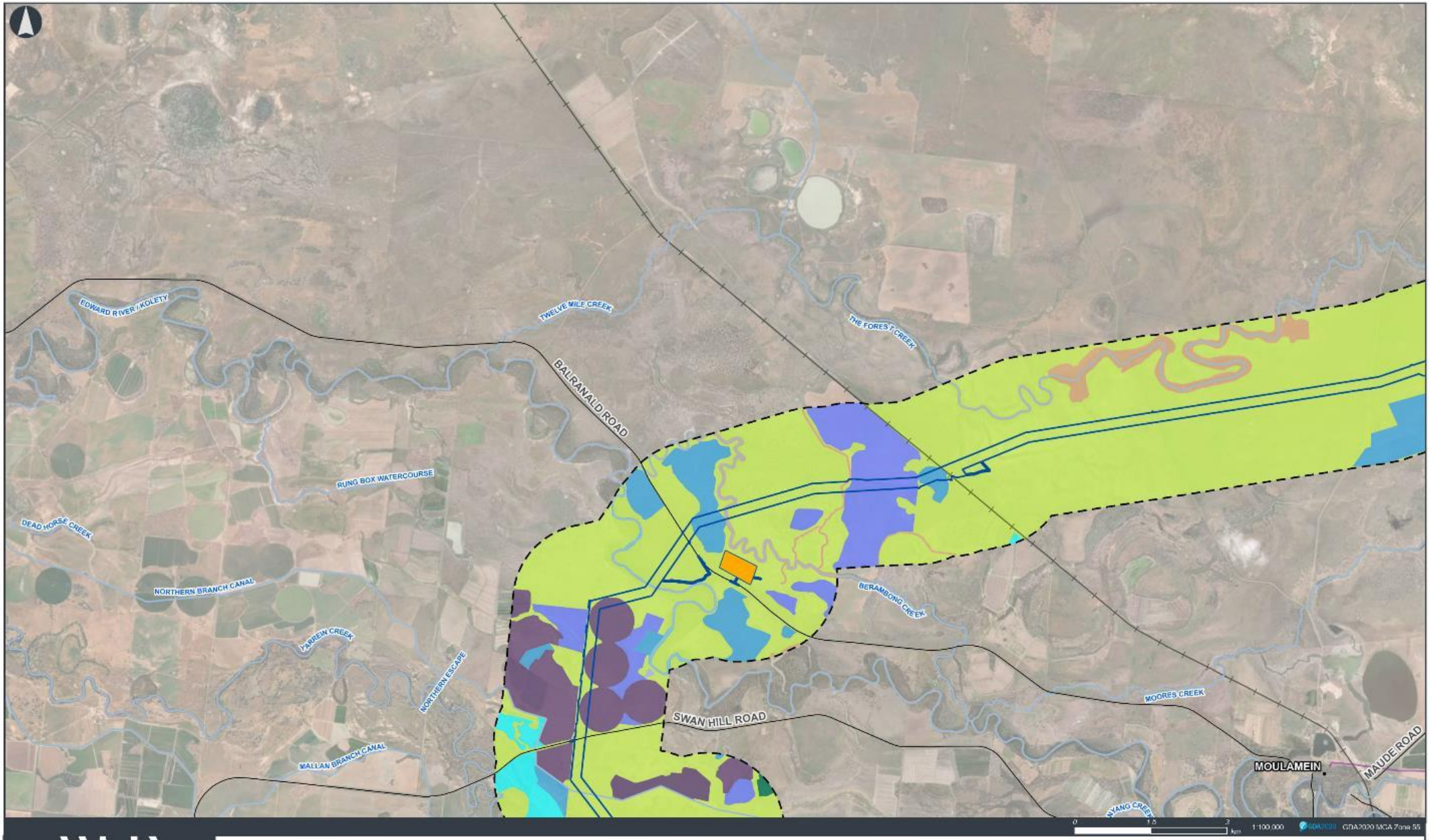
Appendix 1
Land use

Legend

- Main road
- Rail line
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Substation

Land Use (2017)

- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 4.4.0 Irrigated perennial horticulture
- 5.4.0 Residential and farm infrastructure
- 6.3.0 River
- 6.5.0 Marsh/wetland



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VNI West – Technical Paper
Agricultural impact assessment

Appendix 1
Land use

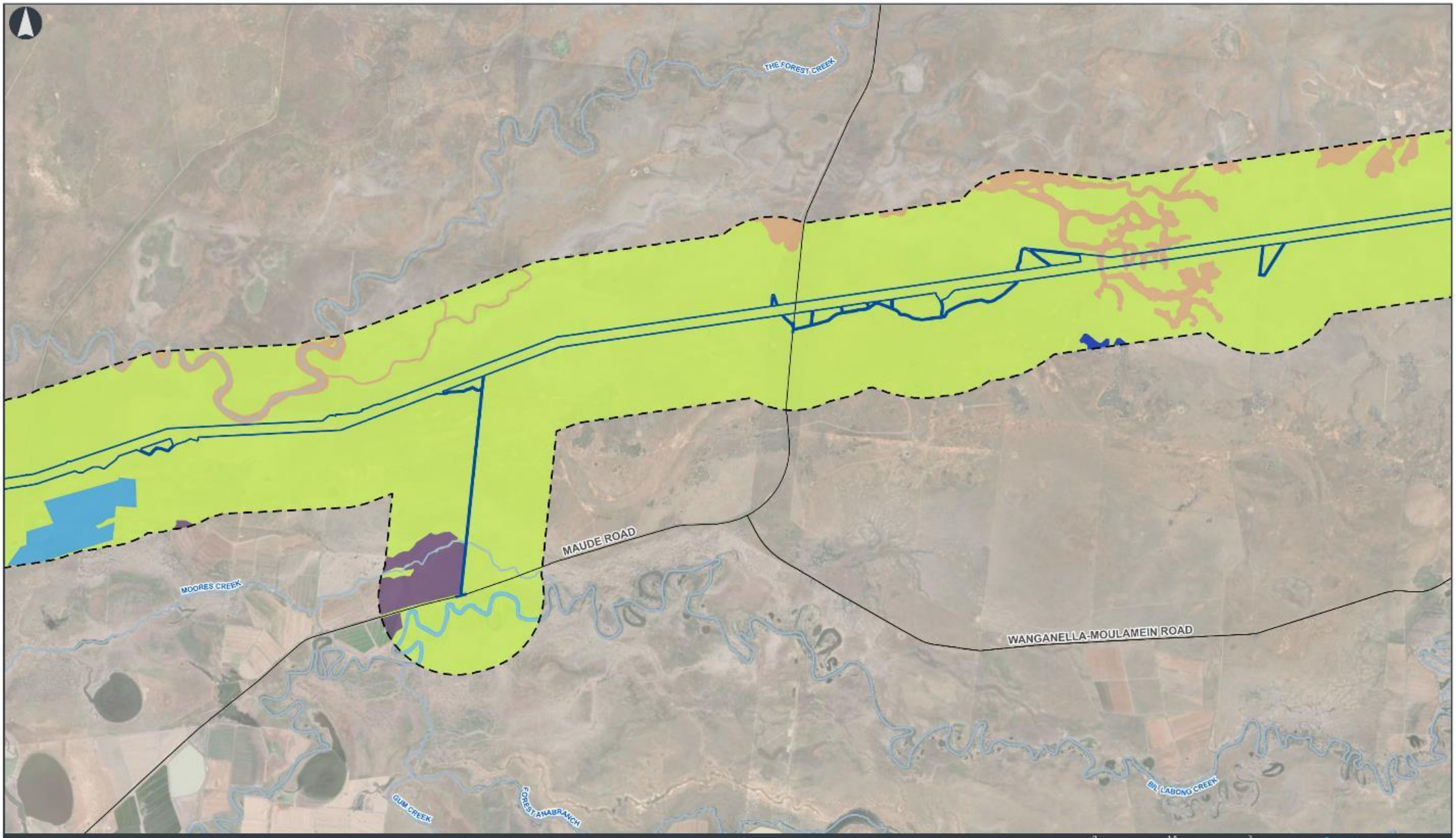
Legend

- Main road
- Rail line
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility
- Substation

Land Use (2017)

- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.2.0 Grazing irrigated modified pastures
- 4.3.0 Irrigated cropping
- 4.4.0 Irrigated perennial horticulture
- 5.4.0 Residential and farm infrastructure
- 5.7.0 Transport and communication
- 6.3.0 River
- 6.5.0 Marsh/wetland

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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VNI West – Technical Paper
Agricultural impact assessment

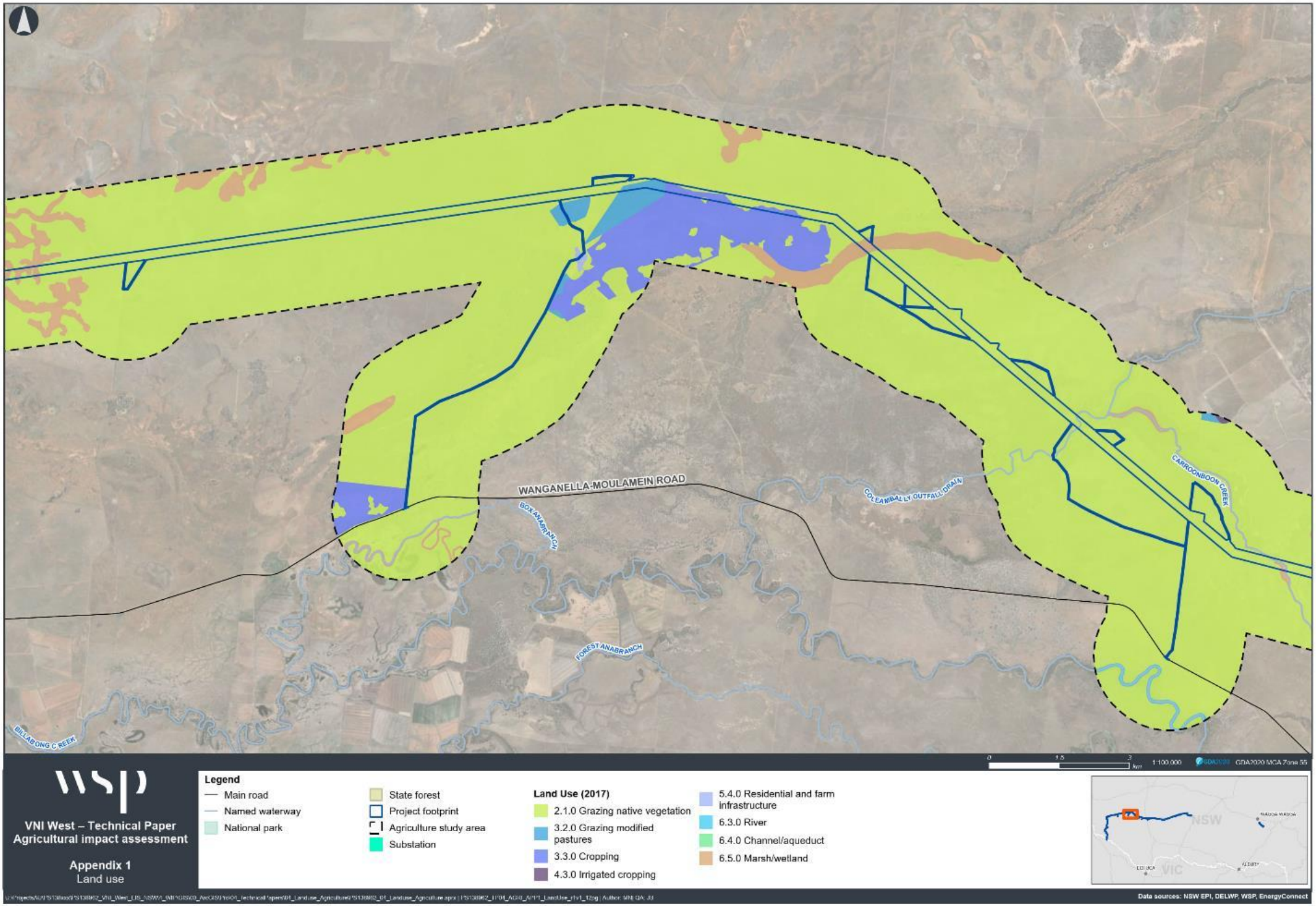
Appendix 1
Land use

Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Substation

Land Use (2017)

- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 4.3.0 Irrigated cropping
- 6.3.0 River
- 6.5.0 Marsh/wetland



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VNI West – Technical Paper
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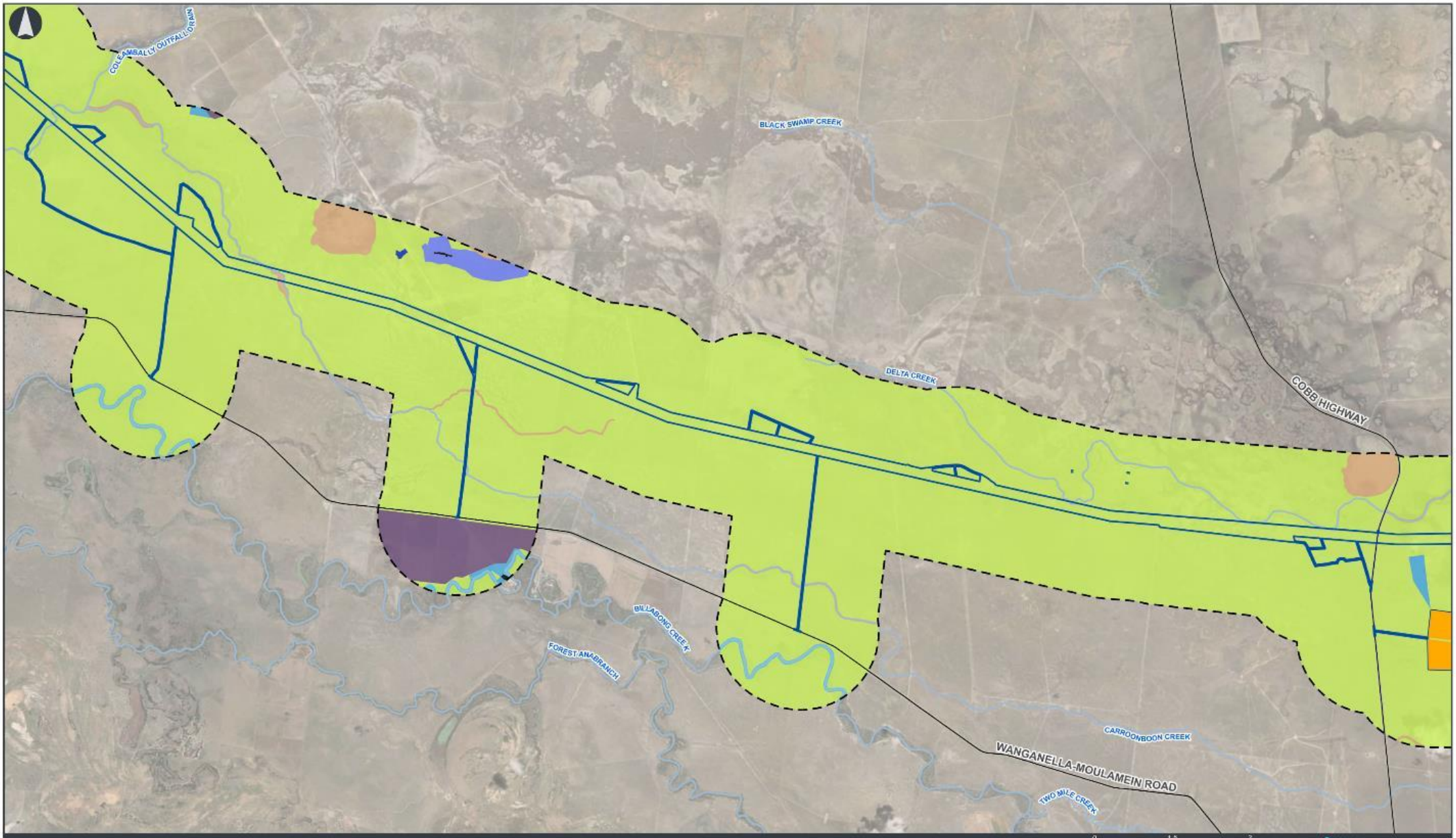
Appendix 1
Land use

Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Substation

Land Use (2017)

- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.3.0 Irrigated cropping
- 5.4.0 Residential and farm infrastructure
- 6.3.0 River
- 6.4.0 Channel/aqueduct
- 6.5.0 Marsh/wetland



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Appendix 1
Land use

Legend

- Main road
- Named waterway
- National park
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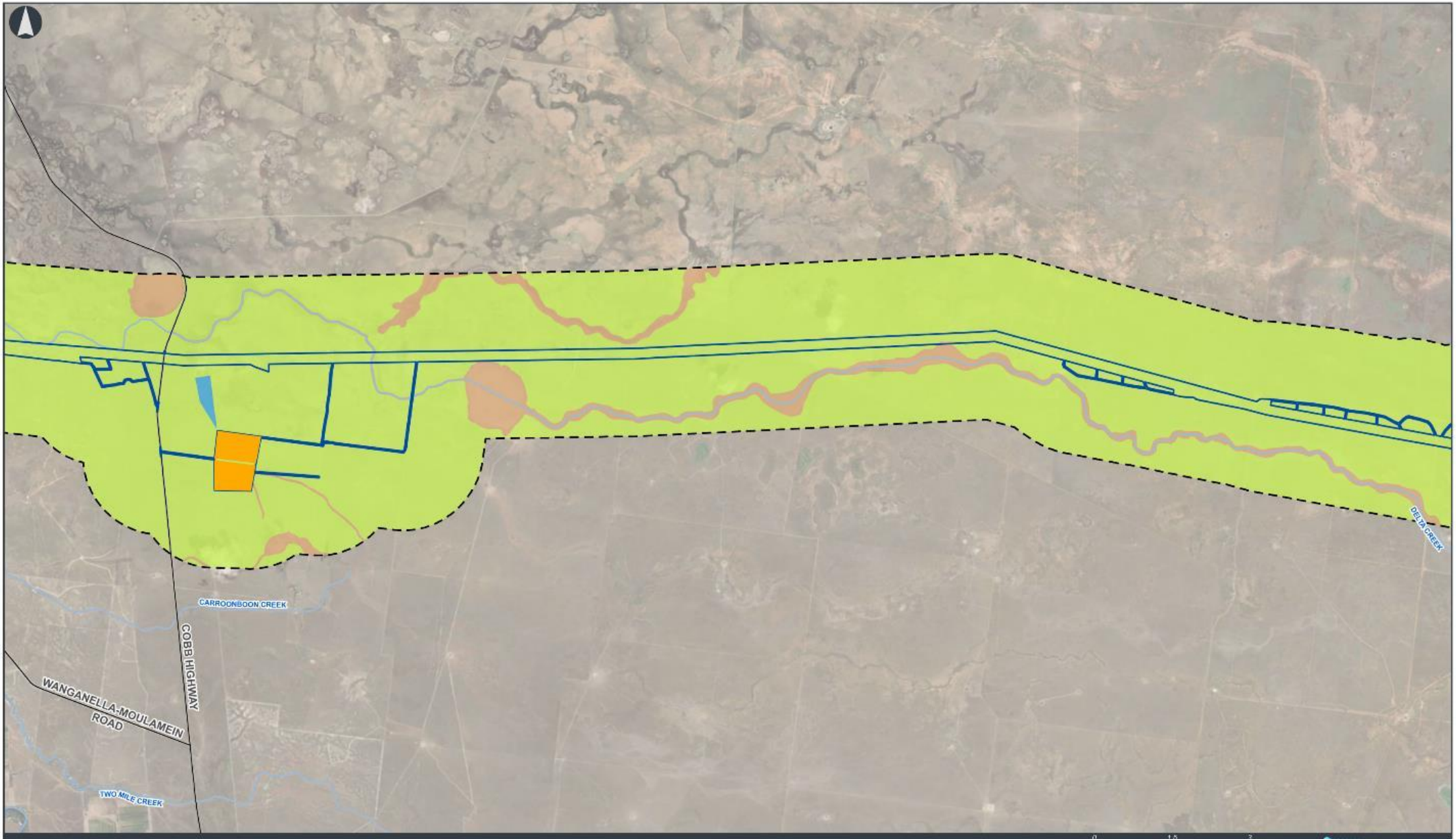
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility
- Substation

Land Use (2017)

- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.3.0 Irrigated cropping
- 5.2.0 Intensive animal production
- 5.7.0 Transport and communication
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.4.0 Channel/aqueduct
- 6.5.0 Marsh/wetland

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 1
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Legend

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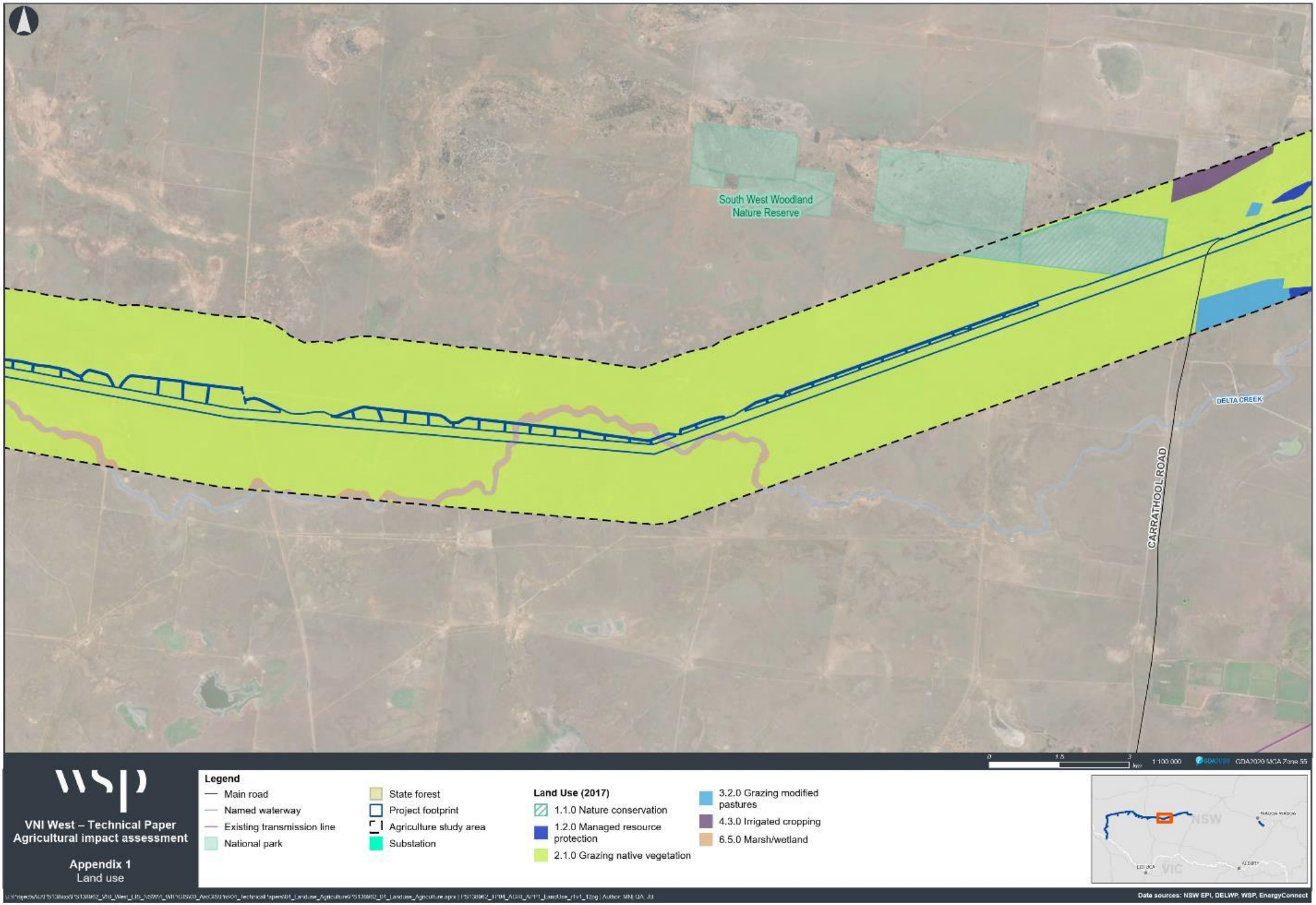
- Substation

Land Use (2017)

- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 5.7.0 Transport and communication
- 6.5.0 Marsh/wetland

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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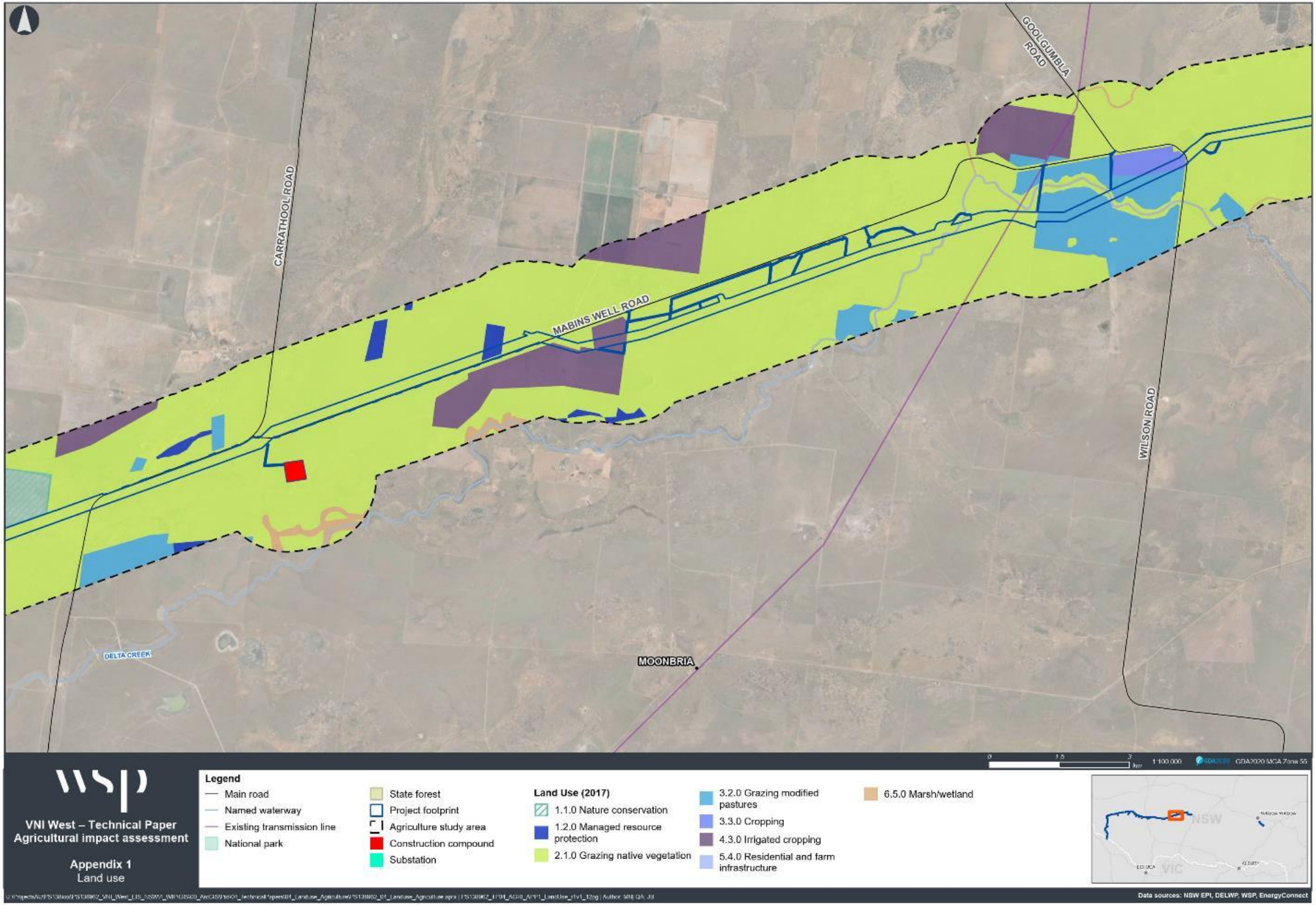
Appendix 1
Land use

Legend

- Main road
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Substation

Land Use (2017)

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 4.3.0 Irrigated cropping
- 6.5.0 Marsh/wetland



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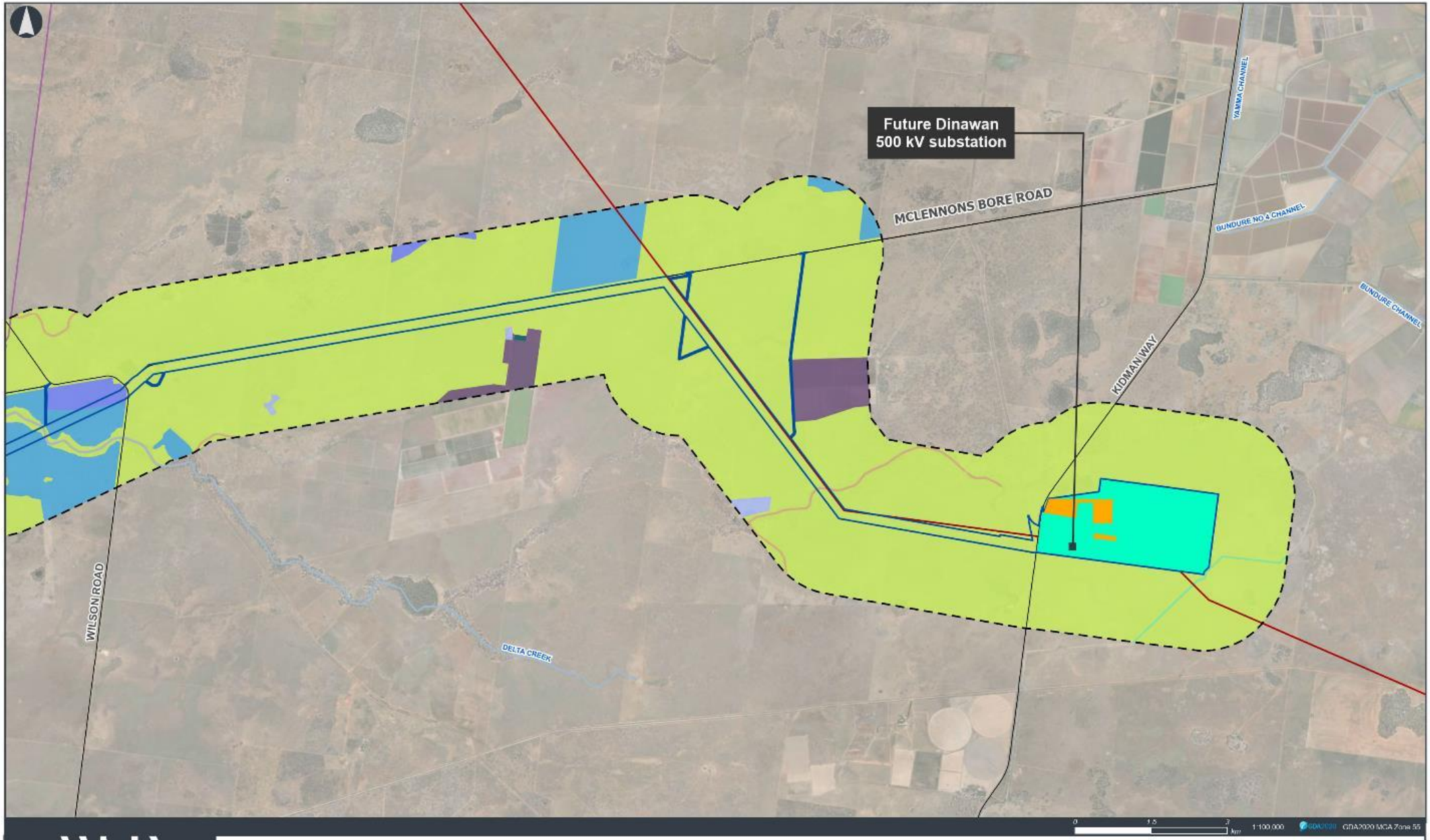
Appendix 1
Land use



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Appendix 1
Land use

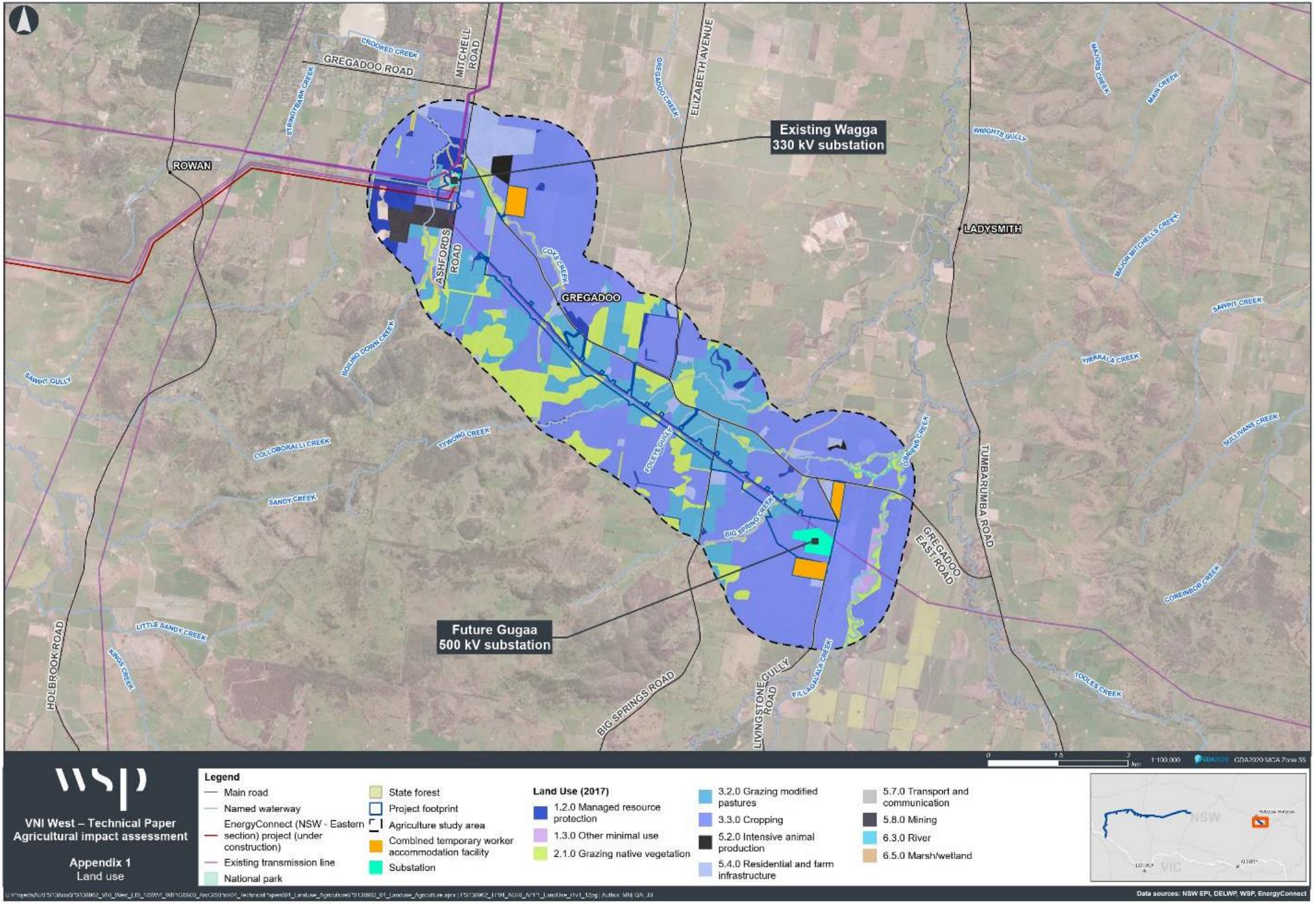
Legend

- Main road
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility
- Substation

Land Use (2017)

- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.3.0 Irrigated cropping
- 5.4.0 Residential and farm infrastructure
- 6.2.0 Reservoir/dam
- 6.4.0 Channel/aqueduct
- 6.5.0 Marsh/wetland

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 1
Land use

Legend

- Main road
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- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
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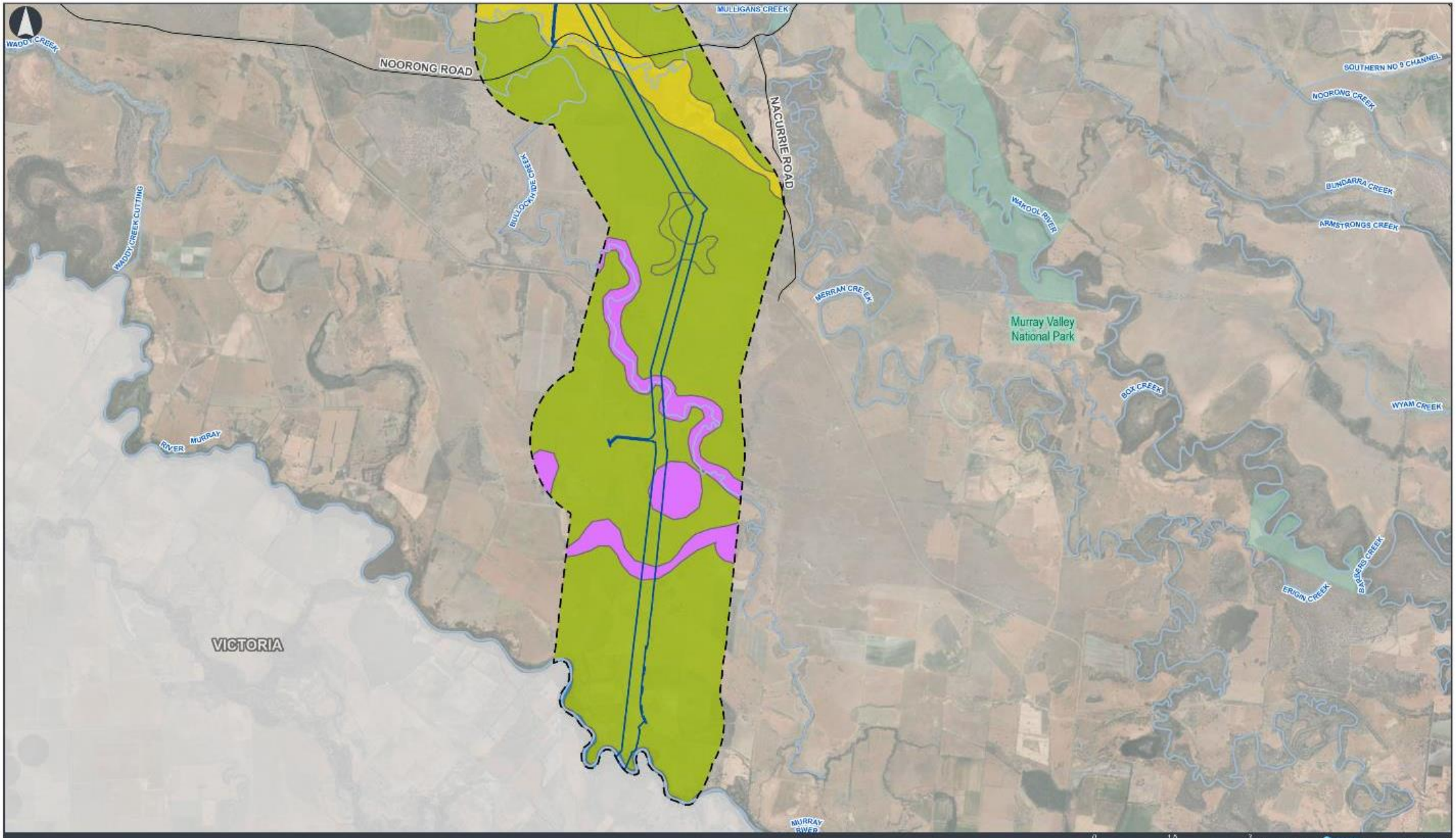
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility
- Substation

Land Use (2017)

- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.2.0 Intensive animal production
- 5.4.0 Residential and farm infrastructure
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.3.0 River
- 6.5.0 Marsh/wetland

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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VNI West – Technical Paper
Agricultural impact assessment

Appendix 2
Land and soil capability

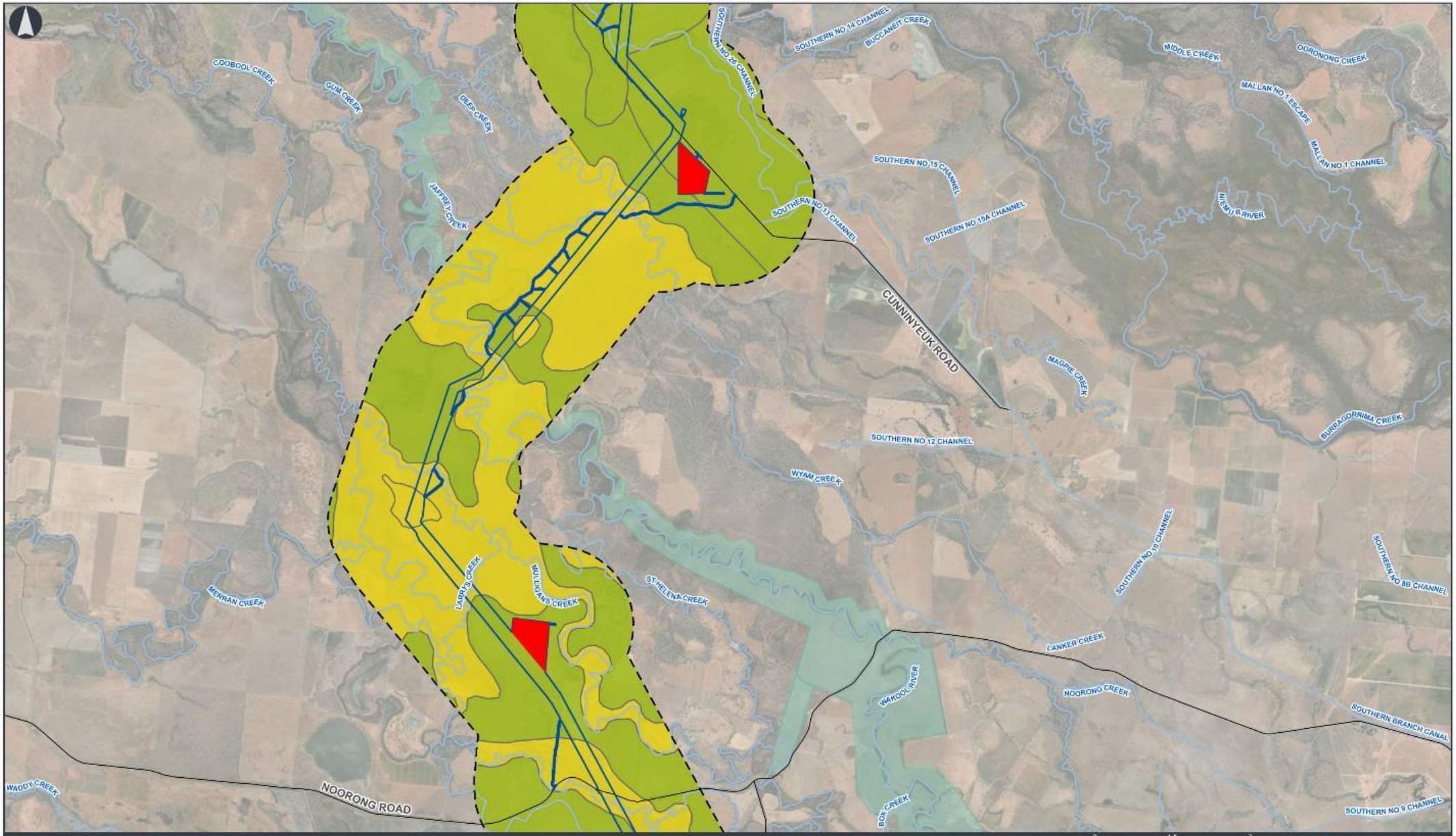
Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations
- Water

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 2
Land and soil capability

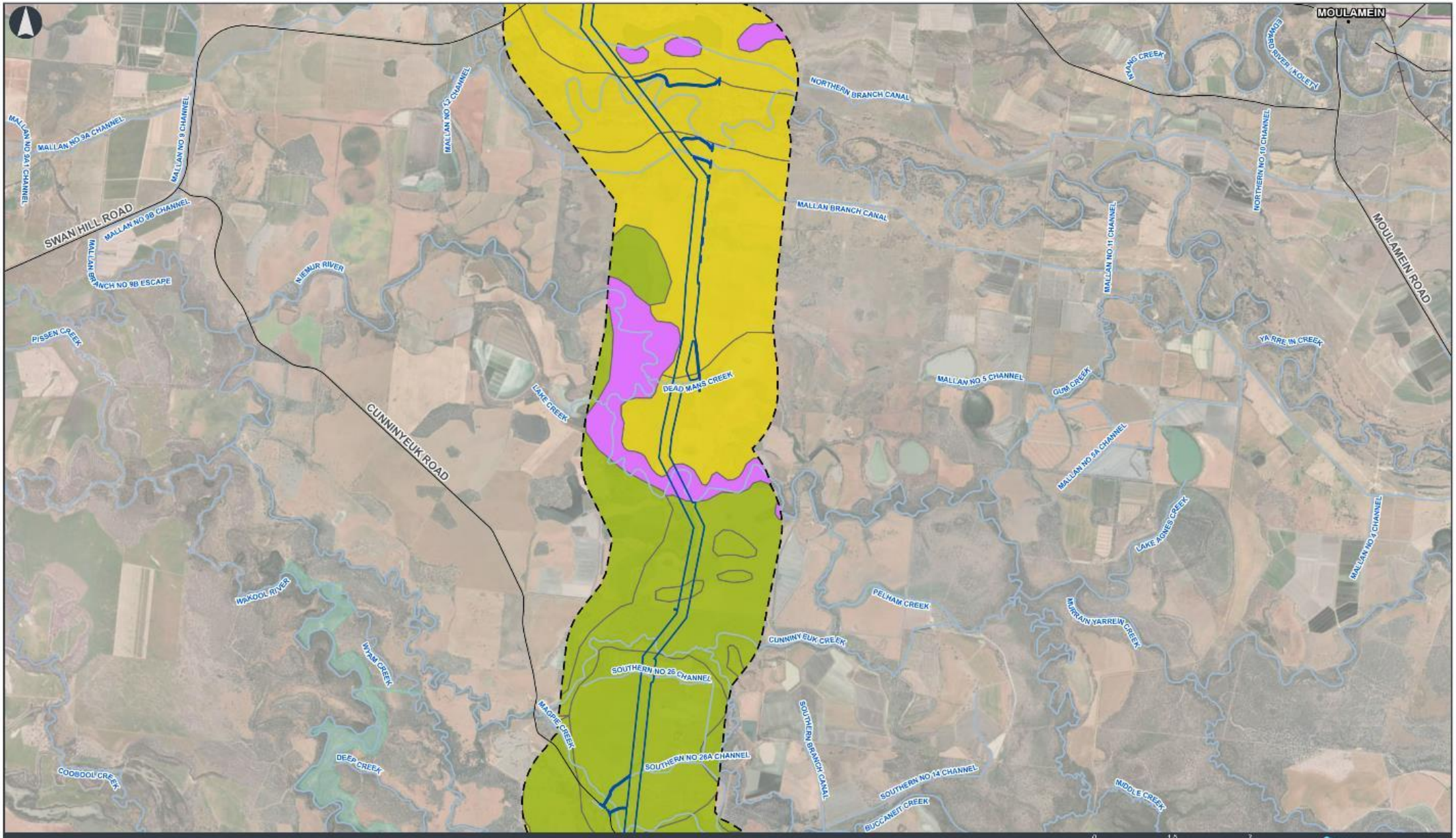
Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Construction compound

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Agricultural impact assessment

Appendix 2
Land and soil capability

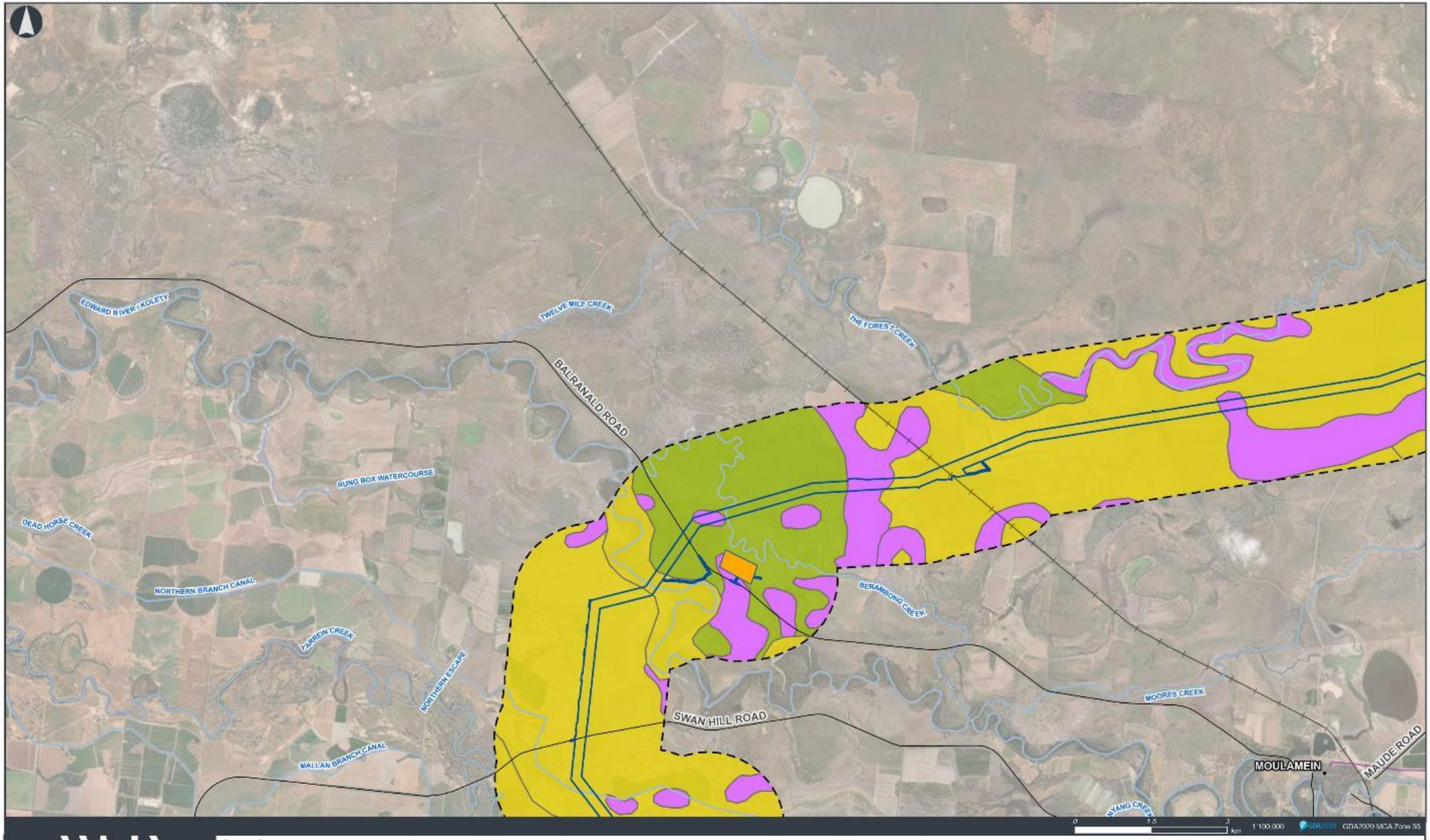
Legend

- Main road
- Rail line
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 2
Land and soil capability

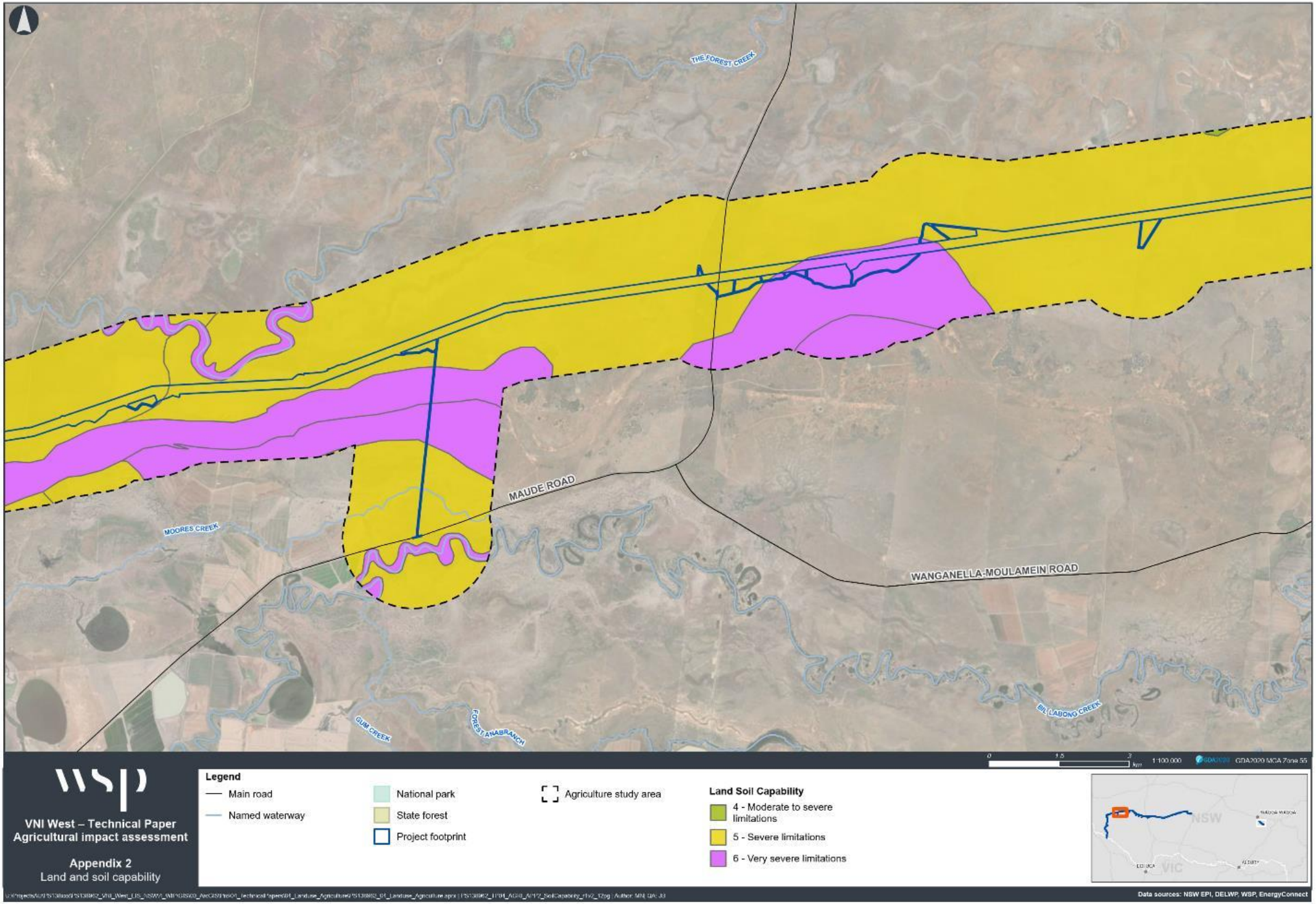
Legend

- Main road
- Rail line
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 2
Land and soil capability

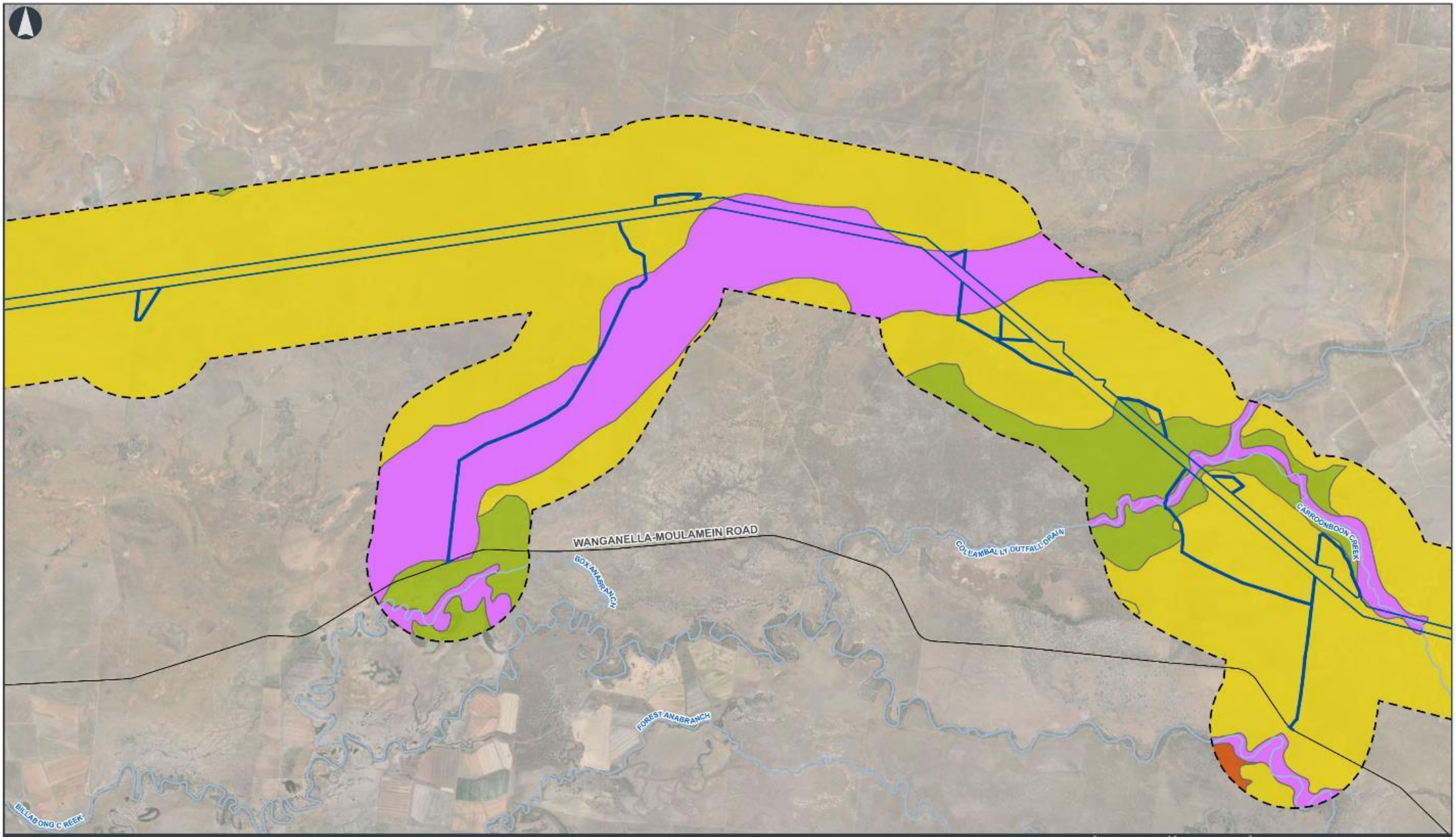
Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 2
Land and soil capability

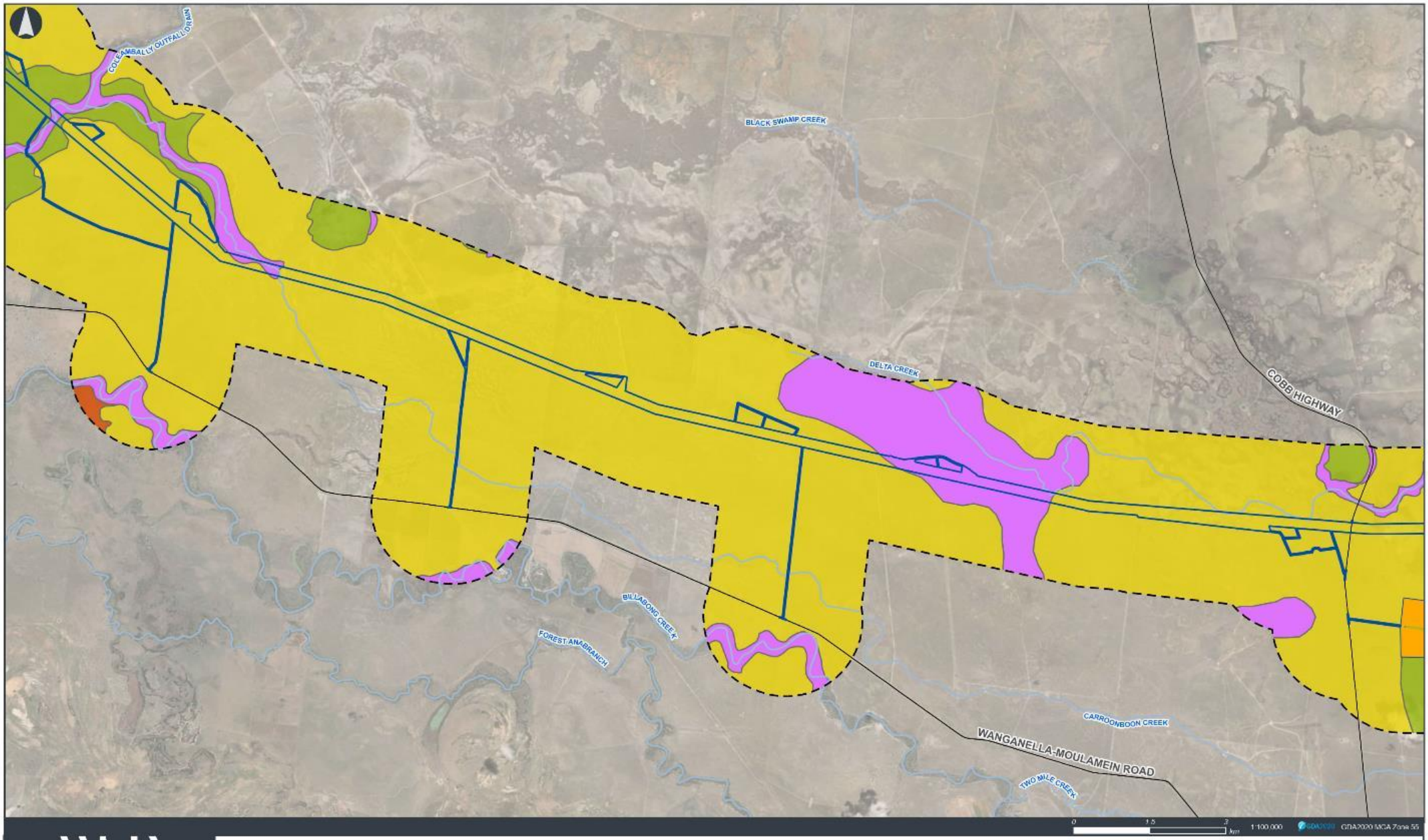
Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations
- 7 - Extremely severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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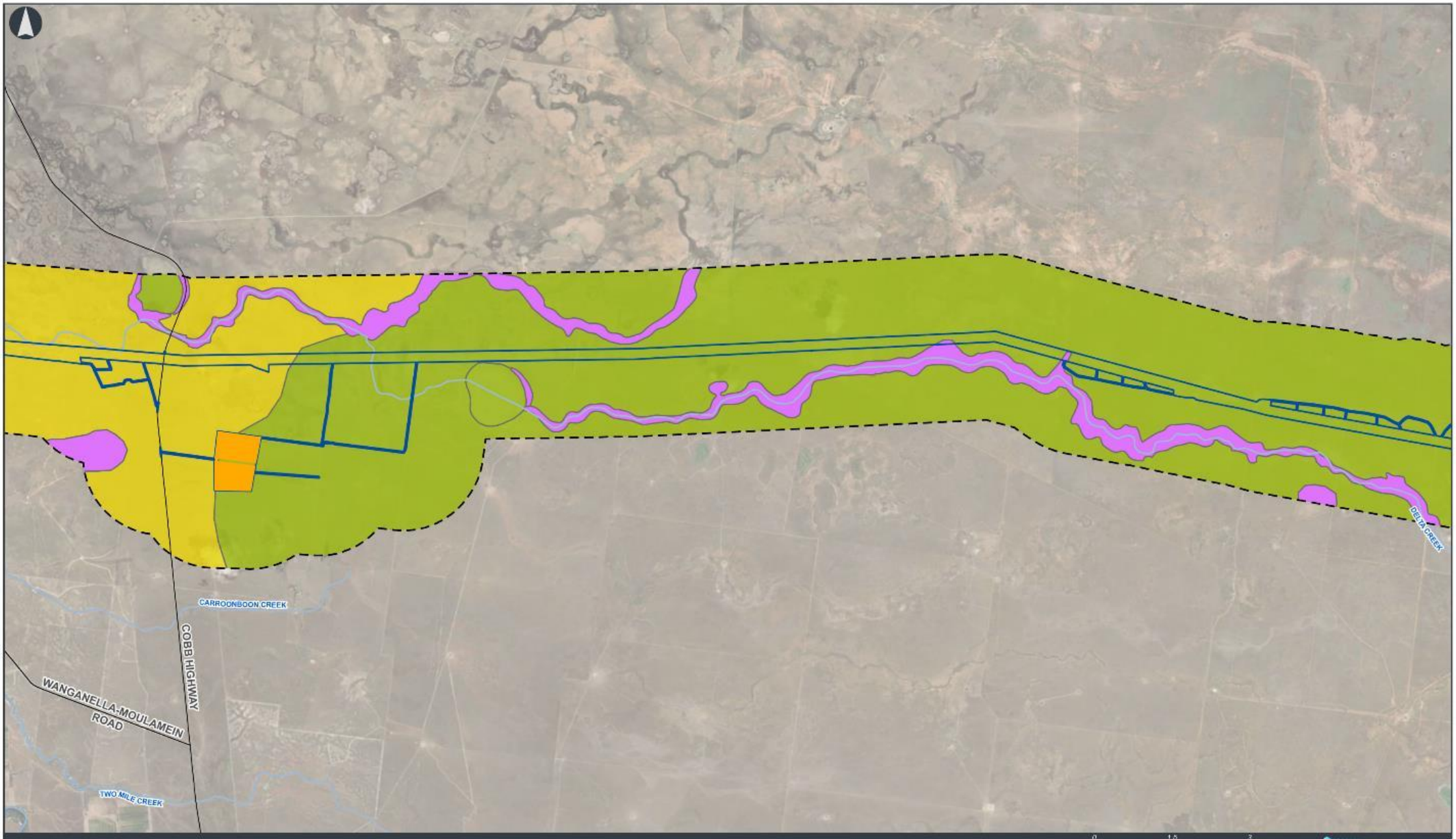
Appendix 2
Land and soil capability

Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations
- 7 - Extremely severe limitations



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Appendix 2
Land and soil capability

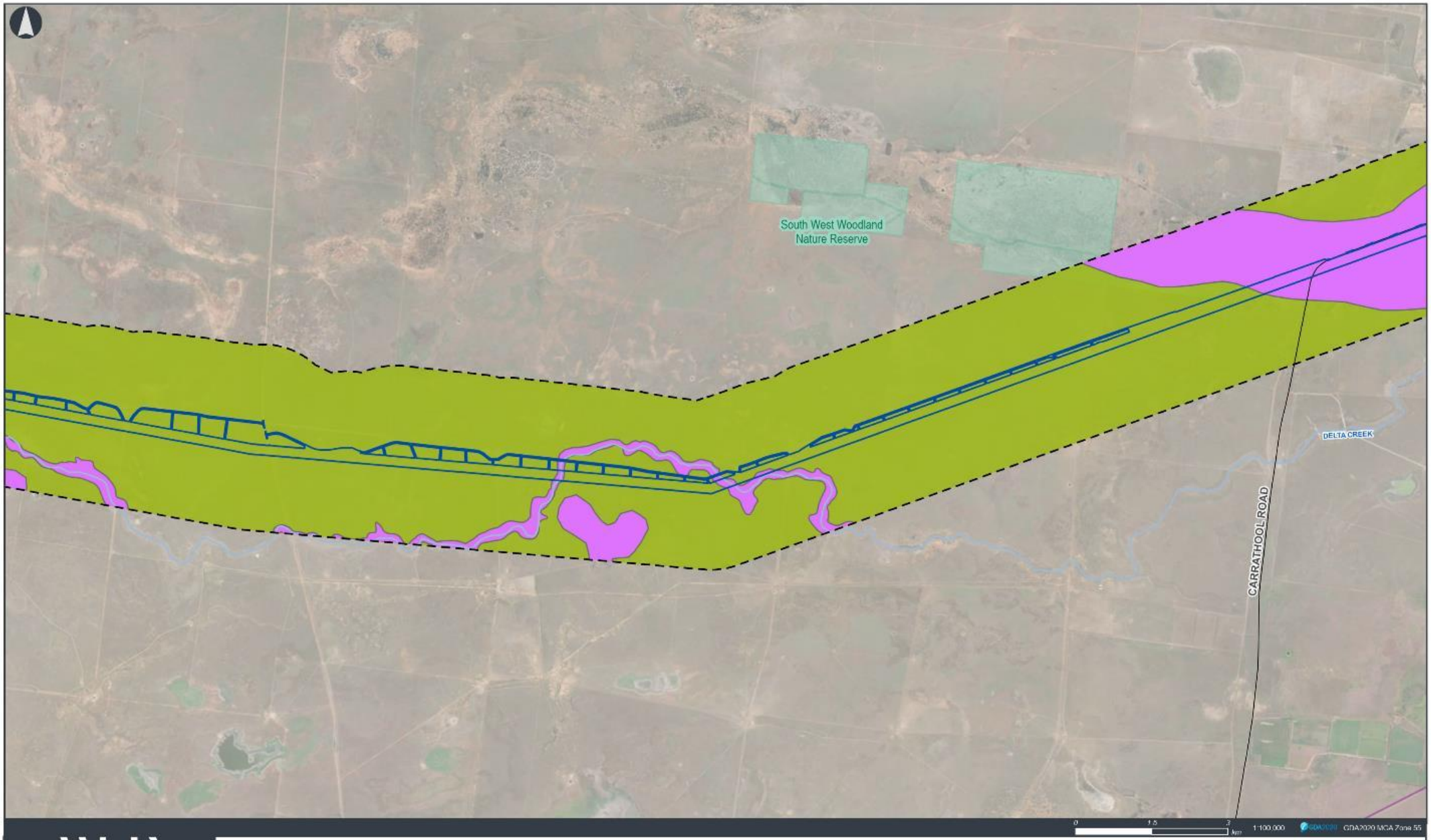
Legend

- Main road
- Named waterway
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility

Land Soil Capability

- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 2
Land and soil capability

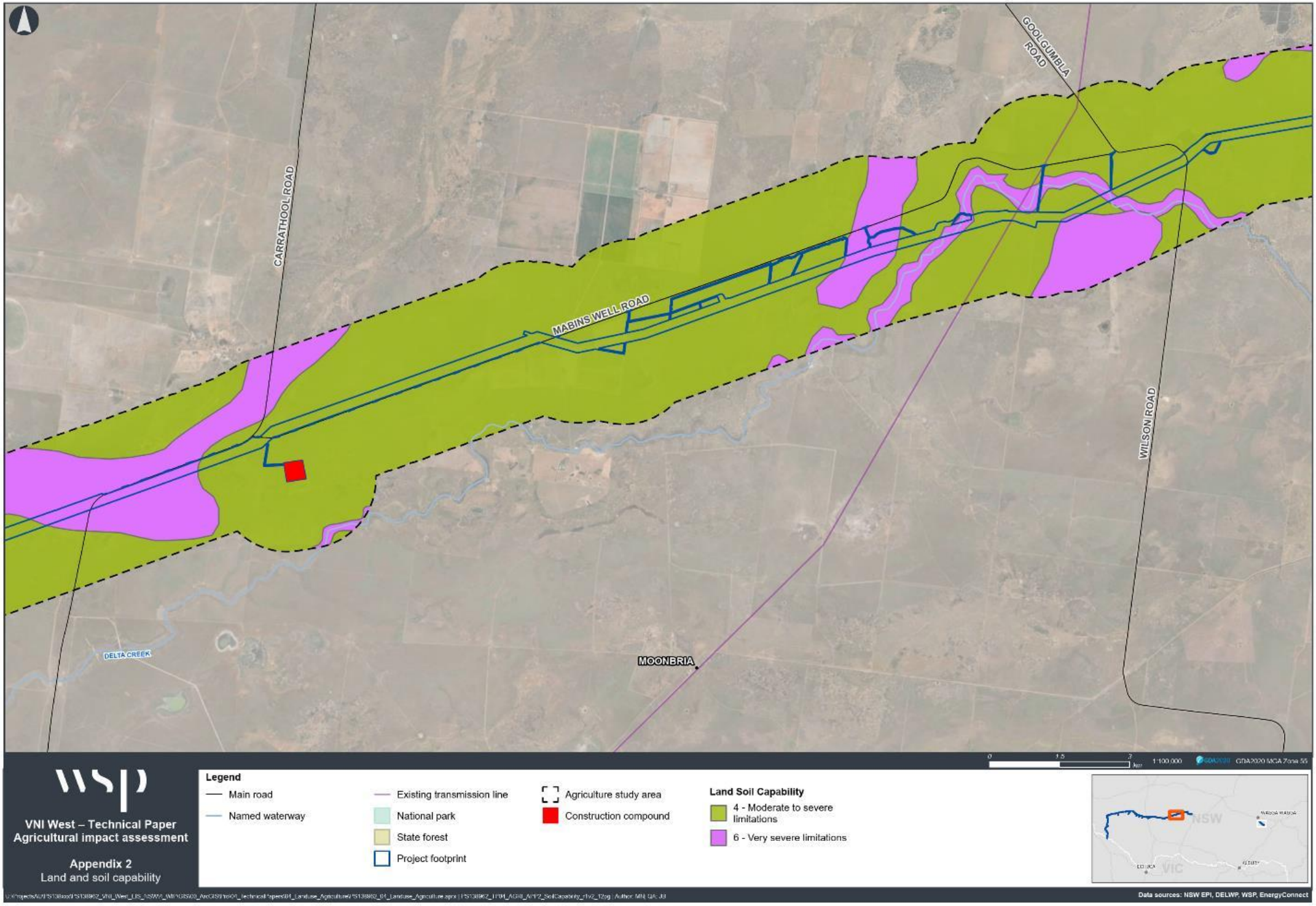
Legend

- Main road
- Named waterway
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area

Land Soil Capability

- 4 - Moderate to severe limitations
- 6 - Very severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect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CARRATHOOL ROAD
MABINS WELL ROAD
WILSON ROAD
DELTA CREEK
MOONBRIA
0
1.5
3
km
1:100,000
GDA2020 MGA Zone 55
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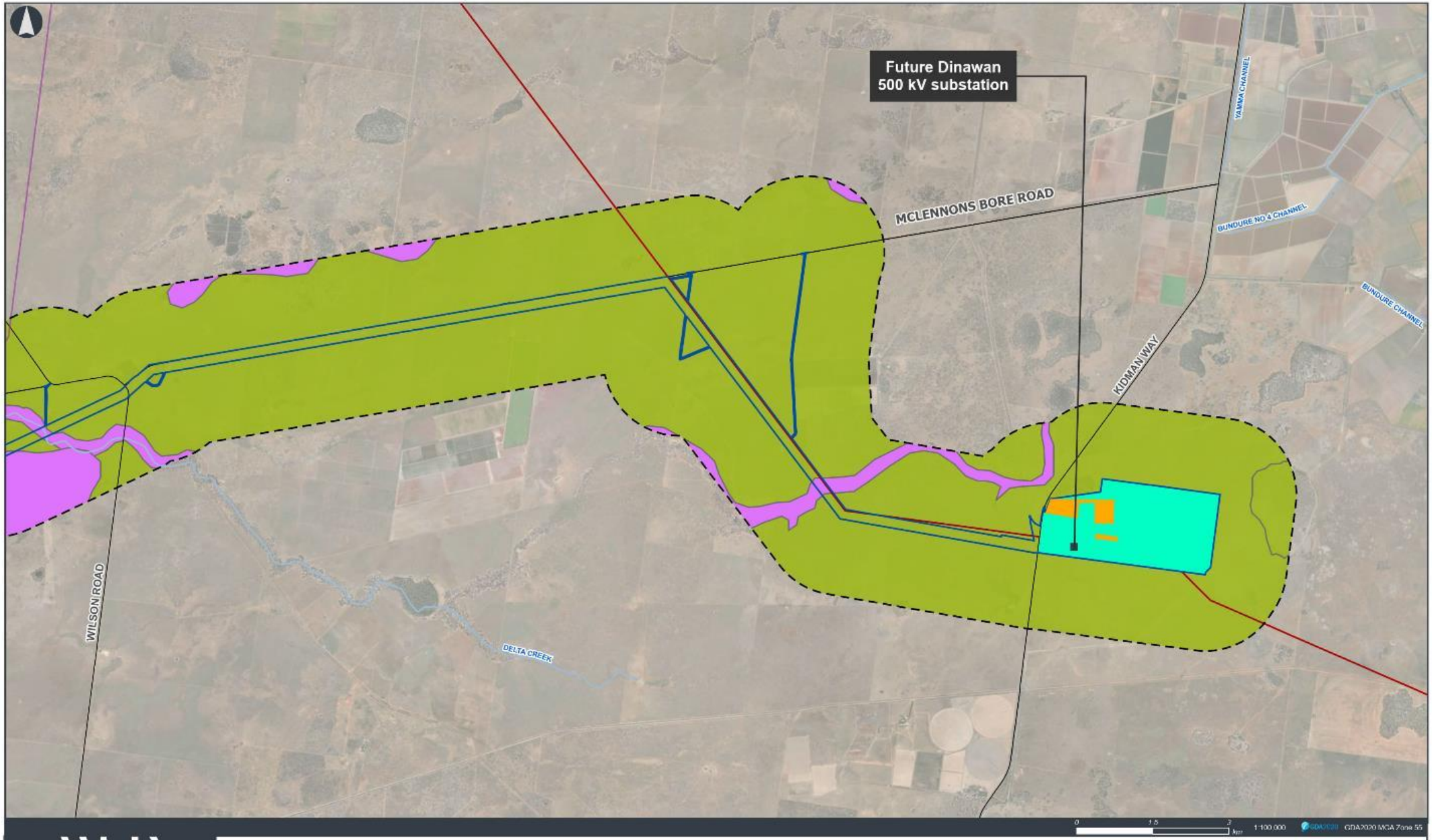
Agricultural impact assessment
Appendix 2
Land and soil capability
Legend
Main road
Named waterway
Existing transmission line
National park
State forest
Project footprint
Agriculture study area
Construction compound
Land Soil Capability
4 - Moderate to severe limitations
6 - Very severe limitations
NSW
VIC
Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Appendix 2
Land and soil capability

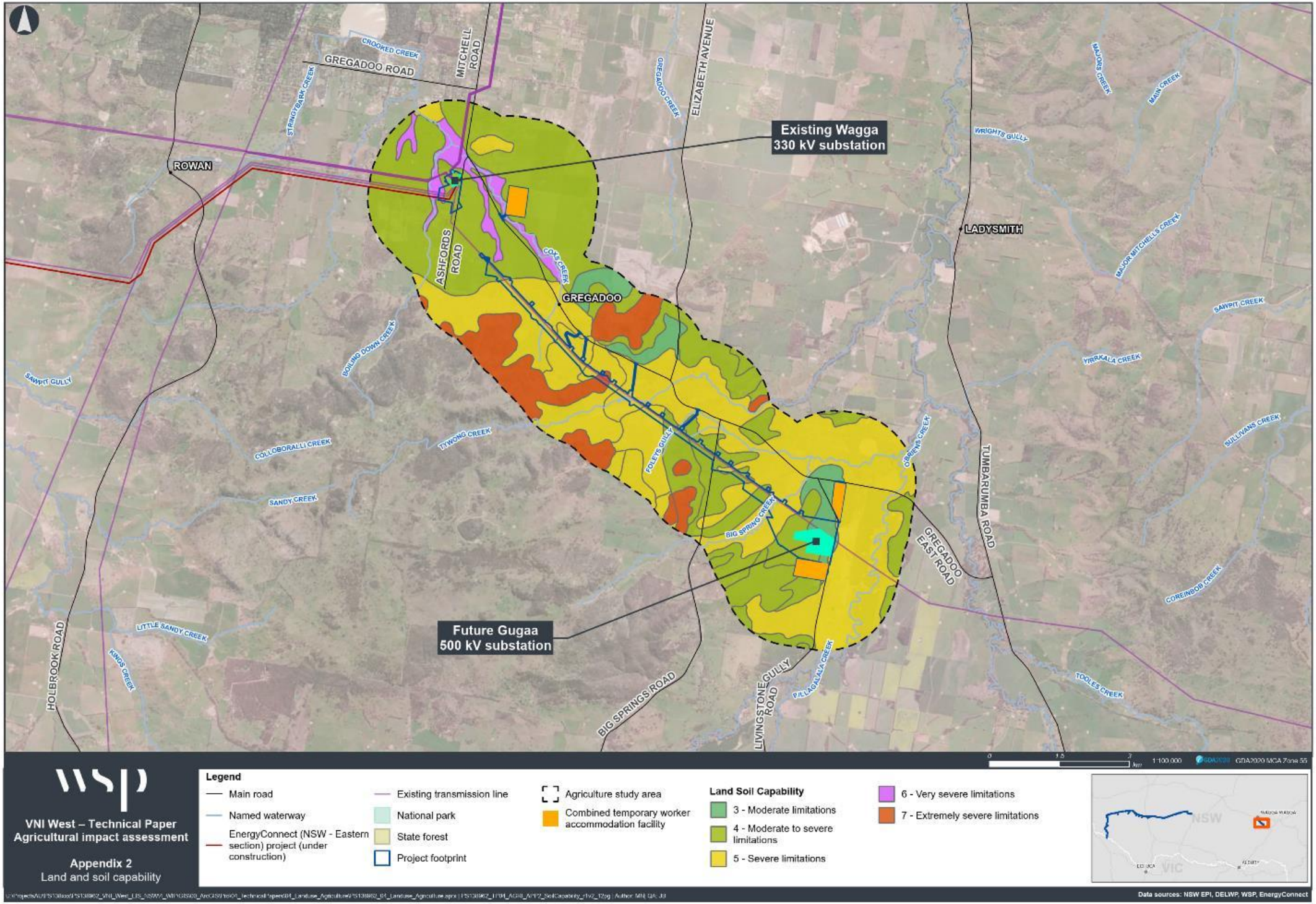
Legend

- Main road
- Named waterway
- EnergyConnect (NSW - Eastern section) project (under construction)
- Existing transmission line
- National park
- State forest
- Project footprint
- Agriculture study area
- Combined temporary worker accommodation facility

Land Soil Capability

- 4 - Moderate to severe limitations
- 6 - Very severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect



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Land and soil capability

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- Main road
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Land Soil Capability

- 3 - Moderate limitations
- 4 - Moderate to severe limitations
- 5 - Severe limitations
- 6 - Very severe limitations
- 7 - Extremely severe limitations

Data sources: NSW EPI, DELWP, WSP, EnergyConnect

Appendix 3

Other regional weed species of concern

(2 pages)

Common name	Scientific name	Murray LLS	Riverina LLs
Agapanthus	*Agapanthus praecox*		X
Anchored water hyacinth	*Eichhornia azurea*		X
Bathurst burr	*Xanthium spinosum*	X	X
Bear skin fescue	*Festuca gautieri*	X	X
Bitter stonecrop	*Sedum acre*	X	X
Blackberry nightshade	*Solanum nigrum*		X
Blue heliotrope	*Heliotropium amplexicaule*	X	X
Box elder	*Acer negundo*	X	X
Bridal creeper	*Asparagus asparagoides*		X
Broomrapes	*Orobanche spp.*		X
Buffalo burr	*Solanum rostratum*	X	X
Cabomba	*Cabomba caroliniana*		X
Caltrop, catshead, yellow vine	*Tribulus terrestris L.*		X
Camel thorn	*Alhagi maurorum*	X	X
Cape tulips	*Moraea flaccida and M. miniata*	X	X
Capeweed	*Arctotheca calendula*		X
Cat's claw creeper	*Dolichandra unguis-cati*		X
Columbus grass	*Sorghum x almum*	X	X
Common heliotrope	*Heliotropium europeum*		X
Creeping knapweed	*Rhaponticum repens*		X
Devils claw	*Ibicella lutea or Proboscidea louisianica*	X	X
English ivy	*Hedera helix*		X
Feathertop Rhodes grass	*Chloris virgata*		X
Flax-leaf broom	*Genista linifolia*		X
Flax-leaf fleabane	*Conyza bonariensis*		X
Fountain grass	*Cenchrus setaceus*		X
Galenia	*Galenia pubescens*		X
Galvanised burr	*Sclerolaena birchii*		X
Gamba grass	*Andropogon gayanus*		X
Gazania	*Gazania linearis*		X
Golden dodder	*Cuscuta campestris*		X
Harrisia cactus	*Harrisia martinii and H. tortuosa*	X	X
Himalayan honeysuckle	*Leycesteria formosa*	X	X
Honey locust	*Gleditsia triacanthos*	X	X

Common name	Scientific name	Murray LLS	Riverina LLs
Horehound	*Marrubium vulgare*	X	X
Johnson grass	*Sorghum halepense*	X	X
Khaki weed	*Alternanthera pungens*		X
Lippia	*Phyla canescens*		X
Long-leaf willow primrose	*Ludwigia longifolia*	X	X
Noogoora burr	*Xanthium occidentale*		X
Ox-eye daisy	*Leucanthemum vulgare*		X
Pampas grass	*Cortaderia* spp.		
Patterson's curse	*Echium plantagineum*		X
Privet (broad leaf)	*Ligustrum lucidum*		X
Privet (narrow leaf)	*Ligustrum sinense*		X
Red rice	*Oryza rufipogon*	X	X
Reed canary grass	*Phalaris arundinacea*	X	X
Reed sweetgrass	*Glyceria maxima*	X	X
Rhus tree	*Toxicodendron succedaneum*	X	X
Scotch and Illyrian thistles	*Onopordum spp.*	X	X
Silk forage sorghum	*Sorghum spp. hybrid cultivar "Silk"*	X	X
Spanish heath	*Erica lusitanica*	X	X
Spiny burrgrass	*Cenchrus* spp.	X	X
Spiny emex	*Rumex hypogaeus*	X	X
St Barnaby's thistle	*Centaurea solstitialis*	X	X
St John's wort	*Hypericum perforatum*	X	X
Sweet briar	*Rosa rubiginosa*	X	X
Star thistle	*Centaurea calcitrapa*		X
Tamarix	*Tamarix ramosissima*	X	
Tangled hypericum	*Hypericum triquetrifoliu*	X	X
Tree of heaven	*Ailanthus altissima*	X	X
Wards weed	*Carrichtera annua*		X
Willow	*Salix* spp.	X	